DISCOVERING CRITICAL SUCCESS FACTORS FOR IMPLEMENTING AN AUTOMATED PERFORMANCE MEASUREMENT SYSTEM: A CASE STUDY APPROACH

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USE OF THESIS

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ABSTRACT

In this age of the Information Economy, access to accurate and timely information is necessary to ensure business success. Underpinning this success is the ability of organisations to react to change and manage utilising automated performance measurement systems (APMS) which exploit the latest technology. Little is known about how organisations utilise such automated performance measurement systems, what drives their strategies, how they implement the systems and what the critical factors for success are. There has been little research published to date on performance measurement software applications and their implementations (Marr & Neely, 2003). The research outcomes in this thesis will hopefully benefit many users who have or are planning to implement performance measurement software.

This research adopts the approach of critical realism, a philosophical position which has been little used in technology studies to date, in discussing the evaluation and implementation of a number of APMS. Such systems are a recent evolution within the context of enterprise IS. They collect operational data from integrated systems to generate values for key performance indicators which are available immediately to all staff, including senior management. The creation and delivery of this data is fully automated, precluding manual intervention by middle or line management. Whilst these systems appear to be a logical progression in the exploitation of the available rich, real-time data, the statistics for APMS projects are disappointing. An understanding of the reasons is elusive and little researched. Through the examination of a number of such implementations, the research seeks to understand the implementation issues involved. A focus group and case study were used as mechanisms for data collection and the results led to a proposed model of critical success factors for implementing an APMS. The research model was added to and modified during the research by: mapping de Waal's (2003) behavioural factors to Wixom and Watson's (2001) data warehousing implementation factors; aligning timeliness and sustainability into a single group called "operating

success” which then leads to “perceived net benefits”; and including an “accountability framework” for ongoing use of the systems. Critical realism proved to be a suitable philosophical stance, by functioning as an “underlabourer” for this research, by "clearing the ground a little...removing some of the rubbish that lies in the way of knowledge" (Locke, 1894, p. 14).

The critical realist beliefs of the researcher target the real mechanisms and structures underlying the perceived events described by the focus group and case participants. The research was completed without incident and indicates how a critical realist foundation assisted the research process. Limitations of the research are discussed as well as further areas of possible research.

Keywords: automated performance measurement, information systems, IS success, critical success factors, performance measurement, performance management, critical realism, grounded theory, focus groups, case study, enterprise systems implementation.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education.

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I would like to go on about how friends and colleagues revived me from attacks of scholarly confusion and desolation. But the people who have rallied around me know how grateful I am.

They really don't need publicity for their parts in my little drama, but I thank the colleagues that I met while on my journey. Some of them have completed their journey, others are still on it and others fell by the wayside, never to return.

I especially want to thank my Principal Supervisor and mentor, Dr Paul Jackson for his oversight, wisdom and patience. I also like to thank Dr Phillip Dobson for his advice and insight on critical realism.

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I finally need to thank my wife Susan and children, Melissa and Sean. Without their patience and kind understanding I would never have completed this thesis.

PRELUDE
PROFESSIONAL PRACTICE REFLECTIONS

With over twenty-one years experience in Information Systems (IS) and Technology (IT), I have project managed the implementation of large award winning corporate projects. The projects I have managed have been unusually successful.

During the last five years I have participated in the development of two large-scale data warehousing applications that were the basis of proposed Automated Business (or Corporate) Performance Measurement Systems. The projects were based on SAP's Business Warehouse product and both data warehouses sourced their data from SAP's R3 Enterprise Resource Planning (ERP) systems but also included a myriad of other non-SAP production systems.

One organisation was a mid to large Government Business Enterprise and the other was a very large global commodity company.

The data warehousing systems had the common objective of producing automatic performance measurement management reporting via a mixture of spreadsheets and Web based reports. The information was presented in a form where no manipulation was required and in most cases was not possible because of the security/authorisation layer.

One system languished as implementation and process change management failed to get traction and the system did not become embedded as a meaningful tool. It is now used in an ad hoc fashion and is seen by some as just an expensive toy.

The other system was nearly complete (90%) and was partially operational (approx 70% of the business processes covered) with over 60% of managers and information analysts using the tool throughout the business. Production benefits were occurring and the system had already paid for itself within the first 12 months. All of a sudden the project was

stopped with no apparent reason (to me anyway). The project was under budget (85%) and was scheduled to deliver on time. It wasn't finished and now, as not all data is collected, holes exist in high level management reports and hence manual intervention is still required. Senior Managers remain frustrated at management reporting delays and are sceptical of the metrics being reported.

Discussions with the IS Managers for both of the above organisations did not indicate any reason for failure, in fact both were very supportive as they struggled to understand how to complete implementation of these systems into their respective businesses.

Business interest at a senior management level remains high at both of these companies and I have been approached by one of the organisations a number of times in the last year to assist in resurrecting the project and finishing the system. I have declined because I have been unable to determine the factors for success and what were the barriers that caused these projects to stop. Without knowing this I felt I could not efficiently undertake the job. The other reason for not taking up the offer is because I wished to view the organisations more objectively by being more external or removed from the environment.

I have not understood why both of these situations occurred as technically the solution was robust, timely and flexible and was considered a success (by the IS Managers anyway). I became increasingly interested in why this type of application struggled for acceptance and started this course of study to try and understand the phenomena.

In 2003 & 2004 there were little published academic articles about the implementation of APMS but there was a myriad of vendor documentation. Late in 2004 and early 2005 this started to change and refereed journal articles started to come out of Europe.

The reason for my research is that I did not understand why the systems I was involved in failed. I have been likened to a vigilante looking to string someone up and as a crusader looking for the Holy Grail. This research was motivated by a desire to try and identify why one performance

measurement system languished and why the other partially succeeded but was stopped.

I intend to do this is by performing the research in a professional and scholarly way. Of course there will be some form of personal biases but as I am aware of them I will try and identify them when they occur.

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LIST OF ABBREVIATIONS

ABC	Activity Based Costing
APMS	Automated Performance Measurement System
B2B	Business to Business
B2C	Business to Customer
BAM	Business Activity Monitoring
BI	Business Intelligence
BPI	Business Process Intelligence
BPM	Business Process Management
BW	SAP Business Warehouse
CEO	Chief Executive Officer
CFO	Chief Financial Officer
COO	Chief Operating Officer
COTS	Commercial of the shelf
CPM	Corporate performance management
CRM	Customer Relationship Management
CRT	Cathode Ray Tube
CSF	Critical success factors
EAI	Enterprise Application Integration
EIM	Enterprise Information Management
EPC	Event-driven Process Chains
ERP	Enterprise Resource Planning
EU	European Union
IS	Information Systems
IFRS	International Financial Reporting Standards
IT	Information Technology
JIT	Just in Time
KPI	Key performance indicators
KRA	Key Result Area
MES	Manufacturing Execution System
ODS	Operational data stores
PLC	Programmable Logic Controller
RTBI	Real-Time Business Intelligence
SCADA	Supervisory Control and Data Acquisition
SCM	Supply chain management
SME	Small to Medium Enterprises
SMS	Short Message Service
SOAP	Simple Object Access Protocol
SOX	Sarbanes Oxley
TQM	Total Quality Management
UTC	Coordinated Universal Time
WFM	Workflow Management
XBRL	eXtensible Business Reporting Language
XML	Extensible Mark-up Language

CHAPTER 1
INTRODUCTION

> "If you cannot measure, then your knowledge is meagre and unsatisfactory" William Thomson, 1st Baron Kelvin (1824 -1907).

This chapter provides a background to the research and states the research question while providing key definitions.

It states the justification for the research and an overview of the approach followed for the research. It gives an outline of the report and delimitates items scoped and assumptions made.

Background to the research

This research aims to describe the nature of Automated Performance Measurement Systems (APMS) and to identify and explain criteria to support a successful implementation of the underlying technologies.

The term "APMS" is an acronym coined by the researcher as a certain class of systems that provide functionality to automate performance measurement.

Organisations, old and new, with standard and or virtual business models are striving for improvement and looking for the ever increasing advantage to improve their businesses. This is never more true in this age of globalisation, where well-informed competitors, suppliers and customers have made modern business environments dynamic and complex. They continue to strive to improve the quality of their products and services while reducing costs and maximising profit.

While this new age of performance improvement has been evolving, several management theories have developed to support this goal. Total quality management (TQM), just in time (JIT), benchmarking, lean management, balanced scorecard and six sigma have been the popular ones but these and others had the same central goal, i.e. to measure performance (Paranjape, Rossiter, & Pantano, 2006, p.5).

With the signing into law of the Sarbanes Oxley (SOX) legislation by President Bush in July 2002 a new dimension to performance measurement and the subsequent reporting became apparent. Traceability of reported results became essential, and some vendors (e.g. SAP, Oracle, Cognos) positioned their products to enable automation of the performance measurement and reporting processes, from the beginning of extraction of source data, production of varied levels of management reports through to the production of board and annual report(s). It is unclear whether the above functionality has been deployed into the before mentioned products and whether the deployment was successful.

Research into performance measurement is not new but research into the automation of the entire process is. There is limited published material on the successes or failures of APMS software implementations (Bititci, Cavalieri, & von Cieminski, 2005; Bourne, 2005; Nudurupati & Bititci, 2005). Even with the introduction of the Balanced Scorecard (Kaplan, R. S. & Norton, 1992) (Kaplan, R. S. & Norton, 2001a, 2001b) and other performance management reporting methods there has been minimal research into the automation of such methods (Marr & Neely, 2003). Where literature does exist, the perspective of the study has been mainly from a business management or TQM perspective and not from an IS viewpoint (Marr & Schiuma, 2003).

Automated performance measurement also assists a business to be able to respond quickly and with some agility. Most decision makers are frustrated with the recognition that many decisions could be made more quickly if performance measurement data was available. (Tebbutt, 2006, p.36). An APMS can assist this by providing this data automatically.

The benefits of agility and speed are also very clear to business managers with McKinsey (2006) respondents citing higher revenues (39 per cent), greater customer satisfaction (36 per cent), greater operational efficiency (29 per cent), increased market share (26 per cent) and/or faster time to market (23 per cent). There is clearly additional capacity within most business unit manager's minds for their operations to improve if they

can get the performance measurements automatically. (McKinsey, 2006, cited in Tebbutt, 2006, p.36).

The proposed research intends to leverage off the DeLone and McLean model of IS success (DeLone & McLean, 2002) by firstly using a focus group of industry experts to refine the success criteria defined and then produce an updated success criteria model for APMS. This updated model will be refined further by testing it against a case study organisation resulting in a new model.

Research Question

The research question for this body of research is:

> "*What are the critical success factors for successful implementation of an Automated Performance Measurement system (APMS)?"*

To assist in answering this question it is intended that the following areas will be researched:

- Operational management performance measurement; and
- Information System success models.

Performance management originates from operational management theory and consist of analytical and theoretical frameworks that relate to their operation while information system success models have been documented at length in the IS literature. This is further explored in Chapter 2.

The researcher does not know what the critical success factors are for implementing an APMS and is embarking on a journey of discovery. The epistemology for this research is that of a critical realist and the reasons for this are described in Chapter 3.

Key Definitions

For the purposes of this research the following definitions are used.

> "Critical success factors are the limited number of areas of performance that are essential for an organisation to achieve its goals

and accomplish its mission. They are the key areas of activity in which favourable results are absolutely necessary to reach goals. Critical success factors are often referred to as CSFs." (Caralli, 2004 p, 11)

"A performance measure can be defined as a metric used to quantify the efficiency and/or effectiveness of action." (Bourne, Neely, Mills, & Platts, 2003, p.3)

"Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action." (Bourne, Neely et al., 2003, p.3)

"A performance measurement system can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions." (Bourne, Neely et al., 2003, p.3)

An APMS is where metrics are collected and are available for reporting or action with minimal or no human intervention to quantify both the efficiency and effectiveness of actions.

"Performance management is the use of performance measurement information to effect positive change in organisational culture, systems and processes, by helping to set agreed-upon performance goals, allocating and prioritising resources, informing managers to either confirm or change current policy or programme directions to meet these goals, and sharing results of performance in pursuing those goals." (Longenecker & Fink, 2001, cited in Amaratunga & Baldry, 2002, p.20)

Performance Measurement according to Neely (2002) is concerned with:

- Measuring the efficiency and effectiveness of actions;
- Aggregating and standardising information; and
- Setting appropriate targets.

A Performance Measurement System according to Kueng, Meier and Wettstein (2001, p.4) should perform the following functions:

- Track the performance of an organisation;

- Support company internal and external communication regarding performance;

- Help managers by supporting both tactical and strategic decision-making; and

- Capture knowledge in a company, and facilitate organisational learning.

Performance measurement systems can be manual or automated. The merging of digital technologies like data warehousing, advanced communications, enhanced connectivity through the internet and mobile networks have assisted with the automation of performance measurement systems or performance measurement "information" systems.

So what is an information system? A search of Google for the definition of information system or systems will return 30 web definitions (Google, 2005). The literature is extensive on the meaning of IS but a precise definition is not always provided. Where the definition is provided, they are similar but have enough differences to make them all unique. The difference comes from the not just the words but also the context from which the definition is being examined. The definitions don't just define an information system but try in some cases to explain what an information system is (e.g. Garrity (1998) uses two viewpoints to discuss IS: An organisational and then a socio-technical viewpoint). For the purposes of this research the following definition is used.

> "Information system means an interconnected set of information resources under the same direct management control that shares common functionality. A system normally includes hardware, software, information, data, applications, communications, and people." (Stanford Electronic Health Information Security Committee, 2005).

This definition supports the automated process defined above as well as the interrelated process between the people using an APMS.

An APMS is therefore an information system where data is automatically collected, analysed and reported and supports the definition of a performance measurement system. In one piece of literature by Paranjape,

B., M. Rossiter, et al. (2006) it is also referred to as a 'Dynamic Performance Measurement System' with respect to global organisations. This is discussed further in Chapter 2.

The definition of an IS successful implementation also needs to be considered. Implementation success has been defined by many researchers and Seddon (1999) looked at 186 articles to try to determine what IS success means. Success means different things to different people and Seddon substantiated this with discussion covering 30 different responses and looking at the context of each response and highlighting the difference. The context in which success is discussed therefore needs to be considered as this influences how the word "success" can be interpreted. Garrity and Sanders (1998) interpreted one measure of success as 'user satisfaction'.

Timing is also a determinant as to whether something is successful or not. Implementation in the near term could be considered successful but in the long term may not be considered a success. The reverse could also be true where the system could be a success in the long term after overcoming initial or near term difficulties (Göbel, Schulz-Klein, & Stender, 2003). Success is therefore based around a predetermined point of reference, both in time and space of the respondent.

The concept of IS success is an ambiguous or ill defined (Garrity & Sanders, 1998) term due to it requiring context and is therefore predominately determined in the mind's eye by the person responding. Any measure of success must therefore be analysed in the context of question, the response received, when they are asked and the understanding of the initial point of reference.

Given the low percentage rate reported of implemented APMS, people using such a system are considered the primary measure of success (Alter, 2000). Other benefits have not been considered. It is assumed that if they are using the system, it must have been delivered with the content required for it to function.

The definition of a successful implementation is therefore simple and concise. It was derived from an Enterprise Resource Planning (ERP)

implementation research paper that used a similar definition to define project success (Brown & Vessey, 2003, p.66).

> "Implementation success for an automated performance measurement system is an automated performance measurement system delivered with agreed-upon requirements and being used in the organisation."

Performance measurement and performance management follow one another in an iterative process; management both precedes and follows measurement, and in doing so creates the context for its existence. This research concentrates on the success criteria for implementing the information system that supports and automates this process.

Corporate performance management (CPM) is a concept introduced by Gartner Research in 2001, which consists of "all of the processes, methodologies, metrics and systems needed to measure and manage the performance of an organisation" (Buytendijk, Geishecker, & Wood, 2004a). This and other types of automated performance measurement are discussed further in Chapter 2, the literature review.

Justification for the research

> "Corporate performance management (CPM) is one of the hottest trends in business intelligence. Under the CPM "umbrella" are the processes, methodologies, metrics and technologies for enterprises to measure, monitor and manage business performance." (Buytendijk & Geishecker, 2004, p.1)

This area of study is new, complex and to date there is little published research (Marr & Neely, 2003) with interest mainly occurring in Europe (Chalmeta & Grangel, 2005; Jackson, 2005; Lawrie, Cobbold, & Marshall, 2004; Neely, 2004). Given these systems are relatively new, the implementation and design of these systems is a little researched area while the number of systems being deployed is rapidly increasing (Paranjape et al., 2006). The European Union (EU) commissioned a research project in 2000 (CORDIS, 2005) that was to deliver an enhanced ERP system which facilitated the automated collection of performance data across supply chains to improve Small to Medium Enterprises (SME) position in global

supply chains. The project was significant and cost EUR$3M. Results of this study were requested for this thesis by the Researcher numerous times, without success.

From a global perspective, performance measurement and the associated reporting is topical as a result of incidents like the Enron collapse and the subsequent introduction of the SOX legislation in the United States (US) in 2002 (Niven, 2003) and other regulations that affect financial reporting (e.g. International Financial Reporting Standards (Bitterer et al., 2006)). This legislation compels chief executives to comply with specific reporting requirements and to personally certify information as accurate and true. Reforms such as the SOX Act represent significant advances in the pursuit of increased disclosure of summarised company information. The important consideration for other countries is the reach beyond the US that the Act establishes. The Act provides that foreign accounting firms which audit a US registrant or a subsidiary of a US registrant will be subject to its provisions, sanctions and penalties.

This legislation rekindled discussion on the types of information provided and brought a negative response from Japan and Europe (Deloitte Touche Tohmatsu, 2002). The Act raises questions about:

- Where and how was the underlying data sourced?
- What was the level of timeliness and accuracy of the data?
- How were the reports compiled?
- How was the information summarised?
- Is the information contained in the report reliable?

Investors and financial institutions are requesting information to allow broader and deeper reporting but want to also know if there was human manipulation in the reporting of the published figures and if so how much? This reinforces the SOX legislation with respect to accountability, but introduces the criteria of reliability.

In Australia there are similar controls but there are gaps as Australian regulators prefer a principles-based approach as opposed to the US “black letter law” approach (Deloitte Touche Tohmatsu, 2002). Black letter law is exactly as defined in a statute of law.

But this information comes at a cost. Manually compiling this information is expensive and more importantly is subject to error and manipulation. Manipulation of the data was something the SOX legislation was trying to discourage.

Since the late 1990’s there have been a significant number of ERP system implementations where data collected catered for most of the measurement data required to meet automated reporting. If it didn’t capture all data requirements it usually had data interfaces to the required production sub systems. ERP vendors (e.g. Oracle, Microsoft, SAP) started to include data warehouse packages in early 2000 to enable access to this data and also provided analytic tools as part of their product suite. SAP, a large German based ERP vendor has included a data warehouse called SAP Business Warehouse (BW). This tool included web based presentation and analytic tools that supported automated performance measurement reports.

Following the ERP implementations and before the introduction of the SOX legislation, a significant number of BW initiatives started but as stated previously, there is little or no literature of success. Western Australia is the Asia Pacific or global headquarters for a large number of global Energy and Commodity companies (e.g. Woodside, BHP Billiton Iron Ore, Stainless Steel & Petroleum, Iluka Mineral Sands, Rio Tinto Iron Ore, Phillips Petroleum). SAP BW is used at most of these companies in conjunction with the SAP ERP.

Organisations have used these systems to create integrated environments to support the comprehensive reporting of business performance to shareholders, regulators and other stakeholders, and by strengthening controls around financial reporting and disclosure processes. The systems provide the foundation for broader disclosure of business information in a controlled and auditable manner. Addressing these issues has become a priority in the wake of highly visible corporate scandals (e.g.

Enron and WorldCom) and changes in business reporting regulations, such as the SOX Act and other regulations that affect financial reporting e.g. International Financial Reporting Standards (IFRS). These integrated environments automate financial reporting and associated business processes and hence are able to monitor and report on financial and non-financial information and meet the legislative requirements of industry-specific regulations, such as the Basel II Capital Accord (Bitterer et al., 2006).

Due to dynamic global competition and ever changing technologies, enterprise decision makers are no longer content with scheduled analytics reports, static key performance indicators on scorecards or fixed dashboards. Their needs have changed and they must be able to enter ad-hoc queries utilising real or near real time operational performance data, delivered to the right people at the right time. Additionally they want control over the data used for analysis and reporting. Decisions made on out-of-date, wrongly intentioned or poor quality data can do more harm than good (Azvine, Cui, & Nauck, 2005).

This research is therefore current, timely and relevant. It focuses on large-scale data warehousing applications at companies where the objective is to implement an APMS. This research is intended to focus on BW implementations instigated and managed in Western Australia by the use of focus groups and case study research.

The other significance of this research is that performance management systems appear to have a high percentage of failures (Bourne, Neely, Platts, & Mills, 2002) and this research may assist organisations to identify key success factors by utilising the DeLone and McLean Information System Success Model. An updated model for implementing APMS will document a set of success factors that may be of some use at these companies and more importantly provide some IS literature in this research domain. The research domain is defined as the sphere of activity, concern, or function of the research.

Approach Overview

The approach followed for the research is illustrated in Figure 1, below. The stages are illustrated and numbered in a circle on the figure. A summary of the approach is below, although a detailed description is contained in Chapter 3.

First, a literature review was conducted based on current literature, resulting in an initial seed model (Figure 8: Research model for Data Warehousing Success (Wixom and Watson, 2001, p.20)). A model was also produced that illustrated the relationship between different disciplines in related performance measurement and management literature (Figure 9: Model of the literature relationship of potential factors that may lead to APMS success.) as well as a model to define the research problem in relation to the associated theory (Figure 10).

Utilising the seed model produced from the literature review, a set of semi-structured interviews was conducted utilising focus groups of industry experts active in the automation of performance measurements. The output from the qualitative interviews resulted in a revised model – Model 1 (Figure 17. Draft Research Model for APMS Success). This is discussed in Chapter 4.

Model 1 was then used as the input for a case study with further refinements to the model being made after analysis of the case study data (Model 2). The Case Study data analysis is contained in Chapter 5.

A final review is conducted in Chapter 6, when a comparison is made of the Focus Group and Case Study data. This results in minor refinements to the model, culminating in the final model (Model 3).

The research concluded when a final model was obtained and the thesis submitted for examination.

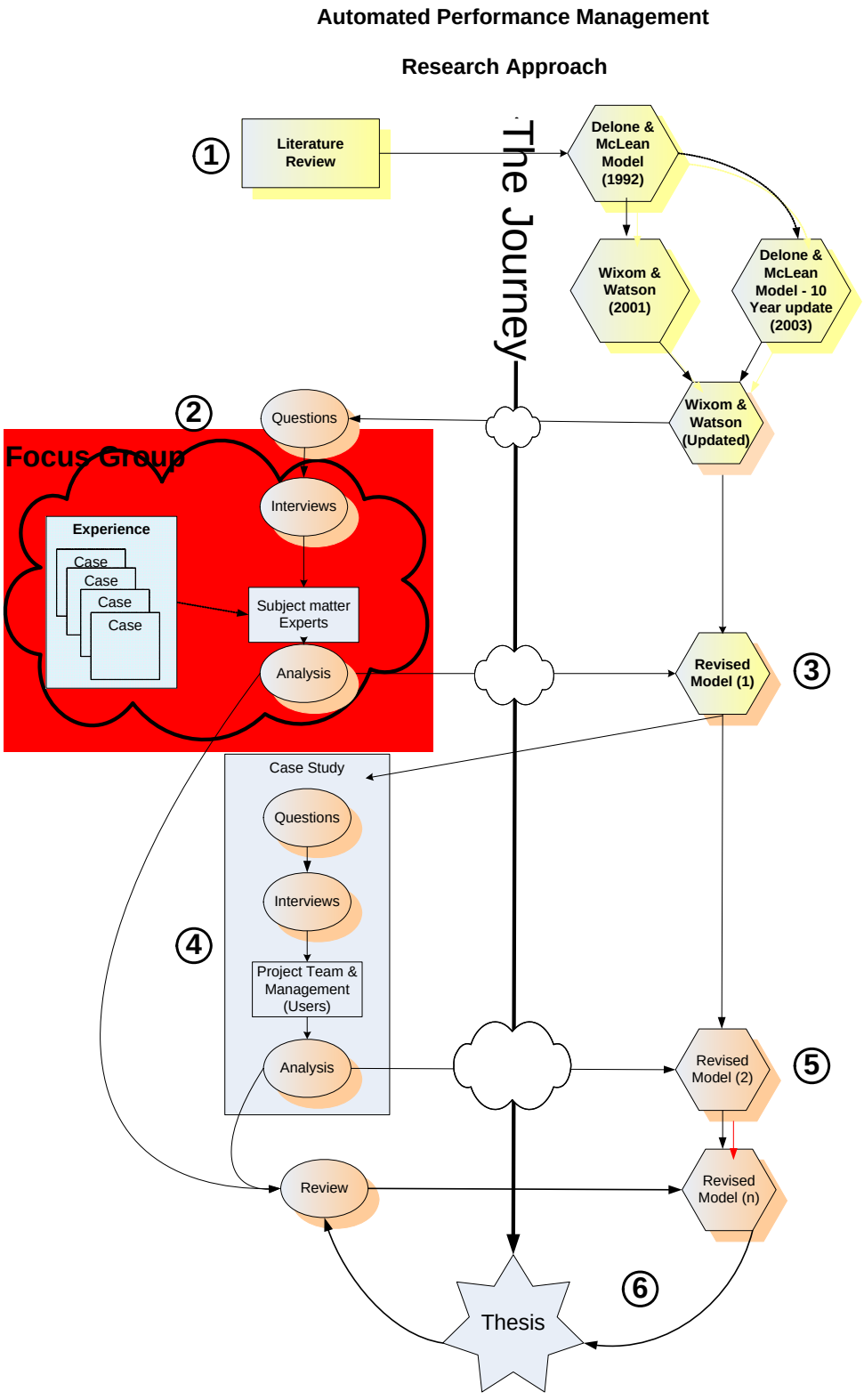

Figure 1. Research Approach

Outline of the report

The thesis chapters follow the method of the research described in the previous section. Each Chapter and its alignment to the process are illustrated in Figure 2, below.

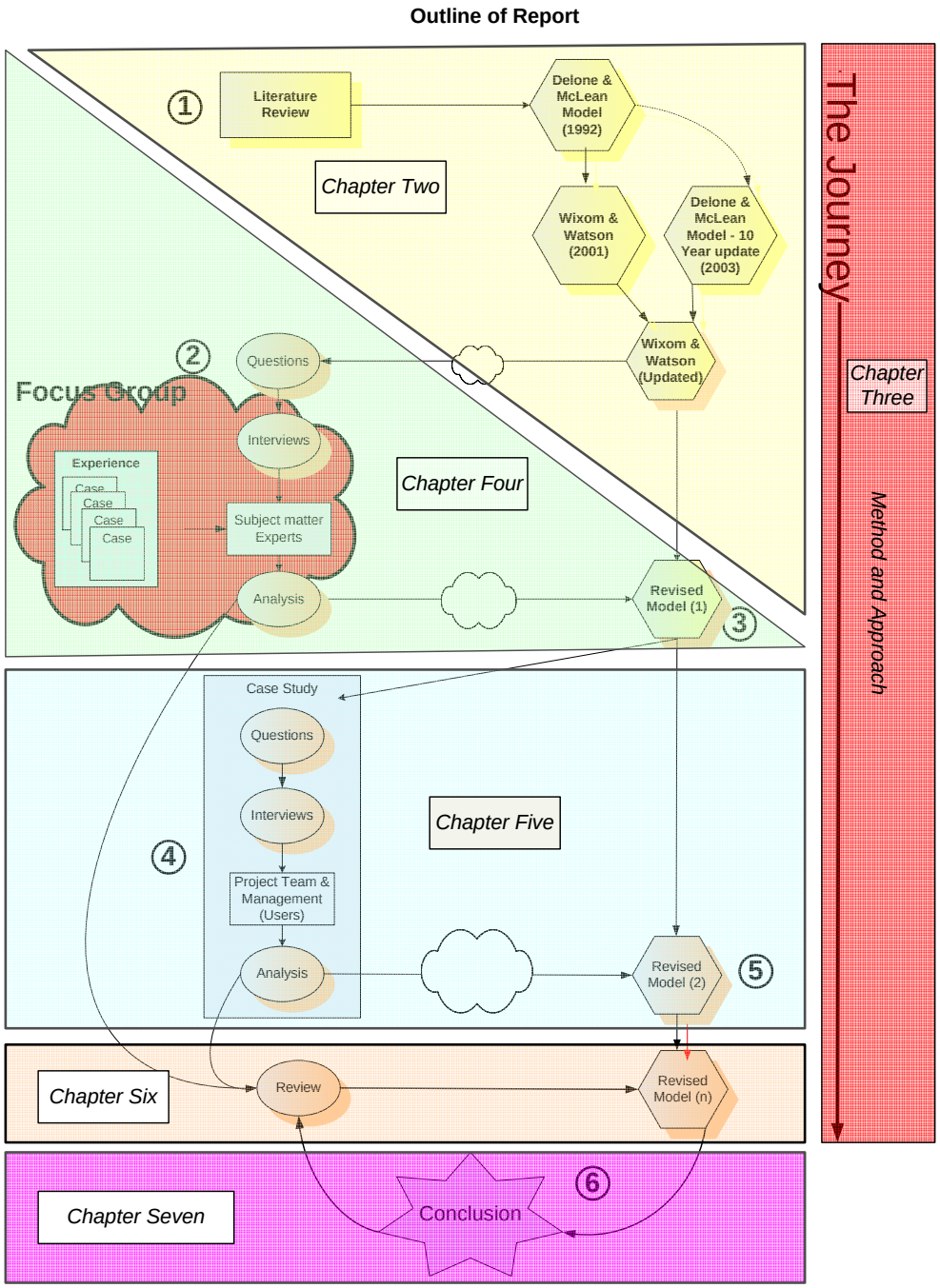

Figure 2. Outline of Report with respect to research approach with chapters indicated

A summary of each chapter follows. It is based around instruction provided by Perry (1998).

- *Chapter One* is this chapter. It is intended to provide a background to the research and states the research question and key definitions are supplied. It states the justification for the research and an overview of the approach followed for the research while illustrating how this relates to other chapters. It delimitates items of scope and the assumptions made.

- *Chapter Two* is the Literature Review. In this chapter the DeLone and McLean models are discussed as well as the extensions produced with the Wixom and Watson data warehousing success

model. Literature impacts from operational management theory and related research issues are also detailed. The research problem and associated theory are discussed resulting in the seed model.

- *Chapter Three* deals with the methodology and underlying philosophical perspectives that have been considered. This "methodology" chapter assisted the researcher in formulating the approach and simplifies the process taken for the reader due to the multiplicity of the paradigms being used.

- *Chapter Four* introduces the reader to the focus group. The justification for the paradigm and methodology are discussed while detailing the research procedures used during this stage. Reasons for the focus group, composition, and difficulties are discussed as well as stating ethical considerations and biases that were raised and or identified that may impact the final results. The results of the focus group data collection are noted as well as an analysis of these results. A comparison is made of the results with respect to the literature and the seed model. The chapter concludes by proposing a modified model with respect to the research problem and associated theory.

- *Chapter Five* follows the same structure as the previous focus group chapter. The major difference here is the modified model is seeded into a set of case study interviews where people from an organisation reflect and comment from their individual experience of the organisations recent APMS implementation. The chapter concludes by proposing an updated model with respect to the research problem and associated theory.

- *Chapter Six* is a discussion on possible reasons for why the results differ between the focus group and the case study. Another updated research model is presented.

- *Chapter Seven* provides conclusions about each research issue or proposition discussed, culminating in propositions about the research problem and presenting the final resulting model. Implications for theory and practitioners are discussed while stating limitations of the resulting model. Further research areas are also listed.

Delimitations of scope

The scope of APMS being a new area of research comes with some risk, as being new also means that there is little known about the area. One risk is that it would be easy to go both broad and too deep into some topics. To facilitate the research and enable it to be completed the following items were excluded:

- Benefits of the success of APMS were excluded because when the original investigation commenced it was uncertain if there was such thing as a successful implementation. The research was to discover the factors necessary for successful implementation and therefore the benefits associated with APMS are not explored.

- Like benefits, the reasons for implementing an APMS into an organisation are not specifically covered. Questions like: Why have an APMS? What is the business justification (or business case) for an APMS? How do they get started? What and how long before there is a return on investment (ROI)? These questions have been excluded from the scope of this research as they do not appear to impact on the success factors for an APMS implementation.

- Detailing the features of an APMS. APMS's are an emerging area of system development with the convergence of traditional business systems, ERP, data warehousing and real-time process control systems. While it has been attempted to describe an APMS and even classify some examples in Chapter 2, the embryonic status of the system area makes it difficult to determine specific features.

- As other systems converge into the APMS domain, so do Supply Chain Management (SCM), Customer Relationship Management (CRM). These too are immature and evolving areas and are treated at a high level in the research.

Key assumptions

The following assumptions have been made in this research:

- The members of the focus group were representative of the people in this field of work.

- There are critical success factors for implementing APMS's.

Contribution

In summary, this research will make two contributions. They are:

- Proposing a model of critical success factors for implementing an APMS; and

- Examination of links between operational management theory and IS success models.

Conclusion

This chapter laid the foundations for this report. It introduced the background to the research, the research problem and research issues. Definitions have been presented, the research has been justified, the approach was briefly described, the report was outlined, and the limitations and assumptions given. On these foundations, the thesis can proceed with a detailed account of the research and its results.

In the next chapter, the literature is reviewed to investigate the relationship between performance management and measurement literature derived from operational management theory. Performance measurement system architectures are examined with respect to the technology challenges, gaps and types of systems available. Relevant published success models and associated factors are discussed resulting in a seed model.

CHAPTER 2
LITERATURE REVIEW

Introduction

The previous chapter provided a background to the research, stated the research question while providing key definitions and justification for the research. It gave an outline of the thesis and delimitated items scoped and the assumptions made.

In this chapter, performance management and measurements literature from operational management theory is studied, while performance measurement system architecture, technology challenges, gaps and types of APMS are investigated through the associated literature. The DeLone and McLean Information System success models (1992, 2002) are discussed with the extensions produced from Wixom and Watson (2001). Finally relationships between the disciplines are analysed to discover possible success factors for implementing an APMS. The research domain and associated theory are also discussed with respect to the literature and result in a seed model for the first stage of the field research.

No specific literature was found dealing with success factors for implementing Automated Performance Measurement Systems (APMS) and there is a minimal amount of literature about performance measurement and IS as applicable to global organisations operating in changing business environments (Paranjape et al., 2006). This is confirmed in a number of articles in the performance measurement area including Jiménez-Zarco, Martínez-Ruíz and González-Benito (2006 p1), Paranjape, Rossiter, and Pantano (2006 p5), Martinez, Kennerley and Neely (2004), Yeniyur (2003 p140), Kennerley, Neely and Adams (2003) and Kueng (2002). Much has been written about performance measurement frameworks to aid the design of appropriate measures (such as the performance prism and the balanced scorecard) and the overhaul of measurement systems in general. There is also literature around the management philosophies for the development of a successful performance measurement system which includes the vision and

strategy, the goals of the different subject areas, and the metrics themselves. Critical success factors (CSFs) in this area of the literature include skills and capabilities, adequate resources, knowledge and management processes through which a company flourishes (Toivanen, 2001, cited in Haapasalo, Ingalsuo, & Lenkkeri, 2006), but nothing was found about the factors for success of APMS'.

The literature review conducted is concerned with analysing CSFs for APMS, the key literature reviewed is drawn from two different fields of study. These were:

- Operational management performance measurement; and
- Information System success models.

Literature impacts on performance management originate from operational management theory and consist of analytical and theoretical frameworks that relate to their operation while information system success models have been documented at length and are based on the work by DeLone and McLean, firstly in 1992 and then again in 2002.

The relationship between performance measurement and IS is explained to determine if there is any relevance between the success of the system and the appropriateness of a performance measurement initiative(s) in that system. Investigation of performance management and its relationship to performance measurement may provide the link between the two.

To understand why performance measurement appears in operational management literature it is first important to understand what operational management is. The following sections explain the concepts of operational management, performance management and measurement with respect to the literature.

Operational Management

Management science and operation production theory are contemporary extensions of the work of Frederick Taylor (Taylor, 1911 cited in Adam, E.E, 1983, p 386) and other scientific management

advocates. The approach to operations management is one of rationally modelling processes with the intent of improving efficiency and resource allocation. Although management science is not unique to operational or production processes, the rationality and data rich production environments supply fruitful opportunities for management to identify problems and use this data to resolve them (Adam, 1983).

Management processes can be categorised in different ways, but Ulrich (1984) distinguishes between strategic and operational types (Ulrich, 1984, cited in Melchert & Winter, 2004 p542). This categorisation stems from the St Gallen management model which asserts that the strategic development process cycle and an operational management process cycle are differentiated but are linked by common monitoring and communication processes, in a normative orientation.

Operational management is interpreted as a control path of strategic management, and business support processes are interpreted as a control path of operational management. Melchert and Winter (2004) state that while operational and strategic management processes are composed of the same activities, they differ with respect to cycle time, execution frequency, the information that is processed and typically they have different responsible organisational units. The common but different activities are monitoring, forecasting, planning and budgeting, activity design and communications.

Operational and strategic management also differ in their structure and timeliness. The similarities and how they are linked is illustrated in the Figure 3, below.

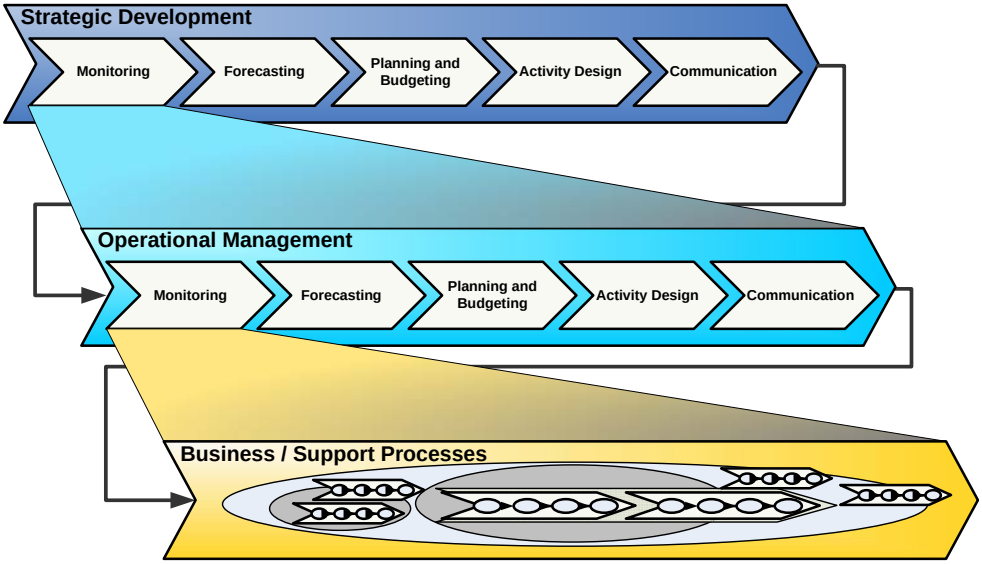

Figure 3. Aggregate process model of business performance management (Melchert & Winter, 2004, p.542)

With respect to the discussion on performance measurement, Melchert and Winter (2004) described the common operational and strategic management activity types as:

- Monitoring: Business processes are observed to identify potential upcoming problems, e.g. deviation from targets when comparing planned against budgets, stock moving to the incorrect location causing contamination or incorrect stock levels, market share prices for competitors (Marjanovic, 2007; Gluchowski et al. 1997, pp.75-76 cited in Melchert & Winter, 2004).

  In the main, the monitoring is done against relevant *measures* that are typically filtered and presented in another acceptable form (e.g. graphical). If it is electronic, the data has to be structured so a computer can process it. For a human being the data or information needs to be presented in order to make it compatible with the needs, abilities and limitations of people, for example with exceptions highlighted.

- Forecasting: *Measurements* obtained during the monitoring activity may be utilised to allow projections for future states, i.e. to serve as an indication of a possible future state. Monitoring and forecasting are tightly coupled in an operational scenario as one typically depends on the other, whereas forecasting has similar requirements to planning and budgeting.

- Planning and budgeting: Planning is the process of proposing the activities required to create a desired future on some scale. Budgeting is the systematic planning that represents a plan at a particular point in time. Budgeting is typically for some form of *measure*, e.g. expenditure of usually a fixed resource, such as money or time, for a given period. The information created during the

monitoring and forecasting activities where potential actions and / or *measures* are identified, are used as inputs in the Planning and Budgeting activity so consequences can be assessed and restrictions reviewed to assist in identifying a solution or set a course of action (a plan or a budget).

To reinforce the monitoring activity, planning and budgeting scenarios or results include *measures* and solutions that are stored and are made accessible.

- Activity design: The planning and budgeting activity results in a set of *measures* (the basis for performance measurement), which are specified during the activity design phase. An activity design may be undertaken in a variety of ways but typically consists of a number of steps taken, the timing and duration of the steps, who is performing the step, who is responsible and where the work is undertaken while also determining how the steps or outcomes are to be measured.

- Communication: This activity requires the creation, distribution and presentation of information by compiling and publishing targets and *measures,* and the associated tasks required to realise the benefits identified during the management activity stream being undertaken i.e. strategic or operational.

In the "Performance Based Management handbook", Artley and Stroh (2001) explain the relationship between strategy and operational processing by means of the link between strategy development and operational management through the collection, analysing and reporting of measures to assist in making sound business decisions. These measures affect the business function by justifying budgetary expenditure, reporting progress on common business objectives, identifying areas of strengths and weaknesses and support continual assessment of the business while driving business improvement. In their words, "*performance measurement supports organisational existence*" (Artley & Stroh, 2001, p.54).

Fawcett, Smith and Cooper (1997) report that strategic priorities should be related to operational excellence. The greatest obstacle is maintaining focus on strategic goals and operational improvements, but information and measurement capabilities are the missing link between strategy and operational initiatives (p.411).

Bitterer at al. (2006), stated that performance measurement help manage performance at the corporate level and create a foundation for an

enterprise wide approach to managing performance. This is done by linking strategy to operational execution and leveraging off business intelligence investments to bring consistency to financial and operational reporting. This then can progress corporate governance and help address compliance issues (p. 19).

As outlined above, *measures* are critical to each of the processes detailed, both from a strategic and operational management point of view.

Performance Management and Performance Measurement

Performance Management

Performance management deals with the management of an accomplishment throughout an organisation and as a result it is a multidisciplinary activity. It involves performance measurement, systems and processes. Performance management is about managing people and 'the way people within an organisation operate and work together'(The Centre for Business Performance, 2005, p.3).

Another similar description of the relationship between performance measurement and management was stated earlier by Amaratunga and Baldry (2002):

> "Performance management is the use of performance measurement information to effect positive change in organisational culture, systems and processes, by helping to set agreed-upon performance goals, allocating and prioritising resources, informing managers to either confirm or change current policy or programme directions to meet these goals, and sharing results of performance in pursuing those goals." (Amaratunga and Baldry, 2002 cited in Folan & Browne, 2005b, p.664)

Performance management is dependent on performance measurement. Artley and Stroh (2001) take it further by stating that

> "Performance measurement is the "heart and soul" of the performance-based management process" (Artley & Stroh, 2001, p.1).

The field of performance management has developed from diverse origins (The Centre for Business Performance, 2005) as different

measurement and management techniques and approaches have developed independently. Accounting is interested in measuring and controlling the financial performance of organisations, Operations have been concerned with shop floor (manufacturing and or services) performance often concentrating on improving throughput and efficiency and Human Resources have been concerned with managing the performance of people. The ongoing management function may be from reviewed against a published strategy or developed plan to deliver future objectives (including planned performance). It is only relatively recently that performance management from these disparate disciplines has begun to converge and recognise the need for integration into a multidisciplinary approach to managing performance. (The Centre for Business Performance, 2005).

Rayner, from Gartner, (2005, p.2) in 2001, defined “Corporate Performance Management” (CPM) in a concept paper in which it is stated that Business Intelligence (BI) had “collided” with Enterprise Resource Planning (ERP). In this early paper, Gartner believe that a CPM software suite must contain at least three of the following application areas:

- Budgeting, planning and forecasting;
- Profitability modelling and optimisation;
- Scorecards;
- Financial consolidation; and
- Statutory and financial reporting.

Two years later, Rayner in 2007 (Rayner, 2007) stated that few vendors can claim to have a complete suite, but although not specifically stated, the claim “of three of the five” is still implicit and remains confusing. This creates uncertainty about what a performance management application or system is and is confirmed in the 2007 paper:

> “Recent discussions with Gartner clients regarding business intelligence (BI) exhibit an increased focus on and use of the term "performance management." It may be easy to talk generally about "optimising performance" for a process, for an operation or across an organisation, but this concept will be interpreted differently by

employees, depending on their level of seniority, departmental or functional focus, and individual priorities." (Rayner, 2007, p.2)

It could be argued that the Gartner clients are confused because they do not know what performance management consists of. The variability of functions and data confirms performance management is unclear and people don't know what they really are. If you don't know what they are, how do you know if you have successfully implemented such a system?

The fact that the Information System literature is confusing on the topic of performance management leads to a discussion into what the operations management discipline calls 'performance measurement'.

Performance Measurement

Performance measurement has become a multi-million dollar industry (Neely, 2002, cited in Paranjape, Rossiter & Pantano, 2006, p.5) as senior managers make decisions based on performance measures that affect the viability and ongoing performance (competency, competitive position and continued profitability) of their companies (Ahmed, 2002; Eccles, 1991; Kaplan, R. S. & Norton, 1992; Neely, 1999, 2000b, 2002; Papatheodorou, Vassiliou, & Simon, 2002). They also make decisions that affect the efficiency and effectiveness of their operations. Using these measures, data, is extracted and made available to become information and knowledge in the operational management process.

Performance measurement is predicated upon the delivery of accurate, timely information to measure process and has been discussed for over 50 years (Ridgway, 1956, cited in Neely, Kennerley, & Martinez, 2004, p.2) with different views to its success, failures, shortcomings and strengths. For example, in the 1980's, Porter and Millar (1985) identified information as a source of competitive advantage and Kaplan began his investigation into performance measures. While some people would argue that Porter, Miller and Kaplan are not within the same discipline or area of study, they identified the value in collecting performance measures to achieve their specific goals. By the 1990s there was increased activity in this area and we saw the Performance Management Manifesto (Eccles, 1991), Kaplan and Norton' Balanced Score Card (BSC) (1992), Organisational

Knowledge (Nonaka, 1994), Porter published “What is Strategy?” (1996) and Guha, Grover, Kettinger and Eng (1997) investigated the link between Business Process Change and Organisational Performance. This was evidence that people had previously started to look for links and relationships between the literatures.

Operational performance measurement and management literature on the other hand were still isolated from each other in the operational management world (Dikolli, 1999; Neely, 1998). About the same time an increasing number of firms appeared to be "re-engineering" their measurement systems, with data suggesting that between 1995 and 2000, 30 to 60% of companies transformed their performance measurement systems (Frigo & Krumwiede, 1999, cited in Martinez et al., 2004, p.1 ; Neely et al., 2004, p.1).

Bourne (2005, p.101) explained that there is significant literature dealing with the design and implementation of performance measurement systems but stated there are few studies of implementation success and failure. His paper describes three phases of research into design and implementation of performance measurement systems involving 16 different businesses. The conclusion from the research is that senior management commitment is a key driver of success, but the paper also describes the main factors which influence and change during the performance measurement project implementation. McCunn (1998, cited in Bourne 2005, p.101) quotes that 70% of performance measurement initiatives fail based on 10 implementation criteria (or “commandments”).

This thesis uncovered six published literature reviews on performance measurement:

- Bourne, Neely, Mills and Platts (2003);
- Yeniyurt (2003);
- Franco-Santos and Bourne (2005);
- PMMI Project(2005);
- Jiménez-Zarco et al (2006); and

- Paranjape et al.(2006).

Bourne, Neely et al. (2003) dealt specifically with literature on implementing performance management systems. Another (Jiménez-Zarco et al., 2006) dealt with performance management systems with respect to new product development and the last (Paranjape et al., 2006) brought the material up to date. These reviews are extensive and form the basis of the operational performance measurement field of study in this thesis.

Marr and Schuma (2003), produced a citation analysis of this field using 301 papers published in various conference proceedings between 1998 and 2002. These papers had over 4,400 citations. The Production Planning and Control Journal produced a special issue (March 2005) to report research on success and failure of performance measurement systems. The objective of this special issue was to collect and present experiences and findings of an international research community working in this area (Bititci et al., 2005, p.99). While comprehensive, the articles once again represented disciplines other than IS. The disciplines covered include: accounting, economics, human resource management, marketing, operations management, psychology, and sociology.

An article by Paranjape, Rossiter and Pantano (2006) is the most recent review and discusses the Balanced Scorecard as a popular performance measurement framework while also identifying the problems associated with designing and implementing performance measures and the lack of dynamic performance measurement systems. The review also explores performance measurement systems as they relate to business processes, virtual organisations and their role in global organisations.

Performance Measurement and Global Organisations

Global organisations (or multinationals) are reported in the literature as having been actively involved in performance measurement and the associated systems for a number of years. They have embraced the technological revolution and specifically have leveraged off the merging of technologies to enable virtual organisations (Davidow & Malone, 1992; Shekhar, 2006; Venkatraman & Henderson, 1998; Walters & Buchanan,

2001) but there is currently very little in the literature on performance measurement in relation to global organisations (Yeniyurt, 2003).

Microsoft and Nokia are quoted examples (Paranjape et al., 2006, p.10) where corporate offices are in one part of the world, product development and testing in a different part of the world and marketing in yet another. Global organisations by definition have to cater with geographical boundaries, different time zones and varied legal requirements. For the most part, global organisations no longer consider these as obstructions but utilise them for their potential advantage and purported increased productivity but little attention has been given to how this organisational configuration is measured and what tools and techniques are used to support this measurement (Walters, 2005, p.233).

Difficulties with managing operations for a global organisation are particularly difficult because the activities of Monitoring, Forecasting, Budgeting and Planning, Activity Design and Communications have to deal with different time zones, varied legal requirements and different languages and cultures (Melchert & Winter, 2004, p.542).

To help overcome these difficulties, Global organisations have spent considerable time researching and implementing performance measurement models and methods (Bourne, Neely et al., 2003, p.5).

Performance Measurement Models and Methods

Historically, performance measurement systems were one dimensional and focused purely on financial measures (Bourne, Franco-Santos, & Wilkes, 2003, p.16) before Eccles (1991) produced his 'Performance Management Manifesto' and then Kaplan and Norton (1992) produced the now widely recognised Balanced Score Card (BSC). Other types of performance measurement Systems include the Business Excellence Model, Shareholder Value Frameworks, Activity Based Costing, Cost of Quality and Benchmarking (Neely, 2000a; Sedera, Gable, & Rosemann, 2001). Most of these models and methods are supported by performance measurement software packages.

While all of these performance measurement models and methods are still used and remain relevant, the BSC seems to be the most influential and dominant model (Marr & Schiuma, 2003, p.685). The BSC literature has evolved to incorporate the concept of ‘business models’ (Eccles and Pybum, 1992) and "strategy maps" (Kaplan, R. S. & Norton, 2000). The BSC has emerged as the cornerstone of a ‘total business performance measurement framework’ (Kaplan, R. S. & Norton, 1996). Questions on the usefulness of the BSC and its benefits have been raised (Neely et al., 2004, p.1) but are not considered to be within the scope of this research.

Performance Measurement Systems

Neely et al (2003, p.129) states that first generation performance measurement systems were static in that they failed to illustrate adequately the linkages between different performance measures. There is significant literature on designing performance measurement systems (PMS) with many providing a good set of directions (Bourne, Mills, Wilcox, Neely, & Platts, 2000; Neely et al., 2000). The performance measurement systems area however, keeps evolving, and to date, very few people have explored how this evolution can be managed (Neely, 1999, p.206). Waggoner et al. (Waggoner, Neely, & Kennerley, 1999, cited in Kennerley & Neely, 2003, p.1222) identify and describe possible forces, which shape the evolution and change of organisational performance measurement systems.

Kennerly and Neely (2003b) explore the evolution of performance measurement systems and the impact of managing these systems in a changing environment (p.213). The importance of managing this change appears wasted in most businesses as they do not ensure that the performance measurements systems continue to reflect the mission and objectives of the organisation. Kennerley & Neely (2003a) provide an insight into the factors that facilitate and inhibit the introduction of new measures, the modification of existing measures and deletion of obsolete measures by investigating the drivers of, and barriers to, advancement (p.1243). This is supported by Waggoner et al. (1999) where they describe how little or no change occurs following the implementation of those factors.

Kueng et al. (2001) described PMS' as having five components. These were people, procedures, data, software and hardware. Descriptions of these components are detailed in Table 1, below. Kueng et al also state that the various systems that deliver performance-relevant data are integrated and that manual intervention (for extraction, verification, conversion and loading of data) is not required, i.e. data collection is completely automated.

Table 1. Components of a Performance Measurement System (Kueng et al., 2001)

People	Procedures	Data	Software	Hardware
Owner of PMS.	Procedures and rules for definition of performance indicators.	Performance-relevant Data (as-is values).	Software for extraction, transformation and loading of data.	Personal Computer or other visual display unit Server.
People accountable for the units measured.	Rules for data management.	To-be values of performance indicators.	Database Mgmt software / Data Warehouse software.	Communication infrastructure.
People who set-up and maintain the PMS.	Rules for data communication.	Performance results (calculated data).	Data analysis software.	Storage system.
Data suppliers.	Rules for use of performance results.	Meta-data: description of performance indicators.	Presentation and communication software.	
Internal and external users of the PMS.				
Internal and external stakeholders.				

Table 1 illustrates the technical, operational, social and political complexities that exist within APMS's. With this complexity comes the need to develop frameworks for relating functional or local performance to overall business level performance, as well as examining the interaction between a performance measurement system and its internal and external environment (Lockamy & Spencer, 1998).

Kennerley, Neely and Adams (2003, p.38) looked at the term 'performance measurement system' and defined it as three inter related elements:

- Singular measures that quantify the impact of specific actions;
- A set of measures that combine to assess the performance of an organisation as a whole; and

- A supporting infrastructure that enables data to be acquired, collated, sorted, analysed, interpreted and disseminated for management use.

The key word in the final element is *'use'*. If managers do not use the data, why is it still being measured and distributed to them? Kennerley et al. do not specify reasons why managers did not use the systems. For example, whether it was due to data inaccuracy, obsolescence or simply ceased to be useful in their business function.

By implementing an APMS, or just a performance measurement system, it has been reported in another study that four mechanisms appear to contribute to the success of measurement managed companies (Gates, 2000). The four mechanisms are: closer agreement among management on strategy; greater clarity of communication; focus and alignment efforts; and organisational culture (p.49).

The success or failure of a performance measurement system is not necessarily defined by the information system itself. Considering just this as an aspect would be a flaw (Guha, Grover, Kettinger, & Eng, 1997, p.120). Another aspect is the performance measures themselves, that can be divided into hard factors (objective or easily assessable) and soft factors (more subjective and difficult to pin down).

The classification of hard or soft for factors has been adopted from the literature. Hard factors are mostly of a technological nature. These factors can be measured, touched or viewed. They have substance. Soft factors on the other hand cannot be. They are soft because they endear themselves to emotions and feelings (Bruch & Ghoshal, 2003, p.45) e.g. organisational initiatives (Filippini, Forza, & Vinelli, 1998, p.200), culture, behaviour and attitudes (Bititci, Carrie, & McDevitt, 1997, p.525).

The hard factors in the definition and subsequent implementation of performance measures include data creation, data collection, data analysis, information distribution and the writing and execution of the software programs to provide the data automatically (Bourne et al., 2000; Turner, Bititci, & Nudurupati, 2005, p.136).

The softer factors tend to be either ‘drivers’ or ‘blockers’ (Lewin, 1947, cited in Turner et al., 2005, p 136). Turner et al., states that Lewin’s (1951) three-phase model suggests it is necessary to decrease or eliminate the barriers before implementing, and increase the drivers after implementing, for the change to be successful.

A five-year action study of the implementation of performance measurement systems by Bourne (2001; cited in Turner et al., 2005, p.136) concluded that there were two main drivers and four blockers as key forces that may impact a successful implementation. The two main drivers were:

- Management commitment: especially senior managers responsible for changing the way the business is managed.

- The perceived benefits from using the performance measures: through the review and rationalisation of the measures and the subsequent automation of reporting these measures (Eccles, 1991, p 132). The perception was that by having better information, Managers would be able to assess how well a strategy was proceeding. This would be done by continual review of the measures associated with the new strategy, and the resulting review of the associated drivers.

The four main blockers were:

- The time and effort required by employees: managers (Mettanen, 2005, p.180) and employees are always busy with many demands on their time and projects are just more problems. Economic efficiency means that additional resources do not always exist for these activities.

- The difficulty of implementing the measures caused by the lack of appropriate information being available from source systems: in most of the companies the data are often not available or not in the format required (Bourne et al., 2000, p.758; Mettanen, 2005, p.180). Data accuracy and the lack of information technology support (Nudurupati & Bititci, 2005, p.152) also add to the ‘information technology blocker’.

- Resistance to performance measurement: occurs when employees are uncertain about the outcome of implementing new technology in general, as well as to performance measurement, in particular due to the fear of personal exposure.

- Parent company initiatives: remove the resources necessary for performance measurement, assigning new higher priority projects,

> and other unintentional initiatives such as company restructuring. These initiates will make the existing measures obsolete or not important. (Turner et al., 2005, p. 137)

These barriers are similar to the inhibitors listed by Buytendijk & Gassman, from Gartner, (2005, p.3) with respect to a corporate performance measurement dashboard implementation. Gartner state that while they understand that managers want access to better, more timely information, it is not yet possible to have real time high quality information as most dashboards are created ad hoc and out of some pressing operational need from manually entered, fragmented data. Initially they tend to work, but as time passes, they fail and the initial expectation is either never met or not maintained. Buytendijk & Gassman draws a parallel with the failure of Executive IS (EIS) in the mid to late 1980's which promised to meet the needs for better management information. These failed due to their limited value in integrating differing reporting streams and management was offered another version of the 'truth', which being another report typically confused the issue.

Buytendijk & Gassman, from Gartner, (2005, p.3) state that to manage a dashboard implementation, success indicators need to be put in place to measure auditability, speed, quality and alignment of the performance measures being displayed.

Kennerley and Neely (2003b), collaborated with Adams (Kennerley et al., 2003)to publish guidelines on how to maintain the relevancy of a performance measurement system. Through the researched cases they identified that relevance and effectiveness was maintained by catering for modifications to the associated performance measurement system as changes occurred within the individual business's working environment. The changes either externally (e.g. competitor actions or regulatory requirements) or internally driven (e.g. extra production, reducing high stock levels, maintaining staff skill levels and managing disproportionate leave entitlements) required the companies to react in a timely, if not immediate, way to the associated business event. In fact,

> "the ideal state would be reached if reactions could be conducted in real-time, i.e. without any latency between recognising a relevant business event and taking an appropriate action" (Melchert & Winter, 2004, p.537).

Therefore what is available for providing this 'real time' link? The answer lies with the development of *automated* performance measurement system?

Architecture to support Automation of Performance Measurement Systems

Buytendijk & Gassman (2005, p.2), from Gartner, state that unlike the 1980's when EIS's where popular, other conditions now make the implementation of dashboards and the presentation of measurements easier to complete. The first is that technology has improved, it is less expensive and in the main commercially available "off-the-shelf". The second is that well understood methodologies now exist along with defined measures, to assist in the process for defining the measures as well as implementing them e.g. Balanced Scorecard (BSC), activity-based management (ABM) and Six Sigma, Solomon indicators used in oil and gas, number of employed persons, staff turnover, Offshore petroleum exploration expenditure.

IS architecture is the authoritative definition of the business rules, systems structure, technical framework, and product backbone for business IS (Zachman, 1987, p.291). IS architecture consists of four layers: business architecture, systems architecture, technical architecture and product architecture. For most organisations, the IS architecture usually comprises a number of assorted applications, with each supporting a common set of business processes (Calhoun, 1987, p.287). Melchert and Winter suggest (2004, p.537) three different reasons why there are many different applications:

- The software packages at the time of selection did not support all processes of the organisation. Many organisations therefore acquire "best-of-breed" to achieve the best fit for their business process.

- An evolving IS architecture driven by the changing needs of the business. Applications are usually replaced when it no longer fits the need, it is no longer supported by the vendor or is costly to maintain.

This leads to comprises of both existing and newly implemented IS that have to be integrated.

- Acquisition and mergers. When two or more organisations come together they have to integrate their IS in order to reduce costs and improve productivity.

Extensive systems development and acquisition has led to the creation of ever increasing, high maintenance interfaces between applications, which are necessary to maintain data integrity and consistency across systems. Many companies in this situation have implemented specialised Enterprise Application Integration (EAI) suites to provide a common integration infrastructure. EAI generally refers to integration at the technology level but the integration also needs to occur at an application or systems level and be representative of the automated business process. This allows for a convergence of business process modelling and enterprise application integration software to allow business process automation.

EAI suites are one example of the off-the-shelf technology that now provides a ready made information technology solution. This allows for transactions to occur either in real-time or near real time, i.e. taking out the latency (or delay) between an event and a corresponding action and utilising a communication protocol or middleware layer to gather relevant inputs from a variety of systems. An EAI suite integrates varied applications in or near real-time by seamlessly pushing data (or data changes) to receiving applications (Lee, J., Siau, & Hong, 2003). The key is the real-time decision-making that EAI allows (Zimmerman, 2003).

Enterprise wide data analysis that has traditionally been performed by Business Intelligence (BI) software is used to provide information that is necessary to assist in making a decision and taking appropriate action if required. BI is defined as the acquisition, interpretation, collation, assessment and exploitation of information. It is performed on information that is both internal and external to the enterprise. As information is gathered, it is filtered and aggregated and can then be used to extract information about problems and inefficiencies in the business (Umapathy, 2007, p.174a).

Actual and historical data can be analysed when using a "data warehouse" as the data source for a BI solution. The data warehouse environment simplifies the integration of the needed data as well as its aggregation to the relevant levels. It is usually not possible with analysis based on data gathered only from an EAI infrastructure.

Knox (2007), a Gartner researcher, states that analytics leverages data in a particular functional process (or application) to enable context-specific insight that is actionable (Knox, 2007). It is used in many industries in real-time data processing situations to allow for faster business decisions (although analytics is different from BI, as BI products play a role in analytics). The convergence of analytics and other IT developments such as business process modelling (BPM), BI and EAI is starting to impact on business measurement systems and is enabling them to provide a richer measurement environment.

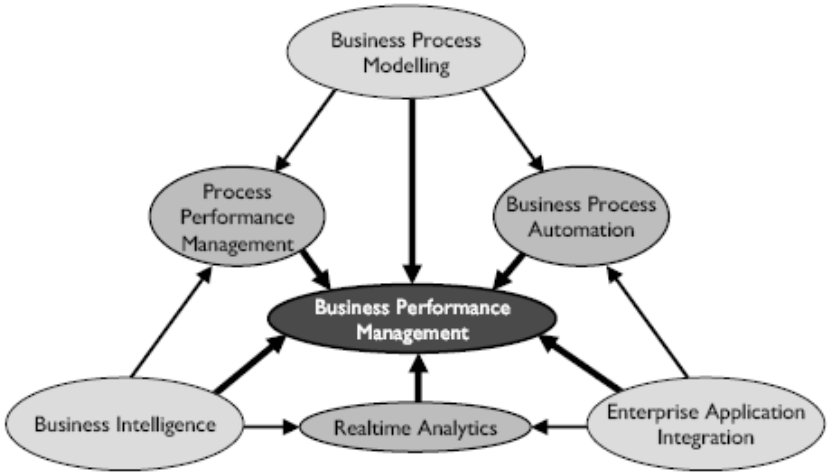

Figure 4. Converging technologies for Business Performance Management (Melchert & Winter, 2004, p.536)

With the convergence of BPM, BI and EAI, Melchert and Winter (2004, p.538) suggest that there are three key enablers for an integrated environment. These services are: Business Process Automation, Real-time Analytics and Process performance management. This is illustrated in Figure 4, above. The service links provide:

- Business process automation. This provides the application integration services to automate business process implementation, e.g. workflow execution to multiple heterogeneous applications (Georgakopoulos, Hornick, & Sheth, 1995).

- Real-time analytics: Real-time analytics allow data to be compared against predefined levels (Rabin, 2003, p.59). Combining the integration capabilities of EAI with advanced analytic capabilities moves analysis of measurements closer to operational management requirements. EAI enables the analytics by reducing latency times to the absolute minimum so BI systems can store the data received.

- Process performance management (or business activity monitoring (BAM) (Rayner, 2005, p.2)). This provides real-time situational awareness by monitoring predefined business events to provide measures and alerts e.g. supply chain operations, event-based marketing and compliance activities (Aalst, Hofstede, & Weske, 2003; Rhee, Bae, & Choi, 2007). It also enables the comparison of data between process in different times or states in order to identify potential for process improvement.

Rayner (2007, p.3) theorises correctly that as BI platforms and analytic applications become more service-oriented, these services would become progressively more embedded in business processes, which leads to an integration with Business Process Management (BPM). This allows for real time decision making and subsequently optimisation of business processes.

Dominant software vendors like Microsoft, Oracle and SAP identified the importance of integration and business process automation and now offer application integration platforms (Biztalk, Production Schedule, XMI and xMii) as part of their application services.

Technology challenges and gaps

While the components may be there to provide an integrated environment there are still technology challenges and gaps which hinder those components from working together seamlessly.

The first gap is that expert analysts are required to drive or configure the software. It is argued (Azvine et al., 2005, p.217-218) that these skills are not possessed by typical end users and require specialist training and skills. These specialised resources are not always responsive to change as the solutions are typically complex and cannot be done in real-time.

The second gap is in the data integration layer. Azvine et al (2005, p.218) report on the evolving but currently inadequate functionality in

query/reporting tools and the associated BI toolsets. This is also confirmed in two other reports of which one is from Gartner (Dresner, Hostmann, Tiedrich, & Buytendijk, 2004; Friedman & Strange, 2004 cited in Azvine et al, 2005). A similar reports was made Schiefer, J., & Bruckner (2003) and it is confirmed as a problem by data warehouse vendors (Haupt, 2003). The data layer needs to provide quality data because business intelligence based on poor quality can lead to mistrust and rejection of the reports.

> "Productivity loss, lack of transparency, inability to address compliance requirements and overall lack of trust of information are among the tangible "pain points" resulting from limited awareness and attention to data quality" (Friedman, 2006, p.2).

The status of master data also has to be investigated and an enterprise wide data synchronisation strategy has to be formulated (Haupt, 2003, p.14). The concept of a master source of data is critical to success as it enables data from disparate system to be brought together and linked together. Master data is the data that is persistent, non-transactional data that classifies an entity that has been agreed across the organisation (Loser, Legner, & Gizanis, 2004). This master data typically resides in one controlling or master system (but may exist and be maintained in many), e.g. Organisational unit hierarchy codes may exist in many enterprise systems to enable reporting by organisational unit but over time they will deviate and will become unaligned to the 'master' system. In some circumstances the master system may be more out of date than other systems utilising it. This problem appears in enterprises where there are a number of disparate applications and there is no corporate data management whereas in a perfect integrate world only one fully integrated system would be in place.

Data quality is not a one-time concern to many companies that implement complex data stores. For systems with complex feeder systems it is not uncommon for previously undiscovered data quality problems to come to the surface after the initial data load is done. Companies then find it necessary to install procedures to regularly audit data quality and then the question arises as to who should have responsibility for executing these ongoing procedures (Greenfield, 2001).

The data layer also requires a dynamic plug-in or interfaces for new data sources. Generic “third party” interfaces are called ‘plug-ins’ which some vendors supply with their respective systems, e.g. SAP, Oracle, Siebel. In general these plug-in technologies consist firstly of a common meta-data structure or data dictionary that creates a unified view of enterprise data so that all users, regardless of their departments or analytical prowess, have access to the same values, field names and sources. They also allow for users to map data items between systems and provide automated data mismatch reconciliation processes or transformation services. (Azvine et al., 2005, p.221).

The third gap is the “operational gap”. Azvine et al (2005, p.217) argue this is the lack of real-time data as the data sources only update the data warehouses on some predefined periodic basis therefore affecting the quality and timeliness of decisions (Ballou & Tayi, 1999; Berg, 2006; Rao & Osei-Bryson, 2007; Schiefer & Bruckner, 2003). Without real-time data, the act of getting the data to the users for analysis of operational business process performance at the most opportune time is not possible and therefore real-time process automation cannot occur. Azvine et al (2005) argue that self correcting processes are the answer in achieving full process automation and this gap is not well supported by product vendors.

Berg (2006) reports that technologies and protocols exist to allow real-time (or near real-time) data loading capability although most companies are still loading their reporting systems through asynchronous nightly loads. Vendors that include these technologies are SAP (SOAP, Xi and xMii), Oracle (XML, SMS) and Microsoft (Real-Time Communication Server and BizTalk). This allows companies to access timelier operational reporting without having to place undue stress on the transactional system (Berg, 2006).

The effect of these blockers is that business cannot react in the immediate timeframe based on insights obtained from BI system. This is because the information is provided after the optimal time for action and therefore the management response is reactive as opposed to being proactive or timely (Azvine et al., 2005, p.219). However, an increasing trend is for

analytics to be embedded in business applications so that a real time closed loop environment is created (Rayner, 2007, p.3).

Automated Performance Measurement Systems (APMS)

So what types of systems are available that monitor not only departmental compliance but total corporate compliance (including global) while adhering to obligatory internal and external market standards enforced by regulatory bodies? What APMS does an enterprise have to choose from, on which it can build and maintain true cross departmental solutions? In addition to the processes and applications being built, they must be capable of changing rapidly in order to align to ever-changing business environments, preferably in near or real-time. The application suites must be flexible and extensible, since product lines may be phased in or out, or additional business units may be added or deleted based on mergers and acquisitions. Such applications must also be capable of providing a diverse user community with the information tailored to their specific needs and demanded by them in order to ensure the financial integrity and security of the enterprise.

APMS within the IS literature manifest themselves in many ways, as the tools and systems have been implemented to provide companies with varying degrees of reporting and advanced analytics. The initial implementations of APMS were data-centric and are based on the collection of historic information and then forecasting future trends. But are these truly APMS'?

Types of APMS

Researchers have classified and named other performance measurement and management application types to assist organisations when selecting a product.

As stated in Chapter 1, an APMS is defined as where metrics are collected and are available for reporting or action with minimal or no human intervention to quantify both the efficiency and effectiveness of actions, i.e. performance measurement is automated. Discussed below are some types of systems that have the potential of being an APMS.

Gartner's Classifications

In July 2006, a report from Gartner (Bitterer et al., 2006) combined the Hype Cycles for Business Intelligence (BI) and Corporate Performance Management (CPM) into one report, as they believed that these technologies and applications were either converging or had converged.

As already stated in Chapter 1, CPM is a concept introduced by Gartner Research in 2001, that describes "the processes, methodologies, metrics and systems needed to measure and manage the performance of an organisation" (Buytendijk et al., 2004a, p.2).

Gartner states that CPM and BI should not be seen as separate initiatives and technology domains, but as an integral part of an Information Technology infrastructure as organisations are no longer looking for online analytical processing, reporting or planning applications but an integrated system to measure performance (Bitterer et al., 2006).

The "hype cycle" as illustrated in Figure 5 below, clusters technologies that Gartner has identified as CPM and BI systems and illustrates the relationship between visibility (or amount of use) against time. This hype cycle also intends to indicate the 'hype' for a particular type of application type based on Gartner's own internal field research.

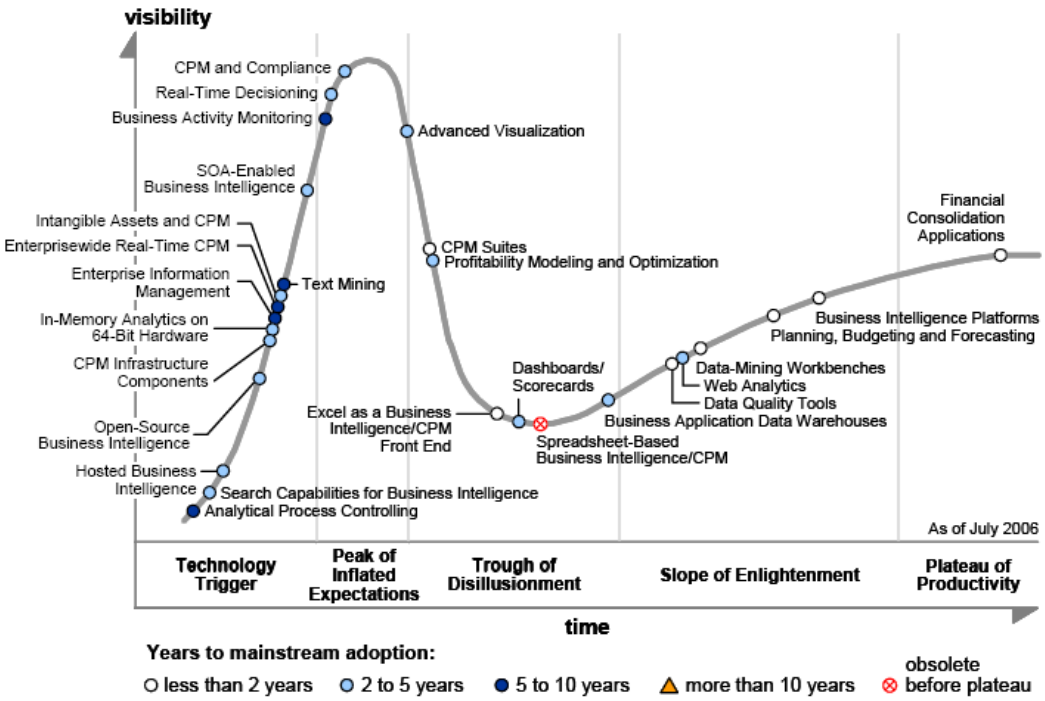

Figure 5. Hype Cycle for Business Intelligence and Corporate Performance Management, 2006 (Bitterer et al., 2006, p.5)

The Gartner hype cycle links many different types of applications to their blend of CPM and BI. As already stated this grouping can cause confusion but is said to represent what is occurring in the marketplace.

As the technologies and applications mature towards real time (or near real-time) data input and reporting, these suites of applications border on what the researcher calls Automated Performance Measurement Systems or APMS. Not all of these application types are what could be called APMS.

A summary of the Gartner application types as well as other application types identified in the technology industry and academic literature are described Table 2. Included is in the matrix is a determination of whether this type of application is an APMS or not as well as the justification. Those that Gartner has classified in the main have examples, whereas academic authors mainly discuss “bespoke” or custom made software and so no examples are available.

Table 2. Types of Performance Measurement Systems (Adapted from Bitterer et al., 2006)

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*64-Bit Hardware In-Memory Analytics*	Use of 64-bit hardware platforms to load data and query results into memory for instant query and reporting, instead of using database records and indexes held on disk. This hardware solution is emerging technology with no more than half the vendors in the BI platform market even able to compile to 64 bit. They also have not designed their software to take advantage of the larger addressable memory space. Vendors that have this capability include Applix, Panoratio, QlikTech and SAP (Bitterer et al., 2006).	No	This is a hardware architecture. This is where Gartner confuse the reader by mixing applications with physical hardware.
Yes	*Advanced Visualisation*	Advanced visualisation techniques have been used for years in the academic and scientific community but have not yet been utilised in mainstream business applications. There is also a lack of knowledge, skill and understanding of how to make use of this technology. Vendors that have products are: Advizor, FYI, Spotfire and Tableau (Bitterer et al., 2006).	No	This is just a mechanism to display measures and results.
Yes	*Analytical Process Controlling*	Where applications, integration brokers and analytics intersect. They assist organisations to identify process bottlenecks, outliers and other execution artefacts within business processes that cannot generally be seen from an operational execution perspective. Vendors beginning to support this technology include IBM, Microsoft, Oracle and SAP (Bitterer et al., 2006).	Yes	Possible to take real time data and execute automated events.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Business Activity Monitoring (BAM)*	Describes the processes and technologies that are used to improve the speed and effectiveness of business operations by raising awareness about important issues as they occur. BAM provides real-time situational awareness by monitoring predefined business events to provide measures and alerts e.g. supply chain operations, event-based marketing and compliance activities. Vendors in this area include: Information Builders; Microsoft; Systar SA; Teradata; Tibco Software and webMethod (Bitterer et al., 2006).	Yes	Meets the criteria.
Yes	*Business Application Data Warehouses*	Oracle and SAP are two examples of business application data warehouses feeding off a business package (e.g. ERP, CRM or supply chain management (SCM)). They have standard BI and data warehousing capabilities but contain standard reports based on vendor supplied data structures and therefore deliver off-the-shelf CPM. This assists with accelerated development and deployment of BI, and performance management applications (Bitterer et al., 2006).	Likely	The data feeds are typically batched after the data has been sent from the controlling business application. The business application is also the master system where most data feeds go to first. This does not allow for a real or near real-time environment. Issues with performance of the underlying business application also determine the extraction, transformation and loading (ETL) timing.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Business Intelligence (BI)*	BI platforms make it possible for organisations to build BI applications by providing capabilities in three areas: analysis through online analytical processing (OLAP); information delivery, such as reports and dashboards; and integration, such as BI metadata. Search capabilities to index and retrieve unstructured information in a BI environment enabling users to find reports, metrics and other items of interest are becoming available and some are now hosted by external companies although these are typically just for reporting and analysis of business data. Vendors include: Business Objects, Cognos, Hyperion, Information Builders, Microsoft, MicroStrategy, Oracle, SAP and SAS, although open sourced application development, application servers or database platforms are appearing e.g. Actuate, JasperSoft and Pentah (Bitterer et al., 2006).	Partial	Not always possible to take real-time data. The ability to search unstructured data usually means complex indexing which is typically found in top end index search engines. These are subject to failure and do not provide real-time or near real-time data capabilities. It is usually a component of APMS.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
No	*Business Process Intelligence (BPI)*	BPI is the application of techniques from the different facets of business intelligence concepts (e.g. analytical applications) to processes. It is based on the analysis of process data (e.g. start and completion of process events) and the automatic derivation of (optimised) process models and performance characteristics. Implemented as a set of integrated tools providing for the analysis, mining, prediction, control, and optimisation of processes. Its overall goal is to extend performance management to business processes (Mutschler, Zarvic, & Reichert, 2007). Reported that BAM is a small part of BPI (van Dongen & van der Aalst, 2005). The goal of these tools is to extract knowledge from event logs (e.g., event logs in an ERP system or audit trails in a Workflow Management (WFM) system), i.e., to do process mining. Vendors include: ARIS PPM, HP BPI, and ILOG JViews.	Yes	Meets the criteria.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Corporate Performance Management (CPM) components*	CPM infrastructure components enable organisations to build applications by constructing scorecards, creating data allocations to support profitability analysis and or currency translations by integrating them into existing BI platforms, rather than creating separate stand alone applications. Enterprise wide real-time CPM is achieved according to Gartner by fully integrating operational and strategic feedback loops, although these claims are unsubstantiated. The feedback loops are implemented via applications that support real-time access to operational and strategic data and analytics, coupled with collaboration technologies that enable users to define, agree on and monitor actions based on feedback. Suites of separate application modules have been produced by various vendors (e.g. Business Objects, Cartesis, Clarity Systems, Cognos, Extensity, Hyperion Solutions, Longview Solutions, OutlookSoft and SAS) but according to Gartner the number of organisations that have implemented CPM suites remains low (1 to 5 percent of target audience), although Gartner expects this to change as there has been an increase in the purchases in this area (Bitterer et al., 2006).	Likely	In theory yes as it meets the general criteria, but claims are unsubstantiated.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Dashboards/Scorecards*	Dashboards and scorecards typically display key performance indicators (KPI's) against some budget or target measure using visualisation, including dials, gauges and traffic lights. They typically allow drill down capability to lower levels of detail. Typical Vendors are: Business Objects, Cognos, CorVu, Hyperion Solutions, Panorama Software and SAS (Bitterer et al., 2006)	No	This is just a mechanism to display measures and results. Due to being a presentation layer, applications implemented as just scorecards/dashboards, are not always properly architected with the underlying data source system (e.g. Data warehouse). When this occurs they will fail, users loose confidence in them and they usually fall into disuse (much like the EIS of 10 to 15 years ago) (Bitterer et al., 2006)
Yes	*Data Quality Tools*	Data quality is the process and technology for identifying and correcting flaws in the data that supports BI. Typical vendors are: Business Objects/Firstlogic, DataFlux, DataLever, Group 1 Software, Human Inference, IBM, Informatica, Innovative Systems, Trillium Software (Bitterer et al., 2006)	No	Data quality has long been overlooked as a critical factor in successful BI, CRM or any other enterprise application scenario (Bitterer et al., 2006).
Yes	*Data-Mining Workbenches*	Data-mining workbenches provide a selection of analytic functions and mining capabilities to model business process for predictive or historical trends. Typical vendors include: SAS, SPSS (Bitterer et al., 2006)	No	The technology is mature with defined practices and processes but is not widespread as the technical expertise they require has limited their use and business impact (Bitterer et al., 2006). Typically not real time and uses older technologies not suited to real or near-time data feeds.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
No	*Dynamic Performance Measurement*	Paranjape et al, (2006) refer to Dynamic Performance Measurement Systems and claim that there is a lack of research in dynamic performance measurement systems for global organisations. Operations management literature from Neely, Kennerley, Bourne etc is quoted and 'dynamic' is stated quite often, both in respect to Performance Measurement, organisations, business environments and systems thinking. (Paranjape et al., 2006).	Unlikely	There is no definition of dynamic performance measurement systems except they are not static and reflect changing business environments. Dynamic Performance Measurement Systems appear to be the next stage of current performance management systems and it is unclear if they are APMS
Yes	*Enterprise Information Management (EIM)*	EIM is an organisational commitment to structure, secure and improve the accuracy, accessibility and integrity of information assets, to solve semantic inconsistencies across functional boundaries, and to support the technical, operational and business objectives within the organisation's enterprise architecture strategy. (Bitterer et al., 2006).	No	APMS are part of the Enterprise Information Management landscape.
Yes	*Spreadsheets as a Business Intelligence/CPM Front End*	Spreadsheets were used as the information delivery and output mechanism for BI. It is also used as a method for entering and manipulating data results from CPM applications. It is typically provided as an add-in to spreadsheets or as an integral part of the underlying technology. Spreadsheets allow the user to remain in control for at least the presentation layer. Typical Vendors include: Business Objects, Microsoft, OutlookSoft and SAP (Bitterer et al., 2006)	No	"Spreadsheets Are a Risky Substitute for BI and CPM Applications ...but ... this represents an ideal opportunity to reduce an organisation's reliance on uncontrolled spreadsheets" (Bitterer et al., 2006). Gartner state that by using spreadsheets as part of BI and CPM it can have a beneficial effect because it will reduce the amount of analysis performed by users collecting and manipulating their own spreadsheet data. This has a corresponding positive impact on compliance (e.g. SOX) due to the reduction of uncontrolled un-auditable spreadsheets (Bitterer et al., 2006).

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Financial Consolidation Applications*	This type of application enables organisations to reconcile, consolidate, summarise and aggregate financial data across different accounting standards and currencies. Vendors who offer fairly mature financial consolidation packages include: Cartesis, Cognos, Hyperion, Oracle, SAP (Bitterer et al., 2006)	No	These applications typically leverage off enterprise architecture to bring together a consistent and auditable set of corporate financial data. While a key criteria for reporting, financial consolidation is often overlooked as part of a broad corporate performance measurement and compliance strategy. This data needs to be incorporated with non-financial data to enable consistent reporting of financial and operational performance.
Yes	*Intangible Assets and CPM*	CPM applications that utilise scorecards are quoted as providing a base for tracking them through some tangible measure. e.g. number of employees registered with a particular skill/knowledge and the number of new employees being trained in that skill. Organisations are looking for applications that have capabilities and properties to manage valuation of intangible assets, including intellectual property as changes have occurred in accounting and reporting standards to handle these types of assets (Bitterer et al., 2006).	No	The claims are unsubstantiated with no vendor examples given. To be able to use such an application a company must also know how intangible assets affect their performance which has proven to be extremely difficult (Myles & Jackson, 2004) and doing this in a real or near real-time environment would be very unlikely.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
No	*Operational Business Intelligence*	"Operational BI builds on existing technology standards to make business intelligence more flexible, transparent and cost-effective by tightly integrating BI with organisation's constantly evolving business processes" " ..Operational BI recognises the need to synchronise the efforts of decision makers at strategic, tactical and operational levels, to reach a common set of business goals. More precisely, "at the strategic level, executives define strategies and goals. At the tactical level, management in the business units sets direction for their organisations, so that at the operational level individuals can take the right actions" Operational BI also focuses on improving business processes by capturing and analysing operational data for the purpose of taking immediate actions to improve business processes. (Marjanovic, 2007, p.3)	Likely	Operational BI requires real or near real-time data loads to enable the operational level actions. Unclear what types of vendor systems are used.
Yes	*Planning, Budgeting and Forecasting*	Planning, budgeting and forecasting includes strategic planning, financial budgeting and high-level operational planning. Budgeting, planning and forecasting is a slow, unresponsive process in most organisations, while these applications will reduce the manual effort required to prepare budgets, shorten planning cycle times and support the adoption of more proactive budgeting processes they are not dynamic and take time using predefined static data. Forecasts can be quickly enabled but the underlying data is still static and loaded in batch. Typical vendors are: ALG Software, Business Objects, Cartesis, Cognos, Hyperion Solutions, Oracle, OutlookSoft, SAP (Bitterer et al., 2006)	No	Users still use Spreadsheets-based financial budgeting processes and use static data derived from a variety of sources (often untraceable). These applications do not typically meet the needs of operational planning functions and typically don't provide links between the aggregated corporate financial budget and operational business plans (Bitterer et al., 2006).

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Profitability Modelling and Optimisation*	Activity-based costing (ABC) applications are included in this grouping as they determine and allocate costs at a highly granular level to allow profitability modelling and enable users to model the effect of different cost and resources. These are typically deployed as stand-alone applications and not integrated into the planning processes to allow driver-based planning and budgeting systems. E.g. Acorn Systems, ALG Software, Oracle, SAP, SAS (Bitterer et al., 2006).	No	These are typically part of the APMS and are used for analysis and reporting.
No	*Real-Time Analytics*	Real time-analytics is "allowing data to be compared in real-time against predefined levels", through shortening the period of time between the occurrence of a business event that requires an appropriate action by the organisation and the time the action is finally carried out.	Yes	Due to the nature of the real-time automation of the data, real-time analytics are believed to be APMS (Melchert & Winter, 2004)
No	*Real-Time Business Intelligence (RTBI)*	The definition of real-time needs to be defined first (Azvine et al., 2005). This is: o Zero latency within a process, o A process has access to information whenever it is required, o Information is provided whenever it is required by management, and o Present (derive) key performance measures for a current point in time and not just historic. Based on these definitions, RTBI supports the same function as the traditional BI, but operates on data that is extracted from operational data stores (ODS) with zero latency, and provides a means to propagate actions back into business processes in real-time.	Yes	Has capability to automate the data load process, although key challenges remain like automated analytics, semantics based information fusion and process automation (Azvine et al., 2005)

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Real-Time Decisioning*	Real-time decisioning provides the analytic and decisioning facility to provide automatic optimal treatment of customers when they initiate a transaction and provide decision based options e.g. Web based loan application facility may offer different loan terms with different conditions based on data entered and stored/available. The ability to make different recommendations is becoming more widespread as the technology matures but the capabilities and opportunities offered have not been recognised by the majority of users and vendors. Typical vendors include: Chordiant Software, Sigma Dynamics and SPSS (Bitterer et al., 2006)	Yes	Specialised application. Typically real-time to allow dynamic tuning when required. Of special importance to on-line Customer Relationship Management (CRM) applications. These may be real-time web based commercial applications where were speed, market share and revenue depend on the information obtained and the decision made. This capability is moving from niche best of breed applications to a standard component of larger suites offered by the mainstream vendors (Bitterer et al., 2006). XBRL is an open source language for implementation of electronic communication of business and financial data. XBRL stands for eXtensible Business Reporting Language and is one of a family of "XML" languages. Further details can be found at http://www.xbrl.org
Yes	*Spreadsheet-Based Business Intelligence/CPM*	Spreadsheets are often used as a de facto BI tool because it is there and easy-to-use for good looking reporting and has the ability to access some data sources directly. "Do not use spreadsheets on their own for BI or CPM, despite the apparent attractiveness of this approach to end users. This will lead to silos of data that cannot be reconciled with each other or the source data " (Bitterer et al., 2006, p.23).	No	Organisations and users deploy spreadsheets because they do not want to invest effort or time in the corporate prescribed platform.
No	*Strategic Performance Measurement System (SPMS)*	A generic classification for a type of system that uses a combination of financial, strategic, and operating measures to evaluate management's success in improving operating efficiency and adding value for shareholders (Gates, 2000).	Yes	Some are based entirely on a financial measure like economic value added but others reported also include non-financial considerations, such as the balanced scorecard's emphasis on customer and employee satisfaction, operational excellence, and new product introduction.

Gartner Classified	Type of Performance Management Application	Description	Automated Performance Measurement Domain	Reasoning
Yes	*Text Mining*	Text mining analyses unstructured information such as e-mails, documents or other typed content to derive patterns and classifications in language or data. This process also enables unstructured information to be transformed into structured data that can be tracked, measured and used to build analytical models (Bitterer et al., 2006).	No	While text is an important part of providing qualitative information around reporting there is no means to link Text Mining with APMS.
Yes	*Web Analytics*	Web analytics are specialised reporting and analytical tools that are used to understand and optimise web site visitors' acquisitions and actions. Fewer than 10 vendors dominate a field of more than 60 vendors. Typical vendors are: ClickTracks, Coremetrics, Google, Omniture, SAS, Unica, WebSideStory, WebTrends (Bitterer et al., 2006)	Partial	Specialised application that is typically real-time to allow dynamic tuning when required. Of special importance to web based commerce vendor where speed, results and billing depend on the information obtained.

Gartner researcher's state:

"*Enterprise wide real-time Corporate Performance Management (CPM) will be valuable to all enterprises because it will "close the loop" between strategy and operational execution in real time. Linking operational metrics tracking to CPM applications in real time will enable the success (or otherwise) of strategies to be monitored continuously, and enable executives to change strategies more quickly in response to market conditions*". . (Bitterer et al., 2006, p 13)

The types of applications, listed in Table 2, are a collection of potential APMS's. The vendors who produce these applications claim to offer a "complete" solution that links strategy to operational execution, but according to the Gartner researchers (Bitterer et al., 2006) critical links between them and corporate performance are missing. As covered earlier, the technologies to integrate these elements into an APMS exist but vendors have not yet appeared to have focused much attention on the defining aspects of an APMS, namely automation.

Information System Success

Having defined the various concepts involved in performance management and measurement and described the current state of thinking, it is now necessary to discuss the notion of what constitutes a *good* or *successful* automated performance measurement system. The literature reviews mentioned above, although comprehensive, are written from an operations management perspective and do not mention known Information System models like DeLone and McLean's Information System (IS) Success Model. What is lacking is a comprehensive and mature approach to the assessment of the success of performance measurement systems. By using the recognised IS DeLone and McLean model as a base, a new more comprehensive success model is required that includes an IS perspective.

DeLone and McLean

The literature in the area of Information System success is extensive and diverse (Larsen & Myers, 1999). Researchers have investigated the success of IS in numerous ways (Garrity & Sanders, 1998). An influential

and often cited work is that of DeLone & McLean (1992), the Social Sciences Citation Index indicates the number of references from 1995 - 2000 to be 21, 21, 26, 33, 32, and 39 respectively, in respected journals such as MIS Quarterly, Information & Management, Decision Sciences and the European Journal of IS. DeLone & McLean reviewed a collection of 180 empirical studies published in seven major IS journals between 1981 and 1987. DeLone & McLean presented their paper in response to issues raised by Peter Keen at the First International Conference on Information System (ICIS) in 1980. Peter Keen asked "What is the dependent variable?"(DeLone & McLean, 1992, p.60). DeLone and McLean stated that if IS research was to make a contribution to the world of practice, a well-defined outcome measure (or measures) was essential – a dependant variable. A dependent variable is a variable whose values in different treatment conditions are compared (DeLone & McLean, 1992 p 69).

In their initial paper (it was revisited in 2002) DeLone and McLean stated "that there are nearly as many measures as there are studies". This resulted in a model for Information System (IS) success, which is illustrated in Figure 6 below. This IS success model or framework was based on the communication theory (Shannon and Weaver (1949) cited in DeLone & McLean, 1992), the information influence theory (Mason (1978) cited in DeLone & McLean, 1992), and a fairly comprehensive synthesis of the important system evaluation research conducted between 1981 and 1987. The numerous studies identified large numbers of factors that were then organised into six categories to develop taxonomy of IS success.

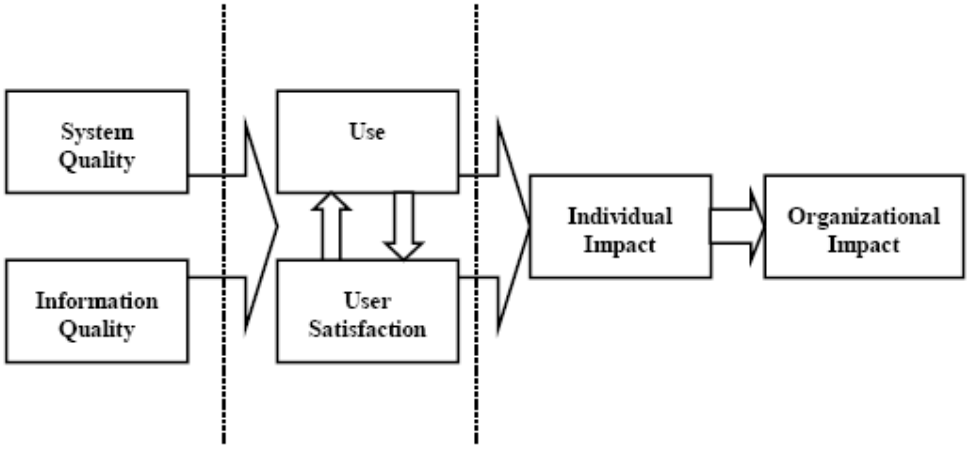

Figure 6. DeLone and McLean IS Success model (DeLone & McLean, 1992, p.87).

The 1992 DeLone and McLean IS success model has been cited in more than 144 pieces of research (DeLone & McLean, 2002). This original model offered a multidimensional set of criteria for IS success. It set out common measurements for each success dimension. 186 empirical studies have tested the relationships among the variables identified in the original model (Seddon et al., 1999). Taken as a whole, these studies gave strong support for the success dimensions and helped confirm the causal and temporal structure in the model (Garrity & Sanders, 1998). Judged by its frequent citations in articles published in leading IS journals, this framework has become the principal evaluation model in IS research.

The original DeLone and McLean model proposed six major dimensions of IS success. These were:

- System quality;
- Information quality;
- Use;
- User satisfaction;
- Individual impact; and
- Organisational impact.

Based on research contributions since the publication of the original model, DeLone and McLean updated their original success framework to produce an updated model which they presented in 2002 (Figure 7, below).

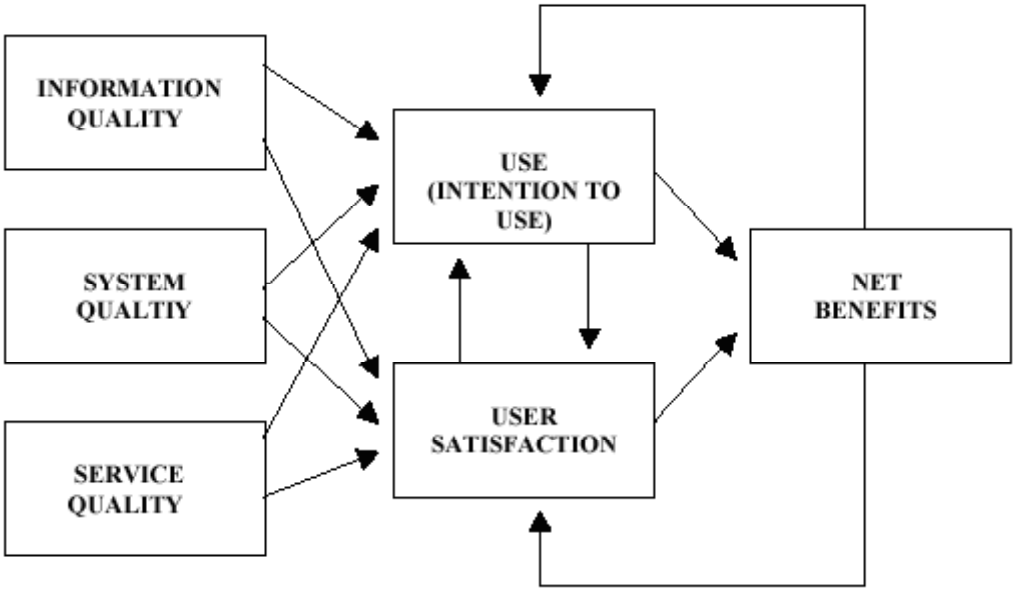

Figure 7. The Reformulated IS Success model (DeLone & McLean, 2002, p.9)

The 2002 changes made to the original model were the introduction of Service Quality and two dimensions, Organisational and Individual Impact, being combined into one dimension called Net Benefits.

DeLone and McLean's revised model makes two important contributions to the understanding of IS success.

- It provides a framework for categorising the multitude of IS success measures that have been used in the literature that have helped contribute to the understanding of IS success in the IS community, and

- The model supports both temporal and causal interdependencies between the various dimensions.

The DeLone and McLean success model has been used by various researchers and has been modified in many ways to suit various types of applications (Seddon et al., 1999). It has been used in areas like:

- Intellectual Capital (Garrity & Sanders, 1998; Myles & Jackson, 2004; Neely & Bourne, 2000),

- Knowledge Management (Okkonen, Pirttimäki, Hannula, & Lönnqvist, 2002),

- Enterprise Resource Planning (ERP) (Bradley, 2003),

- Virtual Organisations (Chalmeta & Grangel, 2005) and

- Data Warehousing (Wixom and Watson, 2001).

Some of the strongest criticisms of the DeLone & McLean success models (1992 & 2002) include mixing variance and process models in one package and the notion of causality (preferring to use the term influence) (Seddon, 1997); misrepresentation of the Shannon's model of communication; blurred theoretical underpinning bound by limited historical views; and the unreality of the unidirectional relationship among use, user satisfaction, individual impact and organisational impact (Garrity & Sanders, 1998). Although it has been criticised, it is still widely used.

Given the diversity of research areas in which the DeLone and McLean model has been used, only one relates closely to APMS. This is a Data Warehousing study by Wixom and Watson.

Wixom and Watson Model

The relationship between performance measurements and data warehouse systems is such that performance measurement systems typically use the data contained in data warehouses. In the literature, performance measurements systems and data warehouses are commonly mentioned together with details given of their close relationship (Kueng et al., 2001; Melchert & Winter, 2004; Teresko, 1999). Kueng et al (2001) describe the components of a performance measurement system of which a data warehouse could be the main component for storing and accessing the data, and Melchert, Winter (2004) and Teresko (1999) describe how the data warehouse tools enable the measurement of process performance and the identification of process improvement opportunities.

As no known model exists for APMS IS success, a Data Warehousing IS success model is a candidate to form a basis for an APMS IS success model. One such model is the Wixom and Watson Research model for Data Warehousing Success (Wixom and Watson, 2001). This model provided further depth to the analysis for this report. The new model helped to identify the various levels of analysis needed and associated impacts at each level. The increasing richness of the model suggests a more

subtle and differentiated interaction between its elements and reduces the dependence upon a few “critical” success factors.

Wixom and Watson (2001) started with the DeLone and McLean 1992 success model and derived a new IS success model for Data Warehousing. In this data warehousing study, managers and suppliers from 111 organisations completed mail questionnaires on implementation factors and the success of their respective data warehouse implementations. The results of their research identified significant relationships between the system quality, data quality factors and perceived net benefits. Wixom and Watson found that:

- Management support and dedicated functional and system support resources help address organisational issues that arise during warehouse implementations;

- On time user participation, and highly-skilled project team members increase the likelihood that warehousing projects will finish on-time, on-budget, with the right functionality; and

- Varied, unstandardised (or non-integrated) source systems and poor development technology will increase the technical issues that project teams must overcome.

The Wixom and Watson Data Warehousing success model is illustrated in Figure 8, below.

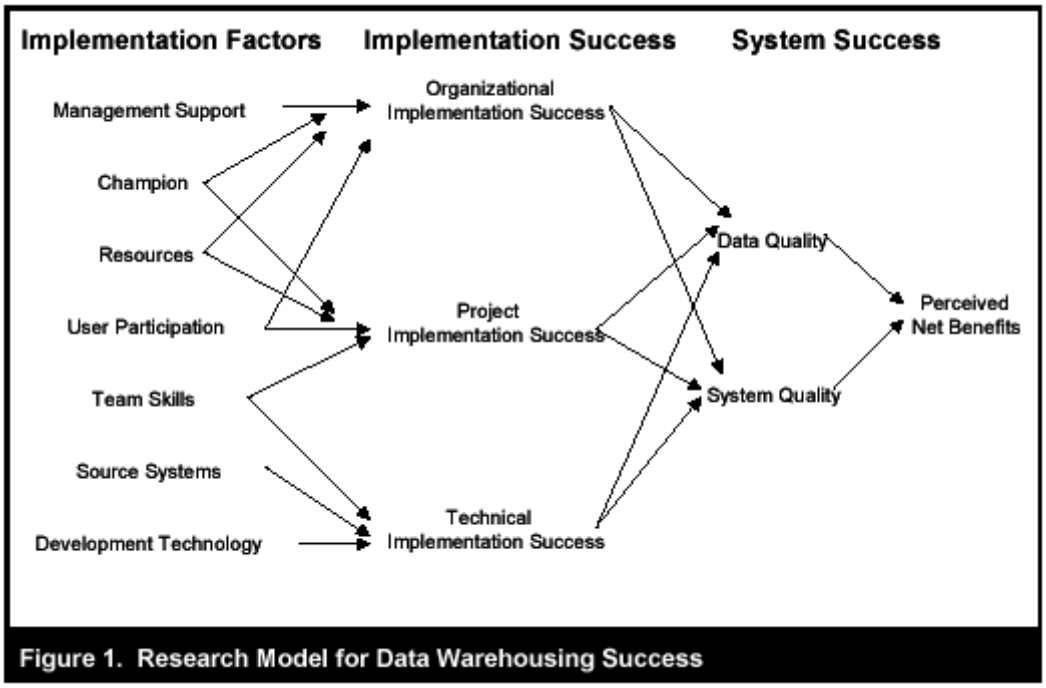

Figure 8. Research model for Data Warehousing Success (Wixom and Watson, 2001, p.20)

Wixom and Watson (2001) excluded two dimensions defined in DeLone and McLean's 1992 model, user satisfaction and organisation-level benefits because:

- User satisfaction was considered less appropriate as end-user perception was typically based around a single application, whereas Wixom and Watson argue that a data warehouse supported multiple applications rather than being an application itself.

- Organisation impact was also excluded as they argued that external factors affected the organisation that they could not control and investigation of these factors would be not repeatable.

Data warehousing has a unique characteristic in that "the amount of complexity involved is what makes a data warehousing project different from traditional software engineering or systems development initiatives"(Wixom and Watson, 2001, p.22). The authors suggest this complexity is because "data warehousing is not an application, …but is rather an enabler of many different current and future applications"(p.22). APMS as one of these applications may utilise a data warehousing environment. Wixom and Watson argue that due to the level of complexity in data warehousing, success factors can be unfavourably affected to a greater degree than with other applications.

System and data quality affect implementation success as “A system displaying high data quality and system quality can lead to net benefits for various stakeholders, including individuals, groups of individuals and organisations (Seddon 1997). It can give users a better understanding of the decision context, increase decision-making productivity, and change how people perform tasks” (Wixom and Watson, 2001, p.20). System and data quality influence the organisational, technical and project issues and vice versa, however, data quality is best explained by factors not included in the Wixom and Watson Data Warehousing success model.

Data quality received considerable research attention regarding its definition, component measures, and importance and was specifically mentioned as a success measure by Gartner researchers (Buytendijk & Geishecker, 2004; Buytendijk, Geishecker, & Wood, 2004b; Friedman, 2006; Ma, Chou, & Yen, 2000; Strong, Lee, & Wang, 1997; Zimmerman, 2002). Data accuracy, completeness, and consistency are critical aspects of data quality in a performance measurement system because if they are not there the underlying initiative can be delayed, run over budget or fail. (Buytendijk et al., 2004b, p.13). While this is no different to any other application, data quality “has an obvious impact on the quality of decision making, increasing the trust in information provided by reporting, analysis and performance management applications” (Bitterer et al., 2006,p.6). Data quality also affects trustworthiness and auditability, a significant reason for implementing APMS so they are compliant with legislative and regulatory requirements. System quality is also commonly used as a performance measure and comprises of other factors which include system flexibility, integration, response time, and reliability (DeLone & McLean, 1992).

Data quality can be evaluated with respect to the quality attributes of origin, correctness, completeness, objectivity and metadata (Zhu & Buchmann, 2002, p.2). Zhu and Bachman (2002) stated four attributes with respect to web data quality, but these are relevant for most data. They are:

> “*Origin* has an effect on reliability of the data and the trust one can place in it and refer to the origin relationship as data lineage. *Correctness* signifies that the data is free of errors.

> *Completeness* describes the coverage of the data. *Objectivity* refers to the lack of prejudice in the data." (p.2)

Completeness and objectivity quality attributes according to Zhu and Buchmann are not mutually exclusive and therefore one always comes with the other. Having only one of the above data quality attributes also means the data can be irregular or unreliable.

Metadata refers to the availability of descriptive "data about the data" (Gardner, 1998, p.59). These could be labels, formulas, description of the data, the data-type (i.e. Boolean, integer, character, etc), frequency, unit of measure, or anything else that describes the data. This aspect is particularly important as the data can be misinterpreted and may contaminate the data warehouse and produce incorrect results. When dealing with data derived from a web source (which may occur in an outsourced or virtual organisation) the data has been found to be potentially unreliable which affects the trust of the respective system (Zhu & Buchmann, 2002).

Relationship between Disciplines

There is no evidence that the DeLone and McLean Success models have been used to explain IS Success for performance measurement systems (or APMS). The authors cited for Intellectual Capital (Garrity & Sanders, 1998; Myles & Jackson, 2004; Neely & Bourne, 2000), Knowledge Management (Okkonen et al., 2002) and Virtual Organisations (Chalmeta & Grangel, 2005) do so while relating system success to performance measurement systems but do not mention DeLone and McLean's success model. As a result there appears to be no evidence that any previous research has established a relationship between the operational management discipline and the DeLone and McLean IS success model.

To establish a relationship between the different disciplines, a preliminary model was produced by mapping common success factors documented in the IS success and operational management literature. The model (Figure 9, below) establishes literature relationships between the IS discipline with that of the operational management discipline. As literature was reviewed and success factors were identified they were mapped to the existing factors from the 1992 and 2002 DeLone and McLean models. This

relationship is illustrated by a line. The type of discipline from where the factor was sourced is indicated by the legend. Where the same factor name was identified, multiple source indicators were used. The benefits for this mapping are two fold. The first is the model demonstrates the relationships between the different fields of study while the second benefit provides a domain and source of reference for the research proposed.

Some of the factors obtained from the operational management discipline indicated that they were in fact from general management. Those factors are indicated accordingly.

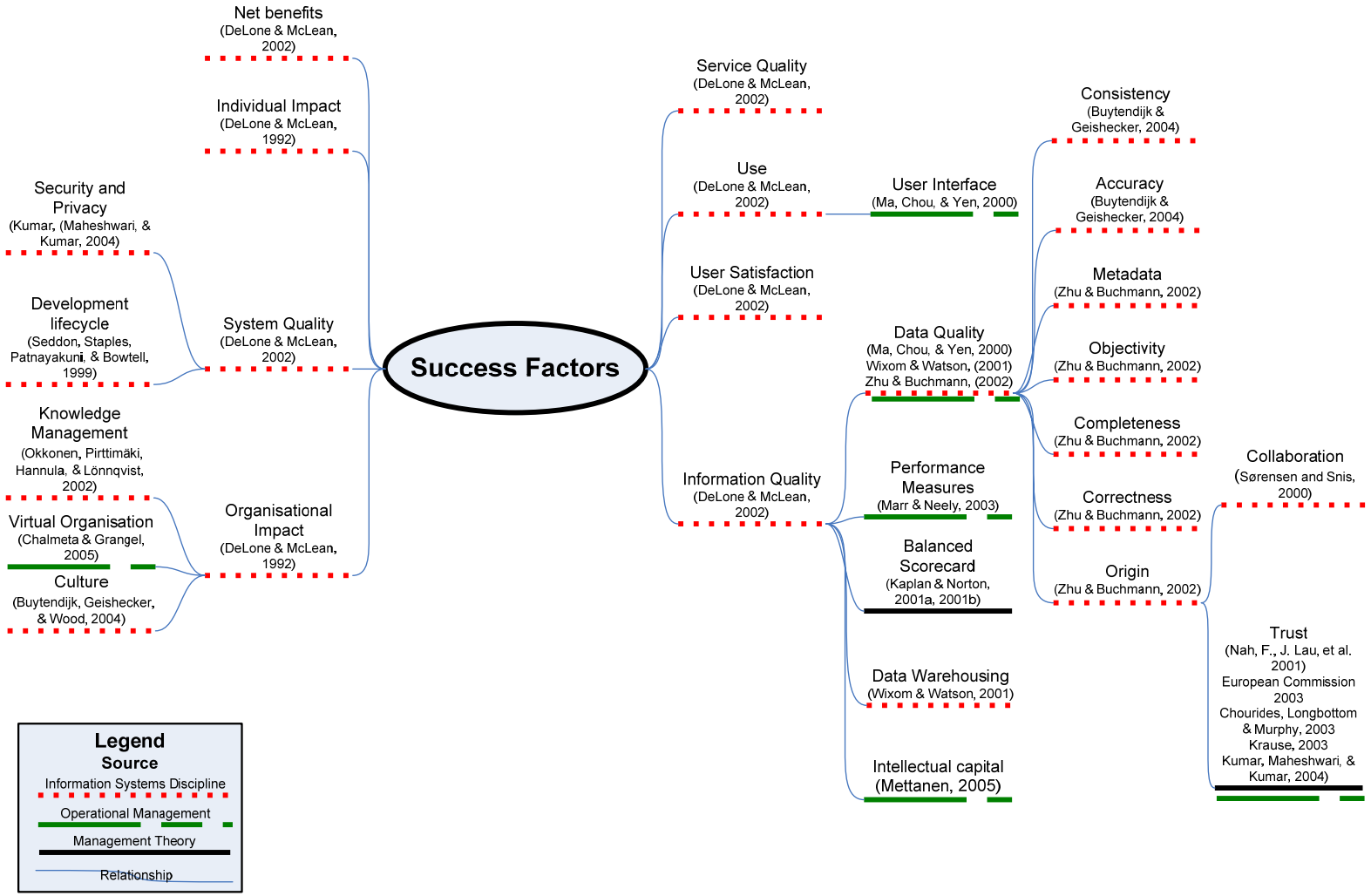

Figure 9. Model of the literature relationship of potential factors that may lead to APMS success.

Other relevant current research

As stated earlier Corporate Performance Management (CPM) is one of the hottest trends in business intelligence and Gartner researchers believe that there is a convergence occurring within the technologies. As such, Gartner is tracking and researching developments in this area.

A search of CORDIS, the official portal for European Union Fifth Framework Programme for research and technological development, reveals one research project into Automated Performance Measurement (CORDIS, 2005). This CORDIS project was called MOMENT (GRD-2001-40488) which is now closed but the results are not yet been published. MOMENT deals with extended enterprises and, from a Performance measurement perspective, with the problem of being able to transfer performance information and knowledge effectively between partners. Contact was made with the researchers on this project and was advised that the project had closed and papers would be published arsing from the project (P. Folan, Personal Communication, 1st June 2005). Three papers were published from this project (Folan & Browne, 2005a, 2005b; Folan, Higgins, & Browne, 2006).

Within the School of Management at Cranfield University there is a 'Research Centre for Business Performance' specialising in the design, implementation, use and ongoing maintenance of performance measurement and management systems. Publications and other research papers are also available (Cranfield University, 2005).

The Performance Measurement Association (PMA, 2007) seeks to be the world's foremost academic practitioner association devoted to advancing knowledge and insight into the fields of performance measurement and management. A significant amount of research takes place through this association and numerous papers are available on-line and current research conferences are also listed (PMA, 2007).

Recent Literature

A scan was done of the literature prior to the submission of this thesis and a single paper was written in early 2007 on success factors for

implementing global IS (Biehl, 2007). It adds some value to the area of critical success of Global IS but it does not substantively add or change what has been described in this literature review.

The research problem and associated theory – the link

While this chapter has been both broad and deep in its review, some pertinent aspects should be commented on. The researcher wants to discover what critical factors affect the success of an implementation of an APMS. Do things like "system quality" and "data quality" exist or are they just social constructs or fictions? The areas, as illustrated in Figure 10 below, are:

- Performance management;
- The operational and strategic management influences and views (Melchert & Winter, 2004);
- The information success factors (Wixom and Watson, 2001); and
- The APMS itself.

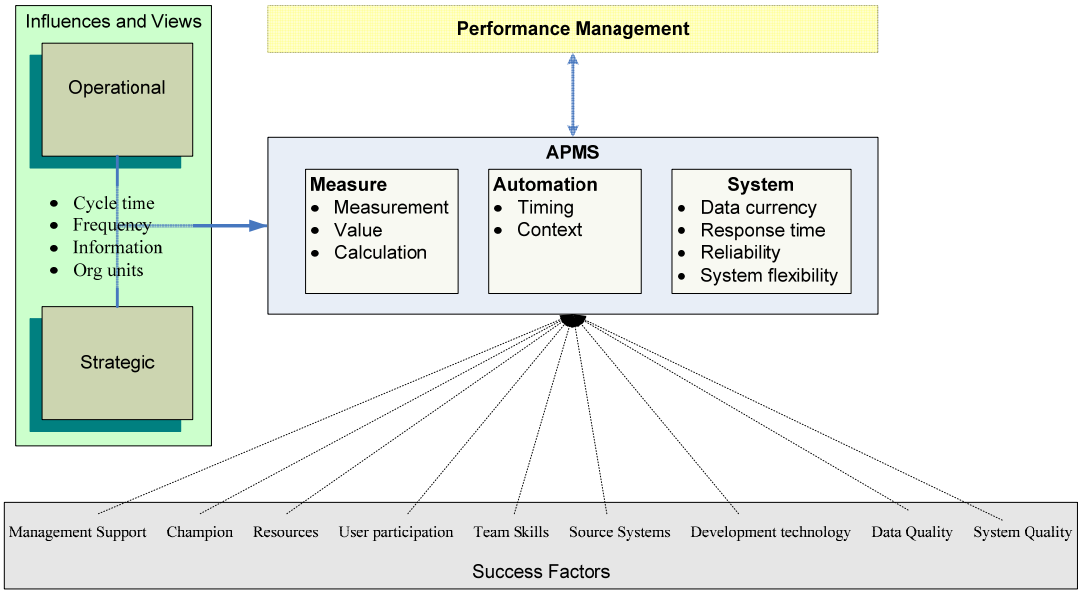

Figure 10. The research problem and associated theory

These areas are summarised below.

Performance Management

Performance management is a multidisciplinary activity that deals with the management of an accomplishment throughout an organisation. It

involves performance measurement, systems and processes. Performance management is about managing people and the processes, practices and methods required.

Operational and Strategic Influences and Views

The research to date indicates that operational and strategic views influence and direct the views of managing an organisation and although different they still use the common management activity types, i.e. monitoring, forecasting, budgeting and planning. What is interesting is that Melchert and Winter (2004) suggest that while operational and strategic management processes are composed of the same activities, they differ with respect to cycle time, execution frequency, the information that is processed and typically they have different responsible organisational units.

Cycle time and execution frequency are not explicitly stated in the Wixom and Watson model, whereas information can be inferred from the data quality factor. The age old argument of when does data become information that becomes knowledge, etc is not within the scope of this research, but it is agreed that confusion could exist between data and information in this case. Subsequent field research in this study will be used to determine if in fact a difference is apparent within the real world.

Responsible organisational structures are inferred in the Wixom and Watson (2001) paper but are not explicitly stated through such quotes as:

> "It was found that management support and resources help to address organisational issues that arise during warehouse implementations;" (Abstract p.17)
>
> and
>
> "A system displaying high data quality and system quality can lead to net benefits for various stakeholders, including individuals, groups of individuals, and organisations (Seddon 1997)" (p.20).
>
> or
>
> "A data warehouse significantly affects how decision making for end users is supported in the organisation because IT professionals no

longer have to extract data and run queries for users as in the past" (p.20).

The effect that responsible organisations can have on the success of an APMS can be many-fold. The depth of the organisation and the alignment of data between organisational structures may be incompatible with systems feeding an APMS. For example, if costs were collected at the lowest level of a 4 tier organisation but the budget was only set at the second or third level how would comparisons be done between actual versus budget expenditure at the fourth level? Strategically the budget may be set and reported from Levels 1 to 2 but operational at Level 3 or 4 they could not be tracked and major operational deficiencies could occur. Now if the organisation was global and had nine or more levels with different degrees of complexity in the organisation hierarchy, such a problem could lead to organisational and operational chaos. While this example seems far fetched, the researcher knows of situations where this circumstance actually occurs on a daily basis, but given the large amount of profit the company makes, the problem is accepted and tolerated with many previous attempts failing to rectify the situation.

Success Factors

The original DeLone and McLean model (Figure 6, p.55) emphasises the micro-macro interaction when it suggests individual impacts aggregate to organisational impacts. However, from a realist perspective, it has no recognition of the macro-micro and micro-micro level interactions (Dobson, Myles, & Jackson, 2007).

The 2002 changes made to the original DeLone and McLean model, Figure 7 (p.57), were the introduction of Service Quality and two dimensions, Organisational and Individual impact, being combined into one dimension called Net Benefits (DeLone & McLean, 2002). From the perspective of critical realism, this moves the model further away from a realist position. By conflating the organisational and individual impacts, it is implied that these are in some sense socially or psychologically constructed, lacking in ontological validity or persistence. Archer (Archer, 1995, cited in Dobson, Myles & Jackson, 2007) argues against such conflation when she

suggests that “structure and agency can only be linked by examining the interplay between them over time, and that without the proper incorporation of time the problem of structure and agency can never be satisfactorily resolved” (p. 65). The static simplistic representation of DeLone and McLean is inconsistent with such a view.

The extension of DeLone and McLean’s original model developed by Wixom and Watson (2001)) to model data warehousing success, provided further depth to the analysis. The new model (Figure 8, p.60) helped to identify the various levels of analysis and associated impacts at each level. The increasing richness of the model suggests a more subtle and differentiated interaction between its elements and reduces the dependence upon a few “critical” success factors.

Combining the factors identified from within the non IS literature with the Wixom and Watson model resulted in a new form of richness, as factors from another discipline were included into this research. The combined mapping of these the factors (Figure 9, p.64) provides the most advanced model to date of the elements which may play a role in the success of APMS. It is these categories that will be used as guidance and a seed for the discussions within the focus groups which constitute the empirical part of this research. This is discussed in Chapter 4 (p.120).

The APMS itself

An APMS consist of three elements which are measures, automation and the system itself, while performance management provides the processes and methods. The system is generally a customised integrated solution comprising of multiple components, typically software packages linked together with EAI software.

Measures

Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action and a performance measurement system as the set of metrics used to quantify both the efficiency and effectiveness of actions (Bourne, Neely et al., 2003, p.3). As such, the implementation and operation of such a system can be highly

political and sensitive. The development of any performance measurement system must adhere to the following stages:

- define the performance to be measured;
- determine and agree on appropriate performance metrics;
- implement systems to monitor performance against these metrics; and
- implement systems to communicate these metrics to concerned stakeholders.

Each such stage in the development of a performance measurement system can be expected to be personalised, potentially highly political, possibly controversial and affect the acceptance of the final management system (Dobson et al., 2007, p.146).

The final communication of performance figures is inherently social. As Pawson et al. (2005, p.22) suggest this collection of performance figures is usually followed by public disclosure of underperforming sectors. Such a public disclosure usually leads to "sanction instigation" whereby the broader organisational community act to "boycott, censure, reproach or control the underperforming party". The final phase is termed "miscreant response" in which "failing parties are shamed, chastised, made contrite and so improve performance in order to be reintegrated" (p.22). As Pawson et al (2005) argue, these social processes are all fallible and can all lead to unintended outcomes. The initial performance metric may be inappropriate or measuring the wrong problem, the dissemination may be inappropriate, public reactions may take the form of apathy or panic rather than reproach thus leading to attempts to "resist, reject, ignore or actively discredit the official labelling" (p.22). The potential for active resistance seems more likely given the automated nature of an APMS system. Automated communication may be seen to imply a lack of trust in intervening management structures and could lead to active resistance (Dobson et al., 2007, p. 146).

Automation

The defining characteristic of APMS is that it is the *automated* communication of key performance measures (or indicators), which are typically real or near-real time data updates. So what are the reasons for reducing the time to get the data? According to Hackathorn (2002 cited in Melchert and Winter, 2004, p.539), the additional business value of an action decreases as more time elapses from the occurrence of the event to action taking place. The time between the event and the follow up action is called action time and is known as the latency of the action being monitored. Latency can also be influenced by data acquisition (data latency), data analysis (analysis latency) and the time it takes to react on that analysis (decision latency) (Hackathorn, 2002, p.24).

Data latency is caused by the refresh cycle or frequency of the data to be stored in the data store. As the data store is typically the middle layer between source systems and the reporting/analysis layer, the time it takes to extract and be able to used it is known as data latency. Analysis latency is the time it takes to have new data analysed and reported that it is ready for some form of action. Decision latency is the time it takes to react to the results and act upon the analysis, and analysis and decision latency affects the people who do the analysis, typically knowledge workers. BAM and CPM try to improve this position by automating specific decision processes utilising rule-based decision engines (Hackathorn, 2002, p.24).

The packages

The system component of an APMS generally consist of a collection of software packages, custom written code and integrating software (EAI),as APMS are not currently available as commercial of the shelf (COTS) applications, There is definitely an opportunity for vendors to deliver this enhanced functionality in the not too distant future.

Gartner and the academic researchers illustrate how the long-time technical and conceptual boundaries between standardised business software packages are not yet mature, but utilising enterprise application integration APMS can be built. Utilising off the shelf integration, BI, process modelling tools, workflow engines and rule-based decision engines the maturity issues

can be overcome when combined with reference models for measures and standardised business processes repositories (Azvine et al., 2005; Berg, 2006; Melchert & Winter, 2004; Melchert, Winter, & Klesse, 2004).

Conclusion

Performance measurement in its raw form is everywhere. Every person in an organisation is responsible for performing and or managing certain activities or processes that that can be measured as part of efforts to improve effectiveness. The old adage “You can’t manage what you can’t measure” (attributed to Lord Kelvin, c.1824-1907) takes on particular significance to effectively manage the performance of an organisation.

Today’s employees work in corporate structures that change continually and become increasingly difficult to manage. Organisations today are fluid and agile, with workers assigned to ad-hoc, interdisciplinary virtual teams. They work on objectives spanning multiple departments and levels of the organisation, invariably in different parts of the world. They need access to measures to analyse and compare current results to strategic and operational plans. All the while the pace of business quickens. Managers must make more difficult decisions in less time and they need the measures to support their decisions and to cater for legislative and corporate compliance.

The literature is comprehensive for performance management and the associated measures. While it could be argued that APMS are just part of the performance management domain, the research clearly indicates that performance management is a broad and confusing term. It ranges from Human Resource management, to managing the performance of an internet site. Gartner try and cover all these bases by even including spreadsheets and full text searching, thereby rendering the term so broad as to be of little use.

Automated performance measurement however is a new and exciting area of research. The aspect of providing the right measures to the right people at the right time is aiming to add to the ideal of an information democracy, a measurement information supply chain paradigm is evolving.

While it could be argued that this paradigm reinforces the Taylorist, managerial, capitalist paradigm, this would only apply if the workers could not see the manager's performance figures every day. In the APMS domain the measures are available to all – it is both bottom up and top down.

In this chapter the literature from performance management and measurements extracted from operational management theory is presented and appropriate system architectures, technology challenges, gaps and types of APMS are investigated through the IS literature. The DeLone and McLean information system success models were discussed with the extensions produced from Wixom and Watson. Finally relationships between the disciplines were analysed and a model was presented that illustrated the relationships between the success factors for implementing an APMS. The research domain and associated theory were discussed, resulting in a seed model for the first phase of the field research, the focus group, which is covered in Chapter 3.

In the next chapter, the methodology and underlying philosophical perspectives are considered. This "methodology" chapter details the approach and underlying epistemology and ontology.

CHAPTER 3
METHODOLOGY

Introduction

In the previous chapter extracts from operational management theory with respect to performance management and measurement literature was discussed as well as IS literature components for APMS, e.g. system architectures and technology challenges. Types of APMS were presented as well as some of the current gaps. Established models for IS success were discussed resulting in Wixom and Watson's data warehousing success model (2001) becoming the foundation model for this research.

This chapter describes the methodology and underlying philosophical perspectives that have been used in this research, giving the reader an idea of the orientation of this thesis. In summary, this research adopts a realist ontology and uses qualitative research method for gathering data from which it is possible to make deductions or hypothesise. This positivist researcher reflects not on one particular case but in general truths that will allow for explanation and predictive outcomes. Data collection and analysis is undertaken to falsify, confirm, or extend the applicability of the grounded theory hypothesis and to spawn new theory. This is based on the researcher's belief that there is an objective world based on practical experience and knowledge that has solutions that may not always be apparent. The positivist approach to extending knowledge is based on the premise of a realist ontology.

The method and approach are explained in this chapter through examination and discussion of the possible approaches that could have been used and explains why grounded theory was selected as a research method. Focus groups and a case study were used for data collection, whilst analysing the data from the perspective of an experienced, "reflective practitioner". The approach is illustrated and the limitations of the research are described.

The chapter finishes with the ethical safeguards taken during the research described.

Philosophical Perspectives

> “A research method is a strategy of inquiry which moves from the underlying philosophical assumptions, to research design and data collection” (Myers, M. D., 1997, p.243)

The aim of the study is to identify CSFs for the implementation of an APMS. The complexity of the research is due to the fact that the study is constructed around people and organisations, making a simple experimental approach not viable. The richness of the research lies in the views and beliefs that are revealed by participants in interviews and group discussion. These conversations become the research data and this type of data is best suited to a qualitative research approach, which is what was adopted for this thesis.

> The most fundamental set of assumptions adopted by a professional community that allows its members to share similar perceptions and engage in commonly shared practices is called a "paradigm." (Hirschheim, R. A. & Klein, 1989, p.98)

Research is based on some underlying assumptions about what constitutes 'valid' research and what underlying paradigms are appropriate. In order to conduct qualitative research, it is important to first state what these assumptions are within the qualitative paradigm before deciding upon the research method. These paradigms then determine the underlying epistemology which assists in the guidance of the research. Epistemology refers to the assumptions about knowledge and how it can be obtained (Hirschheim, R., 1992; Hirschheim, R. A. & Klein, 1989; Myers, B. L., 1998; Walsham, 1993, 1995).

Orlikowski and Baroudi (1991) propose three underlying ‘paradigms’ for qualitative research that are based on a qualitative research epistemology. These are positivist, interpretive and critical. This three part paradigm classification was adopted for this research. While these three research epistemologies are philosophically distinct, in the practice of social research these distinctions are not always so clear cut (Lee, R. M. &

Fielding, 1991). There is considerable disagreement as to whether these research ‘paradigms’ or underlying epistemologies are necessarily opposed or can be accommodated within the one study (Mingers, 2003; Myers, M. D., 1997).

Denzin and Lincoln (1994) define qualitative research as:

> Qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials case study, personal experience, introspective, life story interview, observational, historical, interactional, and visual texts - that describe routine and problematic moments and meaning in individuals' lives. (Denzin & Lincoln, 1994, p.2)

A different type of definition based on defining qualitative research as the opposite of the quantitative approach is as follows:

> Qualitative research, broadly defined, means “any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification” (Strauss and Corbin, 1990, p. 17). Where quantitative researchers seek causal determination, prediction, and generalisation of findings, qualitative researchers seek instead illumination, understanding, and extrapolation to similar situations. Qualitative analysis results in a different type of knowledge than does quantitative inquiry. (Hoepfl, 1997, p.48)

Both definitions indicate that the qualitative paradigm aims to understand the social world from the viewpoint of participants in the research, through detailed descriptions of their cognitive and symbolic beliefs and actions, and through the richness of meaning associated with observable behaviour. Grounded theory can be useful in providing deep insights and understanding of social life (Hughes & Jones, 2002). A qualitative approach is valuable where:

- issues or problems are poorly understood,
- a researcher wants to explore a measurement context,

- system success factors are not clear or other factors are sought,

- it is important to understand performance measurement practices in detail or it is important to discover how a APMS was actually implemented, or

- a researcher wants to know about people's subjective experiences of APMS outcomes.

> The word 'qualitative' is not a synonym for 'interpretive'. Qualitative research may or may not be interpretive, depending upon the underlying philosophical assumptions of the researcher. Qualitative research can be positivist, interpretive, or critical. (Myers, M. D., 1997, p.242)

This is illustrated in Figure 11 below.

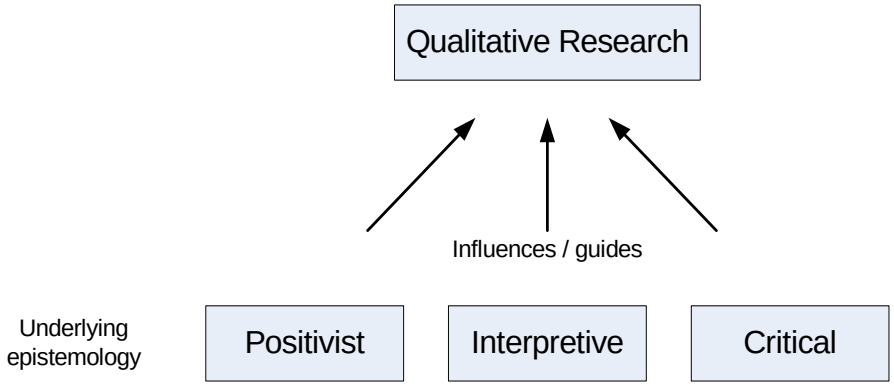

Figure 11. Underlying philosophical assumptions (Myers, M. D., 1997)

Myers (1997) states that the choice of a specific qualitative research method (such as grounded theory method) is independent of the underlying philosophical position adopted by the researcher. He quotes Yin (1994) and Walsham (1993) as having different underlying philosophical positions. case study research according to Yin can be positivist whereas Walsham takes an interpretive stance. Myers believes case study research is critical. Myers reinforces his position by stating action research can be positivist (Clark, 1972), interpretive (Elden and Chisholm, 1993) or critical (Carr and Kemmis, 1986). The researcher believes that grounded theory like case study research and other research methods can consist of multi epistemological positions. This is also supported by the work of Mingers (2003).

The use of multiple paradigms as an approach has been argued within the Information System (IS) discipline (Mingers, 2001) and is best

explained by an example quoted by Mingers. One example is the examination of a Group Support Systems that deliberately attempted to compare and contrast positivist and interpretive analysis on the same set of data. Two separate parallel analyses were carried out but the conclusions were then combined to generate what was said to be a richer understanding (p.254). Mingers (2002) in a later paper reaffirms that this approach will produce richer and more reliable results, although he later qualifies this in a subsequent paper by stating that little evidence exists to support multi-method research (Mingers, 2003, p.233).

The three philosophical perspectives are discussed further below.

Positivist

The ontology (systematic understandings of the nature of being and the existence of entities (Dervin, 2003)) of the research is based on the researcher's belief that there is an objective world based on practical experience and knowledge that has solutions that may not always be apparent.

The positivist approach to extending knowledge is based on the premise of a realist ontology. The researcher is expected to add to an existing body of knowledge by acting as a detached observer and gathering usually quantitative data, from which it is possible to make deductions or hypothesise. The deductions (or hypothesis) reflect that the positivist researcher is not interested in particular cases but in general truths that will allow explanations and predictive outcomes.

Positivist epistemology implies that society as well as nature can be predicted and controlled. This is supported and summarised by Guba & Lincoln (1994) when they stated that in terms of epistemology, positivism assumes that:

1. Objective reality can be captured and analysed meaningfully;

2. The observer can be separated from the subject area or participants and is hence, remote;

3. Observations and generalisations are free from situational and temporal constraints;

4. Causality is linear and there are no causes without effects, no effects without causes; and

5. Inquiry is value free.

(Guba & Lincoln, 1994, cited in Love, Holt & Li (2002)). (Foucault, 1972, cited in McGrath, K. (2005).)

Interpretive

The process to be employed involves starting from a model based on the literature and continually refining this model through interview, observation and analysis. In this case, the underlying assumption is that the analyst is 'interpreting' or allotting meanings, and that a range of these interpretations help the research analyst to a richer, broader, more useful understanding. Because of the focus on the social aspect of IS development, in which values, beliefs and the social construction of meaning are central, this research adopts an interpretive stance.

> "Interpretive research focuses on the complexity of human sense-making as a situation emerges (Kaplan, B. & Maxwell, 1994) and it attempts to understand phenomena through the meanings that people assign to them (Orlikowski & Baroudi, 1991)" (Larsen & Myers, 1999, p.399).

Myers (1997) believes that interpretive research studies generally seek to understand observable facts through the meanings that people assign to them. This is because interpretive methods of research in IS are "aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993 p4-5, cited in Myers 1997).

The main value of the interpretive case study lies in its depth as it allows the researcher to generalise from the case to theory and to obtain deep insights about IS phenomena (Walsham, 1995).

More extensive discussions of the contributions which interpretive research can make to IS research can be found elsewhere (Walsham, 1995a; Walsham, 1995b; Myers, 1997a; Klein and Myers, 1999).

Critical Realism

The epistemology for this research (the branch of philosophy that deals with nature, origins and scope of knowledge (Dervin, 2003)) is that of a critical realist (Dobson, 2002; Habermas, 1968).

Critical realism is a variation of critical epistemology and realist ontology. According to Mingers (2002), "*the original aims were to argue for a critical naturalism in social science"* and to "*re-establish a realist view of being in the ontological domain while accepting the relativism of knowledge as socially and historically conditioned in the epistemological domain*". The word "*critical"* is important as it qualifies the specific themes.

Two definitions from literature that can be used to define critical realism are below.

> "Critical realism is realist because it seeks to give a definition of reality, and critical because: (1) the ontology developed to define reality is developed via a critical dialogue with existing terms of reference (i.e. via internal critiques), and (2) the ontology is taken to be a fallible interpretation of reality and not a definitive claim to map reality. As the realism is construed in a critical way, in accord with the method of critical philosophy, it cannot be claiming to be justified by being a self evidently true definitive map of being. Therefore critical realism cannot be some form of rather extreme first philosophy." (Cruickshank, 2002, p.50).

And

> "In a critical realist approach within evaluation research, real explanations presuppose an understanding of the intervening dynamics allowing results to emerge. The underlying assumption is that generative mechanisms, which make things happen, are to be found beneath or beyond the immediate empirical surface. Through such an endeavour, 'theory' comes to the fore: the need to elaborate conceptual and theoretical models that can explain how human change arises from interventions in social work practice in different settings (how B from A under what conditions C). Ray Pawson and

> Nic Tilley put it very clearly: 'A mechanism is thus a theory—a theory that spells out the potential for human resources and reasoning.' It is one thing to know that certain interventions possibly bring on certain results. However, it is an entirely different matter to know and to be able to explain how and why results, i.e. client effects, in social work practice emerge from certain interventions. This kind of knowledge is certainly based on empirical observations, but it pans out mainly as conceptual and theoretical understanding of the way interventions work." (Morén & Blom, 2003, p.39)

A summary of these definitions from Cruickshank and Morén & Blom is that the critical realist philosophical ontology states that something is real if it can bring about visible or material consequences. In other words, in critical realism something is real if it is causally effectual (e.g., a magnetic field, unemployment, psychological states and poverty).

Critical realism is not naively realist or naturalist. It is accepting significant limitations on the objectivity of our knowledge, although no social theory can be purely descriptive, it must be evaluative. Thus there can be no split between facts and values, and, following from this, the view that social theory is inevitably transformative, providing an explanatory critique that logically entails action (Mingers, 2002, p.298).

As discussed by Dobson, et al. (2007), critical realism is becoming influential in a range of disciplines including geography, economics, organisation theory, accounting, human geography, nursing, logistics and network theory and library science. Critical realism has been proposed as a suitable underlabourer for IS research yet there have been few practical examples of its use in IS research. The application of critical realism within the IS field has been limited to date. Mutch (1999; 2000; 2002; 2005) has applied critical realist thinking in the examination of organisational use of information. In so doing he comments how difficult it is to apply such a wide-ranging and sweeping philosophical position to day to day research issues. Mingers (2002) examines the implications of a critical realist approach particularly in its support for pluralist research. Dobson (2001; 2002) argues for a closer integration of philosophical matters within IS research and suggests a critical realist approach has particular potential for IS research. Carlsson (2003) examines IS evaluation from a critical realist perspective.

The research has been chosen because it is expected to deliver benefits to both the theoretical body of knowledge as well as practical benefits by defining the CSFs for implementing an APMS. This positive epistemology is in line with most other published IS system success research with respect to DeLone and McLean's (1992) model (Lycett, 2003).

The critical realist beliefs of the researcher are targeting the real mechanisms and structures underlying the perceived events described through the interaction of the focus group and case participants. The research question is "What are the CSFs for successfully implementing an APMS?" The researcher does not know what these are and is embarking on a journey of discovery. Quoting from Dobson (2002):

> "The critical realist agrees that our knowledge of reality is a result of social conditioning and, thus, cannot be understood independently of the social actors involved in the knowledge derivation process. However, it takes issue with the belief that the reality itself is a product of this knowledge derivation process. The critical realist asserts that "real objects are subject to value laden observation"; the reality and the value-laden observation of reality operating in two different dimensions, one intransitive and relatively enduring; the other transitive and changing." (p.6)
>
> and
>
> "… critical realism may also provide a useful grounding for IS research in general by elevating the importance of philosophical issues and thus allowing for a more consistent approach to research. Its recognition of a transitive and intransitive dimension to reality provides a useful basis for bridging the dualism between subjective and objective views of reality: "real objects are subject to value-laden observation"." (p.15-16)

The assertion by Dobson that transitive (production of knowledge) and intransitive (existing independently of humans) dimensions (Mingers, 2002) reaffirms the selection of the method and approach. A critical realist belief allows the consideration of the soft factors (e.g. organisation, management direction and buy-in, etc) through the transitive dimension while the hard factors (e.g. data quality, data capture mechanisms, etc) associated with the system (the non human elements) bring the second

dimension, intransitive, into perspective. The dualism between soft and hard factors, together with the subjective and objective view of reality, come together during the research.

The belief of the researcher (for this research) can be put simply. “There is a real world problem that needs a real world answer. It just hasn’t been found yet.” Or put another way:

> “The critical realist asserts that "real objects are subject to value laden observation"; the reality and the value-laden observation of reality operating in two different dimensions, one intransitive and relatively enduring; the other transitive and changing.” (Dobson, 2002, p.6-7)

This belief was reinforced when a case was found that appeared to have actually been successful in implementing an APMS. How this occurred in discussed further in Chapter 5, the case study.

In line with Pawson et al. (2004, cited in Dobson, Myles & Jackson, 2007), the use of critical realism as an underlying philosophy for the APMS research, appears to offer some particular benefits:

- It has firm roots in the social sciences and allows one to identify and make salient the external, objectified, social structures which function as causal elements in the success and failure of implementation. Using this paradigm, one is allowed to explore in depth the social aspects of systems use and implementation;

- It is grounded in the rigor of structured, analytical philosophy and one can be reasonably confident in its reliability and consistency as a base paradigm for research development;

- It is not a prescriptive method or formula for developing research but provides a logic of enquiry that is “inherently pluralist and flexible”, embracing both ‘qualitative’ and ‘quantitative’, ‘formative’ and ‘summative’, ‘prospective’ and ‘retrospective’, perspectives – it suggests but does not prescribe which ‘rocks to look under’;

- It seeks not to judge but to explain, and is driven by the question ‘What works for whom in what circumstances and in what respects?’ - it supports the pragmatic realization, after many years of IS failure, that ‘there is no silver bullet’;

- It learns from (rather than ‘controls for’) real-world phenomena such as diversity, change, idiosyncrasy, adaptation, cross-contamination

and ‘programme failure’ – its outcomes therefore are a good fit within the context of organisational learning and professional reflection;

- It engages stakeholders systematically, as experienced but nevertheless fallible experts whose ‘insider’ understanding of historical reasoning and action needs to be documented, formalised, reflected upon and validated within complex, multi-level explanatory models.

Critical realism provides a foundational platform for developing the research. The following realist elements were important in the study development:

- Focus on context and setting;
- Emphasis on explanation and ex-post evaluation;
- The need for an “analytical dualism”;
- An emphasis on the social nature of IS implementation; and
- The ontological depth of critical realism.

These are discussed further below.

The realist focus on context and setting

Pawson, Greenhalgh, Harvey and Walshe (2004) describe realist review as “a relatively new strategy for synthesising research which has an explanatory rather than a judgemental focus. It seeks to unpack the mechanisms of how complex programmes work (or why they fail) in particular contexts and settings” (p. 21). Such methods are becoming more prevalent in the analysis of the effectiveness of social programs. It is the contention of this research that a similar approach is effective in examining the heavily social and contextual nature of complex APMS implementation. Critical realist evaluation moves from the basic evaluative question - *what* works - to *what is it about this implementation that works for whom in what circumstances*.

Realist emphasis on explanation and ex-post evaluation

The realist focus on explanation rather than prediction necessarily encourages an emphasis on ex-post evaluation. The realist would suggest that ex-ante or predictive evaluation is difficult given the highly complex nature of the implementation environment. Ex-post evaluations after the event are more in keeping with the underlying realist focus on explanation rather than prediction.

The critical realist focus on explanation rather than prediction suggests that the critical realist method involves "the postulation of a possible [structure or] mechanism, the attempt to collect evidence for or against its existence and the elimination of possible alternatives". The realist agrees that we have a good explanation when:

- The postulated mechanism is capable of explaining the phenomenon;
- We have good reason to believe in its existence; and
- We cannot think of any equally good alternatives (Outhwaite, 1987, cited in Myles, et al., 2007).

Such an approach has specific impacts on the research process in that it argues for research heavily oriented towards confirming or denying theoretical proposals. For the realist the initial explanatory focus may be on proposing (i.e. transcending or speculating) non-experienced and perhaps non-observable mechanisms and structures that may well be outside the domain of investigation. As Wad (2001, cited in Dobson, et al., 2007) argues:

> "If we take explanation to be the core purpose of science, critical realism seems to emphasise thinking instead of experiencing, and especially the process of abstraction from the domains of the actual and the empirical world to the transfactual mechanisms of the real world" (p.2).

The realist need for an "analytical dualism"

The original DeLone and McLean model (1992) of IS success in Figure 6 (p.55) is realist in focus, as it emphasises causal factors – however the critical realist would have difficulty agreeing with the simplistic notion

that organisational impacts are solely pre-determined by individual factors. The realist argues for a deeper multi-level analysis that recognises that individual agency (micro) level impacts are only one of the components - such an analysis ignores the duality of structure in that agency actions are both constrained and enabled by pre-existing structures. (Dobson, et al., 2007.p. 144)

Any research study founded on critical realism needs to reflect this duality of structure and agency. Archer (1995, cited in Dobson, et al., 2007) proposes that such a duality is difficult to properly examine in social situations and therefore argues for an "analytical" or artificial dualism whereby structure (macro) and agency (micro) are artificially separated in order to properly examine their interaction. Hedström and Swedberg (1998, cited in Myles, et al., 2007) propose three basic mechanisms:

1. Situational Mechanisms (macro-micro level)

2. Action-Formation Mechanisms (micro-micro level)

3. Transformational Mechanisms (micro-macro level)

The typology implies that macro-level events or conditions affect the individual (step 1), the individual assimilates the impact of the micro-level events (step 2) and a number of individuals generate, through their actions and interactions, macro-level outcomes (step 3). Such a critical realist perspective on technology is presented by Smith (2005, cited in Myles, et al., 2007) when he suggests that "technology introduces resources and ideas (causal mechanisms) that may enable workers to change their practices, but these practices are also constrained and enabled by the structures in which they are embedded…Thus, …a researcher must try to understand how the generative mechanisms, introduced by the technology into a particular context of structural relations that pre-existed the intervention, provided the resources and ideas that resulted in changes (or not) to individual practices that then either transform or reproduce those original structural relations" (p. 16). Such a representation highlights the historicity of IS implementation and argues for a consideration of the environment prior to IS initiation. The framework also suggests that any study of APMS implementation would

need to view the implementation as fundamentally a change of pre-existing *social* practices.

The original DeLone and McLean model emphasises the micro-macro interaction when it suggests individual impacts aggregate to organisational impacts. However from a realistic perspective it has no recognition of the macro-micro and micro-micro level interactions.

The 2002 changes made to the original DeLone and McLean model (Figure 7, p.57) were the introduction of Service Quality and two dimensions, Organisational and Individual impact, being combined into one dimension called Net Benefits (DeLone and McLean, 2002). From a realist perspective this again moves the model further away from a realist position in that the organisational and individual impacts are conflated. Archer (1995) argues against such conflation when she suggests that "structure and agency can only be linked by examining the interplay between them over time, and that without the proper incorporation of time the problem of structure and agency can never be satisfactorily resolved" (p. 65). The static simplistic representation of DeLone and McLean is inconsistent with such a view.

The models did however provide guidance as to the various categories that might be used in the grounded theory analysis.

An extension of DeLone and McLean's original model developed by Wixom and Watson (2001) to model data warehousing success provided further depth to the analysis. This model (Figure 8, p.60) helped to identify the various levels of analysis needed and associated impacts at each level. The increasing richness of this model suggests a more subtle and differentiated interaction between its elements and reduces the dependence upon a few "critical" success factors.

This research utilises the Wixom and Watson (2001) model and produces a final research model (Figure 31, p.285) that reinforces a more fine and differentiated interaction between its elements and reduces the dependence upon a few "critical" success factors.

An emphasis on the social nature of IS/IT implementations

The defining characteristic of APMS is that it is the automated communication of key performance indicators. As such the implementation and operation of such a system can be highly political and sensitive. Performance measurement can be defined as the process of quantifying the efficiency and effectiveness of action and a performance measurement system as the set of metrics used to quantify both the efficiency and effectiveness of actions (Bourne, Neely et al., 2003, p. 146).

As stated in Chapter 2, the development of any performance measurement system and can be expected to be potentially highly political, possibly controversial and affect the acceptance of the final management system. The final communication of performance figures is also inherently social and there is potential for active resistance to the automation of performance measures and their communication (Dobson et al., 2007, p.146).

Organisational goals are set by management; high level requirements are set by management, as are timelines, resources and objectives. The design solution of APMS, its overarching principles and objectives, depend upon the ideologies, requirements and principles of these decision makers. These principles are based upon a normative threat (the Sarbanes-Oxley legislation and similar such acts) as well as the drive to maximise productivity through control and early intervention. The ideology of industrialisation, that increasing labour productivity is the foundation of increasing wealth and the improvement of social and economic conditions, also makes rational resistance difficult. The solution of APMS is therefore conservative, preserving the power *status quo* and serving the needs of those who need to control, measure and manipulate. “Middle management is often most active in resisting corporate performance measurement, fearing that its reporting mechanisms will expose them or threaten their power” (Buytendijk & Gassman, 2005, p. 4). Here we can observe a structure of legitimated management and regulation interacting with the agency of individual and idiosyncratic leaders and subordinates. Critical realism allows that these structures have a causative function, derived from the ontological commitment of protagonists. These causal events may have

elements which can be generalised, but their universality needs to be understood in the context of agency and individualism.

Conversely, where there is an emphasis on authority and control, this is antithetical to knowledge commitments and the hostages one gives to fortune, when one gives away knowledge. One of the complicating factors in systems design in particular, as indeed it is in any form of innovation, is the implications of change for participants involved in and stakeholders affected by the change. Innovation of any kind is knowledge intensive and controversial, 'uncertain, fragile, political and imperialistic' (Kanter, 1996). It crosses boundaries, redefines job descriptions and requires close communication. This leads inexorably to the fact that:

> "IS development is also a political process in which various actors stand to gain or lose power as a result of design decisions" (Robey & Markus, 1984, cited in Dobson et al., 2007)

New divisions of labour and requirements for cooperation, a transcendence of current work processes, will break down existing divisions of labour and require extensive cooperation. Particularly in organisations with command and control management paradigms and Fordist conceptions of the structure of work, boundary spanning and the unimpeded flow of information will be perceived as threat to those whose authority is based upon the existence of boundaries and fiefdoms. The adjustment and threat to power structures defined through knowledge is a high risk area for projects whose focus and objective is to codify knowledge and ways of doing things and make them freely available. The case of APMS is particularly interesting because it is managers whose knowledge is being codified and commoditised and whose ability to intervene and massage production figures is being withdrawn. It is managers whose fiefs are becoming subject to a super-Panopticon, accessed by the CEO himself, who may ring up at 8:00 a.m. and complain about the previous day's poor production quality. The stance of critical realism can sensitise researchers not only to the collision of conflicting structures, but also to the motivations of the protagonists who inhabit those structures and have careers to build or mortgages to pay.

People in organisations are usually aware of the importance of their knowledge to their position, status and remuneration and any reduction may well be met with lack of full cooperation. The implementation of APMS moves this to the next level. Martin and Shell (1988, cited in Dobson et al., 2007, p. 147) state that "the major resource distribution by technological change is knowledge: groups with knowledge of the old system may lose control of knowledge under the new system" (p.119). Scarbrough and Corbett (1992, cited in Myles et al., 2007) assert that the higher the levels of autonomy and job specialisation, the greater the power of the job holder. If this is correct, then if these two parameters are reduced by technological change, it is more than likely that the change will be resisted at some stage of the technology change project: either in design, implementation or use. This resistance is a denial of the legitimacy of the technological solution – and may have nothing to do with whether the solution is 'the best for the company' or even represents a best possible reorganisation of work processes. Critical realism recognises the role of individual agency in the withdrawal of support and legitimation for the normative and regulative structures implied by the 'organisation as machine' metaphor in which APMS finds its validation. The *automated* aspect of an APMS has implications for the autonomy of the manager in that the APMS is intended to by-pass the manager's intervention, although in the Cases instance MDE allows this to manipulation to occur but it is tracked. The performance management aspect of the system has implications derived from surveillance and control and the concomitant power structures.

The diverse range of stakeholders – subordinate to the accountable managers are line staff, whose actions have already been 'informated' by the implementation of an operational information system. They are responsible for data entry (which must be timely and accurate for the APMS to succeed). There are the technical personnel who set up and maintain the APMS. They must understand the needs of the other 'culture' and be competent in the execution of the technology. There appears to be quite different purposes and value orientations within these groups.

There is a requirement for a high degree of structure and order in the interaction between systems and the delivery of meaningful outcomes. The

derivation of a few key numbers from highly complex ERP systems requires the correct functioning of many software and hardware systems and types of components, as well as standardised (highly 'structurated') rules, processes and meta data definitions.

The ontological depth of critical realism

In accordance with the recognition of continuing micro/macro interaction and the social implications of IS implementation, Carlsson (2003, cited in Myles, et al., 2007) proposes a multi-levelled investigation of the research situation. As Figure 12 below illustrates, the framework includes macro phenomena, like structural and institutional phenomena, as well as micro phenomena, like behaviour and interaction. The framework highlights the importance of wider macro level issues on individual situated activity. As Carlsson suggests (p. 13) the self and situated activity focus concentrates on "...the way individuals respond to particular features of their social environment and the typical situations associated with this environment." (Layder, 1993, cited in Myles et al., 2007).

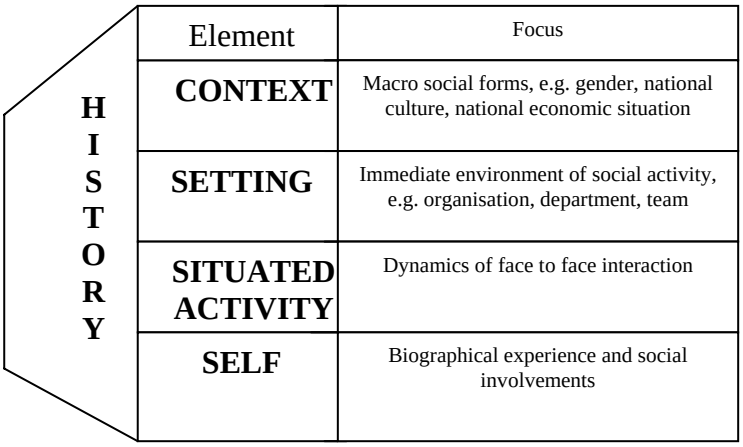

Figure 12. A Realist Research Map (Carlsson, 2003, p.13, cited in Dobson et al., 2007, p.148, adapted from Layder, 1993).

Critical realism is ontologically bold in the sense that it not only encompasses an external realism in its distinction between the world and our experience of it but it also suggests a stratified ontology and a so-called depth realism in defining the objects that make up such a world. This concept suggests that reality is made up of three ontologically distinct

realms – first, the empirical, that is experience; second, the actual, that is events (i.e. the actual objects of experience); and third, the transcendental, non-actual or deep, that is structures, mechanisms and associated powers. The deep structures and mechanisms that make up the world are thus the primary focus of such an ontological realism, *events* as such not being the primary focus. An important element within critical realism is that these deep structures and mechanisms may, in fact, be only observable through their effects and thus a causal criterion for existence is accepted:

> "Observability may make us more confident about what we think exists, but existence itself is not dependent on it. In virtue of this, then, rather than rely purely upon a criterion of observability for making claims about what exists, realists accept a causal criterion too (Collier, 1994). According to this a plausible case for the existence of unobservable entities can be made by reference to observable effects which can only be explained as the products of such entities…. A crucial implication of this ontology is the recognition of the possibility that powers may exist unexercised, and hence …the nature of the real objects present at a given time constrains and enables what can happen but does not pre-determine what will happen." (Sayer, 2000, p.12, cited in Dobson et al., 2007, p. 148).

Realist researchers need to be able to account for the underlying ontological richness they implicitly assume and also need to reflect the belief that any knowledge gains are typically provisional, fallible, incomplete and extendable. Realist methodologies and writings, thus, must reflect a continual commitment to caution, scepticism and reflexivity (Stones 1996, cited in Dobson et al., 2007, p.140).

Method

The general area of qualitative research includes several research methods. These include case studies, participant observation, ethnomethodology, grounded theory, biographical methodology and clinical research methods (Das, 1983). Specifically within the field of IS, Myers (1997) outlined four qualitative methods as being particularly significant in IS research. These were action research, case study research, ethnography and grounded theory.

The choice of research method influences the way in which the researcher collects data. Specific research methods also imply different skills, assumptions and research practices. The four research methods outlined by Myers (1997) were examined with respect to their suitability for this research.

- Action research has been acknowledged as a legitimate research method in the fields of organisation development and education although in IS action research was for a long time largely ignored. Myers states that there seems to be increasing interest. This was supported by a number of recent publications on Action Research (Avison, Baskerville, & Myers, 2001; Bourne, 2005; Coghlan & Brannick, 2001; Neely et al., 2000; Nudurupati & Bititci, 2005; Turner et al., 2005). Action research involves significant involvement in the research situation, with the opportunity for effective learning, but at the likely cost of objectivity. As the researcher is not involved in any of the research situations, this method was discounted but it should be noted that a number of the publications were written from an Operational Management perspective with an APMS as the system being researched.

- Case study research. The term case study can have multiple meanings and can be used to describe a technique or instrument for data capture (e.g. a case study of a particular organisation) or to describe a research method. Myers states that case study research method is the most common qualitative method used in IS (Alavi, M. & Carlson, 1992; Orlikowski & Baroudi, 1991, cited in Myers 1997) Myers quotes Yin (1994) as he 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 (Yin, 2003 p 13)." (Myers, M. D., 1997, p.4)

  The case study method was considered as a candidate method as one organisation agreed to participate in the research project. Even if this method is not selected, the involvement of a case organisation means it will be used as a technique for data capture.

- Ethnographies are similar to interpretive in-depth case studies but the researcher spends more time in the field and is more intimately involved in the social group that is being studied. The researcher is part of the group where the research is taking place. It is sometime referred to as "living with the natives".

  The difference between case study and ethnographic research is that ethnographic research does not have formulated research questions and hence avoids preconceived ideas. The research is done by

observation and is a case of action and reaction. Ethnography also tries to develop a “thick description” of what actually occurs and does not proceed according to a predetermined schedule as a case study does (Yin, 1989). Prasad (1997) also refers to the use of “thick description” in which the full context is included to ensure that deeper meanings are uncovered.

In ethnographic research not only are interviews and documentary evidence collected as data, but data is also collected during participant observation. Myers (1999) indicates that it is in this way the ethnographer searches out and analyses symbolic forms. Prasad (1997) also highlights that it is essential in ethnography that the social situation or context be understood from the point of view of the research participants. Myers (1997), on the other hand says that the ethnographer does not need to empathise with the subjects.

While the experience of the researcher could provide valuable insights to the focus group participants and APMS not all aspects are known to the researcher.

The researcher will not be “living amongst the natives” and there is a specified timeframe for data collection and analysis so this research method was not considered appropriate.

- Grounded theory is a research method that seeks to develop theory that is grounded in data systematically gathered and analysed (Myers, M. D., 1997). Grounded theory is:

"an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data." (Martin, P. Y. & Turner, 1986, cited in Myers 1997, p.4),

Grounded theory differs from other research methods due to its specific approach to theory development as there is a continual review of the data collected right up until the last set of results. It also involves constant analysis and likely incremental improvement to the underlying theory. Myers (1997) believes that grounded theory is becoming progressively more common in IS literature because the method is particularly valuable in developing context-based, process-oriented descriptions and explanations of the phenomenon (Orlikowski, 1993, cited in Myers 1997). Due to the underlying theory developed for the literature on success models and the intent to build on this theory by identifying success factors with respect to APMS this method was considered a candidate method.

Although case study and grounded theory were considered candidate methodologies for this research, grounded theory was selected as the

research method for the collection and analysis of data for the following reasons:

- Theoretical foundation. Grounded theory attempts to deal with the gap between theoretical research and practice and provides a rich description of the area under study (Martin, P. Y. & Turner, 1986). This supports the aim of this research to theoretically extend IS implementation literature for APMS and to provide an insight for those organisations either implementing or intending to implement an APMS.

- Theoretical framework. Grounded theory will provide a framework for the investigation and determination of what success factors fit and which don't. This is more 'a priori' use of existing theory.

- Incremental development of a new theory. This is done by using a structured method to ensure that the emerging theory is closely tied to and consistent with the empirical data (Glaser, 1978; Locke, 2001). The intention of the research is to use the DeLone and McLean success Model and another derivation, Wixom and Watson model, and then modify the model through a process of refinement to produce a new model for APMS IS success.

- Human experience is rich and complex and so qualitative research studies that focus on human experiences must present contextual analysis of the resulting research results. The links between success factors and automated measurement systems will include the soft factors, including human experience. To reveal how these are applied, how they interrelate, interact and influence each other a qualitative research approach could be employed (Denzin & Lincoln, 1994; Yin, 1993). Grounded theory is a qualitative research approach (Myers, M. D., 1997).

  ".. to produce accurate and useful results, the complexities of the organisational context have to be incorporated into an understanding of the phenomenon, rather than be simplified or ignored.' (Orlikowski, 1993, p.311)"

  A more detailed description of grounded theory follows.

Grounded Theory

"The discovery of Grounded Theory" started in 1967 (Glaser & Strauss, 1967). Grounded theory is a method for the collection and analysis of qualitative data.

Constant comparison is the heart of the grounded theory process. Interviews (or other data) are compared to other interviews (or other data) and through analysis, theory emerges. When the theory starts to develop, this is compared to established theory.

Grounded theory is based on three elements:

- Identifying conceptual categories prior to and during data collection;
- Theoretical sampling and enhancement through coding and integration - Concepts; and
- Hypothesis or generation of theory.

These three grounded theory concepts have importance within the process of interpretive research. The first is constant comparative analysis. This is a procedure for identifying conceptual categories and their properties that may be embedded in the data. The second is theoretical sampling whereby the conceptual categories are enhanced through coding and integration. In the grounded theory method, conceptual properties and categories may be ‘discovered’ or generated from the qualitative data. These two processes then assist in the development of integrated categories which in turn assist in the development of hypotheses or new concepts of theory (Hughes & Jones, 2002). As the process is iterative, a circular process continues ever spiralling until no added value exists in the data collected.

Concepts are the basic units of analysis since it is from these concepts that theory is developed. The process of conceptualisation takes place during the analysis of the research data. Corbin and Strauss state:

> Theories can't be built with actual incidents or activities as observed or reported; that is, from "raw data." The incidents, events, happenings are taken as, or analysed as, potential indicators of phenomena, which are thereby given conceptual labels. If a respondent says to the researcher, "Each day I spread my activities over the morning, resting between shaving and bathing," then the researcher might label this phenomenon as "pacing." As the researcher encounters other incidents, and when after comparison to the first, they appear to resemble the same phenomena, then these, too, can be labelled as "pacing." Only by comparing incidents and naming like phenomena with the same term can the theorist accumulate the basic units for theory. (Corbin & Strauss, 1998, p.7)

Categories are defined by Corbin and Strauss (1998, p. 7) as:

> Categories are higher in level and more abstract than the concepts they represent. They are generated through the same analytic process of making comparisons to highlight similarities and differences that is used to produce lower level concepts. Categories are the "cornerstones" of developing theory. They provide the means by which the theory can be integrated." (Corbin & Strauss, 1998, p.7)

The third element of grounded theory is the generation of the new theory. Theory can be raised to describe generalised relationships between a category and its concepts and between discrete categories. This element was originally termed 'hypotheses' by Glaser and Strauss (1967) but is also referred to as “propositions”(Pandit 1996) or “composing theoretical elements” (Locke, 2001). This element is important as one of the main purposes of Glaser and Strauss’ original proposal was to challenge the hypothetico-deductive (or scientific method) approach which demands the development of precise and clear cut theories or hypotheses before the data collection takes place (Kelle, 2005).

As the research study continues, data collection and analysis becomes more specific centring on the emerging theory. This is where another process also occurs, theoretical saturation. Theoretical saturation is when the process continues until no more additional data, coding, or sorting contribute to the extension of the theory (Glaser & Strauss, 1967).

The continuing comparative nature of grounded theory can be used to produce either conceptualisations or rich descriptive accounts. The conceptualisation versus descriptive debate is the main difference between the Glaserian and Straussian approaches to grounded theory.

Glaser emphasises induction or emergence utilising the researcher’s creativeness within each cycle of iteration, while Strauss is more interested in a more rigorous systematic approach to confirm validation. Glaser argues that the rigorous verification method could be used for testing only a few of the central hypotheses only. While Glaser argues that Strauss' version has its own merit, he states that it is not grounded theory. The methodical way of creating grounded theory (and still be acceptable to scientific standards) is

explained further in Strauss and Corbin (1990). The research method utilised in this research was neither one nor the other, but leans more towards Glaser.

Reflective Practitioner

"The knowing is in the doing". Reflections of the researcher.

The researcher, although not part of the case subject area or the organisation from which the focus group participants are represented, has been close enough to their respective organisations to understand and gain rich insights into the subject areas due to the specific expertise of the researcher, and having worked previously for some of these organisations. The researcher is not part of the system (s) being analysed nor a researcher conducting self-study, but as already stated has inside knowledge of the research subjects.

When the researcher holds some deep-rooted beliefs, these can be captured as text and then analysed with other text as just another incident in the data ((Glaser, 1978) (Glaser & Strauss, 1967)). This could occur during an interview where a response from a question although recorded, could convey one meaning but in the context and resulting body language mean another, For example, "yeah" means yes but can also mean "well sort off" or even "no". The subsequent data analysis of such data entries will then falsify, confirm, or extend the applicability of the grounded theory hypothesis under consideration.

Utilising the work of Coghlan and Brannick (2001) Figure 13, below, the researcher is placed in the top left quadrant, Quadrant 1. This is highlighted by the red eclipse.

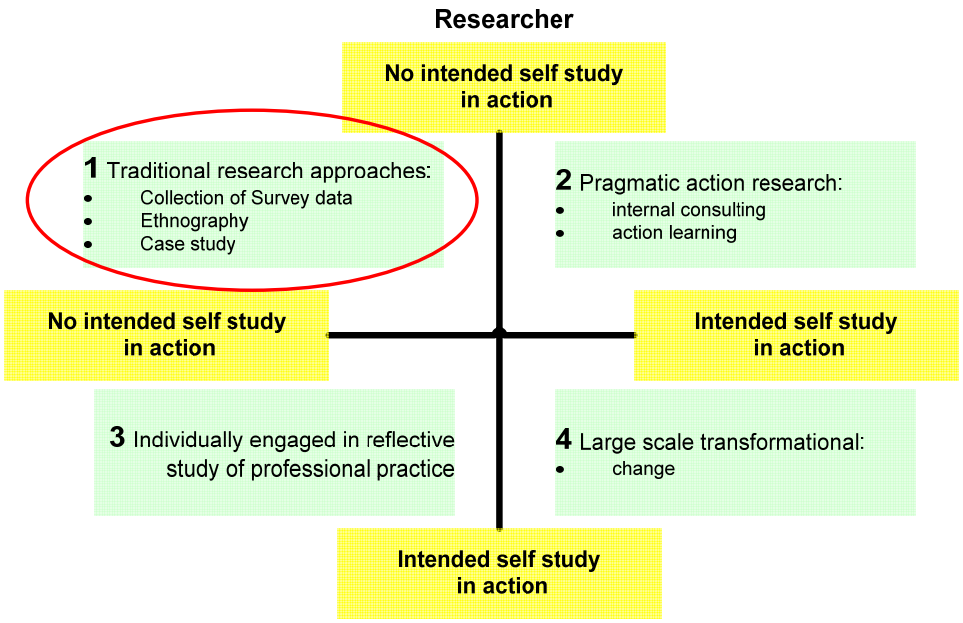

Figure 13. Focus of researcher and system (Coghlan & Brannick, 2001 Figure 4.1 p41)

Quadrant 1 is defined by the absence of intended self-study in action by both researcher and system. This is a situation where the researcher focus' is on an issue or problem but will take on the role as an external observer, therefore not engaging in any calculated self reflection as part of the research process. At the same time, the system itself sees the researcher as foreign and not committed to engaging in the problem, only witnessing it. This quadrant contains most traditional research approaches, such as qualitative and quantitative studies, ethnography or case writing. (Coghlan & Brannick, 2001, p. 41) While grounded theory was not highlighted by Coghlan and Brannick, the researcher believes that grounded theory also fits within this quadrant, if for no other reason than it doesn't align itself to any of the other three quadrants.

As stated previously, the researcher is a practicing IS/IT professional, skilled in the development and implementation of APMS. This internal understanding of the unit of analysis (APMS), can lead to important insights of the people and their actions while researching APMS. This is known as a reflective practitioner approach (Schön, 1983).

The reflective practitioner stance is based on professional learning and the development of critical, self-reflecting practice. Schön (1983) describes technical professions such as doctors, lawyers and managers with skill bases that support our understanding of learning in organisations due to

the experience and insight obtained from solving day to day problems in their professional practice.

Being a skilled practitioner, much of the knowledge and expertise is embedded in the practitioners practice or practical experience. The aim of the reflective practitioner is to make these internal or implicit understandings, explicit. This assists in explaining and clarifying, not only for the researcher, but colleagues and peers alike. The researcher can analyse and develop research as well as add to the body of knowledge. This also assists the positivist stance stated previously.

This reflective approach is based on the concept that:

> " in much of the spontaneous behaviour of skilled practice we reveal a kind of knowing which does not stem from a prior intellectual operation" (Schön, 1983, p.51)

Schön (1983) refers to this reflective practice process as "reflection-in-action" which is thinking about the action while performing the action, rather than afterwards. It is based on continual review and refinement. Each stage has a completion or a goal attainment. The completion of the stage therefore sets the stage for the next, and so forth. The thinking process has similarities to grounded theory but is "internal" and therefore not the same.

The reflective practitioner approach also supports elements in both the research process and the success factors themselves.

The process is evolutionary as a proposed model starts with the literature and is tested with input from the focus group. The researcher participates and facilitates the focus group while confirming, analysing and identifying other possible factors that influence success. This of course will have reflective practitioner input. The questions and model contained in this proposal will no doubt change prior to the next examination - the case study. During each stage change will occur. Change is inevitable as these changes to the model are the goal of the research.

The factors themselves by their very nature contain elements that cannot be controlled. As discussed previously the success factors can be

hard or soft. The hard factors can be controlled but the soft factors cannot be. Soft factors typically related to individuals or organisations and these soft factors will be influenced by the experience and professional learning's of the researcher.

Interpretive research and the grounded theory approach are still used within the modernist paradigm which sees the world as predictable and controllable (Maceviciute & Wilson, 2002).

Research Approach

The research approach was based on the following stages and was executed as per the original research proposal.

A literature review was conducted based on the DeLone and McLean IS Success Model (DeLone & McLean, 1992). By contrasting their ten year review (DeLone & McLean, 2002) and the Wixon and Watson Data Warehousing Success model (Wixom and Watson, 2001), a model based on this IS literature was used as the initial seed model. The literature review also consolidated and reviewed the available literature available in the operations management literature, where there had been recent publications. By comparing and contrasting the literature from these two disciplines, factors are added to the initial seed model for APMS success.

This model was then the basis for defining a set of questions for qualitative interviews. These questions can be found in Attachment One.

Once refined the questions were then the basis of a set of interviews utilising a focus group (Krueger, 1988). This focus group was composed of IS industry experts active in the automation of performance measurements. The results were then analysed and a revised model produced (Model 1).

Model 1 was then tested against a case study (Yin, 1989) with further refinements to the model being made as required. This resulted in Model 2. The questions were also refined for the case interviews and these can be found in Attachment Two.

Through a cyclic process of review, more refinements to the model occurred (Model n).

The research then concluded when a final model was obtained and the thesis submitted for examination. (This document).

The stages are illustrated in Figure 14 below, with each stage number corresponding to the number in a circle on the figure.

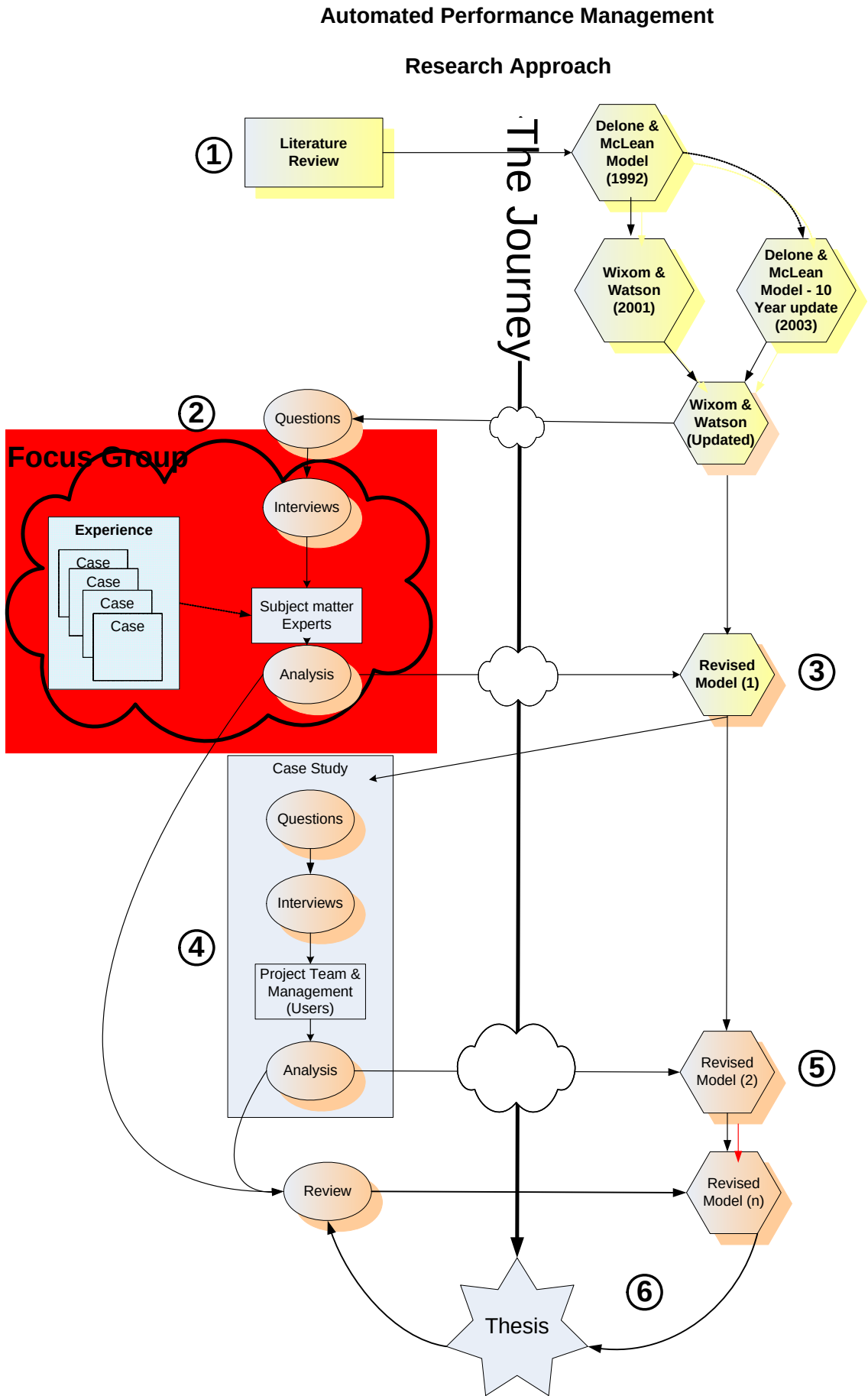

Figure 14. Research Approach

As stated previously, this approach is based upon a comparison of the data collected in each stage and on the Glaser approach to grounded theory. What is different with the proposed research approach is that unlike grounded theory where the literature is accessed as it becomes relevant (Glaser, 1978), a formal literature review was conducted prior to the formal focus groups interviews and this was the basis from which the initial proposition (or draft model) of CSFs was based. An ongoing literature review was conducted as the study progressed due to the interpretive nature of the research.

Each stage is discussed further below, but the planned approach was the actual approach followed during the research. Exceptions are discussed in the description of each stage below.

Literature Review

A formal literature review was conducted during Stage 1 and was based on the preliminary literature review and theoretical framework discussed in Chapter 2. The majority of the literature review was conducted for the proposal for this dissertation, although a mix of varied and related material was also examined. This ended up being the fundamental basis of the model for the following stages even though an ongoing literature review was conducted as the study progressed.

Relationships between two different disciplines were fundamental to the models development. These were discussed in Chapter 2.

Data Collection

Two qualitative research tools were used for data collection. The first utilised focus groups (Krueger, 1988) to confirm current literature and established a model using expert knowledge, while the second method used the case study method (Gomm, Hammersley, & Foster, 2002; Leenders & Erskine, 1978; Yin, 1989) to reconfirm and refine the model. Both of the approaches follow that of a reflective practitioner (Schön, 1983), with elements of post modern research (Bhaskar, 1986, 1991; Dobson, 2003; Popper, 1934/1980), while the overall research method followed the grounded theory method (Glaser & Strauss, 1967).

The focus group was stage 2 of the research and the case study was stage 4.

The research approach was defined to provide the researcher with a set of results that would produce an updated IS success model based upon the incremental knowledge gained during the previous stage of the investigation. As the results of each stage were determined the design of the next stage was adjusted accordingly. These adjustments in the main where very minor and were easily accommodated into the original planned framework.

Data Collection Tools

The research utilised the input from the focus groups and one case study area. The analysis and subsequent output was based on the questions, feedback received and reanalysis of the factors. These collection tools are more fully explained in the next sections (focus groups and case study).

The purpose of the focus group is to explore rather than to describe or explain in any definitive sense (Babbie, 2000, p. 303).

The research was conducted principally utilising dialogical interviews for both individuals in the focus group and for the case study. Interviews were both formal and informal due to the reflective practitioner role of the researcher.

Myers (1999) suggests that researchers:

- Write up their field notes on a regular basis. These notes include observations, impressions, feelings, premonitions, and questions which emerge.
- Write up an interview as soon as possible.
- Regularly review and develop ideas as the research progresses.
- Develop strategies to deal with the collection process at the beginning of the research. The researcher should be summarising, indexing and classifying the data as appropriate.

These activities were performed during the collection of data in each stage of the study.

Focus Groups

> "The focus group interview works because it taps into human tendencies. Attitudes and perceptions relating to products, services, or programs are developed in part by interaction with other people. We are a product of our environment and are influenced by people around us. A deficiency of mail and telephone surveys and even face-to face interviews is that those methods assume that individuals really do know how they feel." (Krueger, 1988, p.23).

A focus group is a group of people brought together for a more or less, open-ended discussion about a particular topic, issue or concern. A facilitator (or moderator - in this case the researcher) provides a framework and structure to the meeting, integrating open-ended questions to promote discussion. The focus group as a tool relies upon the group to interact if there is to be any meaningful discussion.

Focus groups if run successfully can provide multiple viewpoints or responses on a specific topic or issue. They are efficient as multiple responses can be obtained through focus groups in a shorter period of time than performing individual interview with each participant. Based on the experience of other participants other trends or discussions may result and the researcher can observe the interaction between participants. During the focus group meetings, multiple viewpoints were expressed that assisted in refining the model.

Krueger (1988 p 44) suggest that focus groups have several advantages, including:

- That the technique is a social event, where people speak about real life events.
- They are flexible;
- The people attending the focus group are usually experts or knowledgeable in their field so the results are excepted, i.e. it has a high face value;

- Results are known usually at the end of the focus group. The results are timely; and

- They are cheap when compared to other data gathering techniques. This is closely linked to being timely as the focus group meets, talks information received/delivered and consensus reached (summary/conclusion/answer).

The disadvantages of focus groups relate to the potential constraints that a group setting can place on individual's responses, especially when dealing with peers. The facilitator must also be highly skilled in managing a group interview and have experience running such activities. The facilitator must have skills in group dynamics and interviewing techniques to ensure the success of the group.

Krueger (1988 p 44) also suggest that focus groups like all information gathering techniques have limitations that affect the quality of the results. These are:

- Focus groups afford the researcher less control than individual interviews;

- Data are difficult to analyse;

- Facilitators require special skills;

- Differences between groups can be troublesome;

- Groups are difficult to assemble; and

- The discussion must be conducted in a conducive environment.

Focus groups present another face of reality in that open-ended questions allow the participants to select the manner in which they respond. Focus groups encourage interaction among the respondents and allow people to change their opinions after discussion with others (Krueger, 1988 p 108).

Focus groups as a qualitative research tool, provide a subjective, but not statistically valid, understanding of the larger community's attitudes and is a formal method of interviewing a group of people/participants on a topic of interest (Krueger, 1988).

The focus group was selected as an information gathering mechanism because unlike other quantitative research, focus groups are centrally concerned with understanding attitudes rather than measuring them (Krueger, 1988). The goal of the focus group created for this research was to gain access to feelings and emotions, by putting together a group of domain experts, new CSFs may emerge or existing ones be confirmed, i.e. They *all* may know a specific factor but as *individuals* this factor appears insignificant or not relevant. In this research context, focus group research is a direct, sensitive, and interactive method of assessing expert opinion, accomplishing what individual interviews cannot. It allows approaches, attitudes and priorities to be creatively recorded by allowing respondents to talk freely and to choose CSFs significant to them.

Focus groups are not uncommon in other qualitative research, and are suited to grounded theory (Mingers, 2002). So are informal conversation, group feedback analysis, or any other individual or group activity which yields data (Dick, 2004). The same principles used for individual interviews also apply for interviews with focus group participants. These interviews used open-ended questions and focussed on listening and learning from the responses to the questions.

During Stage 2 of the research, semi-structured, open-ended questions based upon the amended model from DeLone and McLean with Wixom and Watson derivations as well as operations management literature were directed to the focus group. These questions allow interviewees to answer from a range of dimensions allowing for diverse rich answers (Krueger, 1988). The advanced planning and design of these questions is to reach the goal of extracting the maximum response from all participants during the meeting. The aim was to not have to reinterview. This was successful as no follow up interviews were required.

Stewart and Shamdasani (1990) suggest that questions for the interview sessions that include words such as how, why, what and when, imply to participants that the researcher is interested in not only their views but are inviting a degree of complexity by allowing for a flexible response. Kreuger (1988) argues that the “why” question should be used rarely in a

focus group as this may force participants to provide answers that seem appropriate to the situation and justify their position. Kreuger states that these answers are really just quick responses with no real thought and may be even irrational. Kreuger also suggests that dichotomous questions (a simple yes and no answer) should also not be used and should be treated with caution as they tend to elicit ambiguous responses (p.61).

Figure 15 in chapter 4, contains a list of the questions used during the focus group and a number of questions are based on advice from Kreuger (1988). He suggests that a focused interview should include less than ten questions with the aim for it to be really only five or six. This is supported by Stewart and Shamdasani (1990) who suggest that most interviews should consist of less than twelve questions. Six questions allow approximately 20 minutes discussion per question during the two hours allocated to the focus group meeting.

> "Focus groups are best conducted with participants who are similar to each other, and this homogeneity is reinforced in the introduction to the group discussion. The rule for selecting focus group participants is commonality, not diversity. Care must be exercised to be alert to subtle distinctions that are not apparent to the researcher such as social status, educational level, occupational status, income, and so on." (Krueger, 1988, p.26)

The composition of the focus group participants are industry experts in APMS, having been involved as either system architects, developers (service providers), analytical analysts or business managers (users) and vendors. Invitations were made to business groups, software providers and industry consultants experienced in the field of APMS. The invitations excluded those people involved in the case study organisation. The candidate case study organisation is discussed in the following section.

Some of these products and associated organisations (service providers, users and vendors) are known to the researcher due to his experience and interest in APMS.

The focus group questions were developed based on items selected from existing literature (DeLone & McLean, 1992; DeLone & McLean, 2002; Garrity & Sanders, 1998; Wixom and Watson, 2001). Specifically the

questions deal with organisational constructs, system and information quality, use and project implementation success.

Case Study

As already stated, the use of a case study was selected as a method of data collection within the grounded theory method. The case study in this research study is used as a technique for data capture. This approach is consistent with the grounded theory methodology where Strauss (1987) highlights the value of the case study approach when used in conjunction with grounded theory. Grounded theory seeks to generate theoretical assertions which lead to hypotheses based on the gathered evidence. These hypotheses may lead to different theories with different levels of complexity based on the data from the case study, i.e. the theory may be case dependent and only relevant for that case. The research approach used only one case study at the end of data collection phase, and was intended principally as a model validation mechanism, although using the grounded theory method of qualitative data analysis, new data may spawn new theory. In fact during the case study phase this did occur. It is described more fully in Chapter 5.

The case study (Gomm et al., 2002; Leenders & Erskine, 1978; Yin, 1989) was selected as it allows for evaluation and reflection of the model produced from the focus group. It helps explain how and why situations occur while putting the results from the focus group into a real context. This is an accepted approach and provides a rigorous basis for the refinement of any assertions that are formulated (Yin, 1989). Walsham (Walsham, 1995) considered Yin's position to be positivist whereas Walsham put forward an interpretive approach to case study method. Walsham did agree however that Yin's approach emphasised the "how" and "why" questions and this also supports the interpretive research approach proposed.

Glaser (1998 pp. 40-42) states that utmost care must be taken when combining methods like case study and grounded theory. For example Yin states:

> "theory development prior to the collection of any case study data is an essential step in doing case studies." (Yin, 1994, p.28)

This statement though valid for case study research, is in breach of a key principle of grounded theory, i.e., iterative theory development. To be clear, the case study is only being used as a data collection method, i.e. one unit of the final analysis.

An organisation agreed to participate in the research study and although happy to be involved in this research, does not wish to be publicly identified. The organisation is a large corporate body that attempted to implement an automated performance measurement system some years ago. Numerous attempts were made to make it work, but with mixed success. In recent years another attempt has been made and this result is discussed in depth within the case study chapter (Chapter 5), while reflecting on the lessons learned from the previous attempts.

Data was obtained from formal interviews, numerous documentary sources, and many informal discussions with some of the participants of the case. Semi-structured interviews were conducted with all the key players in the APMS project. The aim was to interview as many different people who had different roles in the later project, although some had also participated in the previous attempts. The roles ranged from the project sponsor (who reported directly to the Chief Executive Officer (CEO)), the project manager, process owners and members of the core APMS team as well as users of the system (both complex and simple).

Details of how confidentiality was maintained for participants and organisations involved in this research are contained in the ethics section at the end of this chapter.

Limitations

There are a number of limitations to this research. These are:

- Transferability,
- Generalisability,
- Personal bias, and
- Realist review.

These are described further below, although other limitations may occur. Additional quality criteria is described after these limitations which were used to assist in quality control.

Transferability

There are limits as to what can be published because of the sheer nature of knowledge. Not everything can be made explicit and often the context of the data, necessary for reasonable interpretation, is missing. Transferability of these results therefore can be affected.

Transferability is a process performed by readers of research. When reading, people try and take specifics of the research situation and compare them to the specifics of an environment or situation with which they are familiar and draw their own conclusions. If there are enough similarities between the two situations, readers may be able to infer that the results of the research would be the same or similar in their own situation and try and envisage the results in their own context - the “transfer”. To discourage mismatching between contexts, the researcher documented as much as possible about the research method and environment, the case study and focus group participants in order to allow the reader to determine whether it is similar to their own experience. This was done while keeping identities confidential.

Generalisability

Another limitation of the research is related to the generalisability of the research.

Generalisability is applied by researchers (in an academic setting) and can be defined as the extension of research findings and conclusions from a study conducted on a sample population to the population at large (Gomm et al., 2002). Although it is intended to utilise industry experts to form a focus group, these experts are based in Perth, Western Australia, with only a few having experience outside of this location. The sample therefore is not representative of a larger global sample. The findings of this local, specific study are not generalisable to other samples and contexts, but

the results are available to anyone who wishes to read, understand and use them as they see fit.

Personal Bias

Another limitation is the personal bias of the researcher due to the involvement in other technical projects of this nature. By utilising a data collection approach of focus groups and a case study organisation, continual objective refinement of the model will occur. By keeping a journal of activities and experiences, these records will then be a reflection that will allow the interpretation of results. The journal will also provide an audit mechanism to allow review and identify differences or ambiguities to either describe or resolve the issue identified. This journal contains records of key events, dates and people, an interpretive, self - evaluative account of the researcher's personal experiences and thoughts (good and bad), that should lead to a reflective account of the issues and actions.

Realist Review

Realist review, while selected as the epistemology for the study, does however have a number of limitations:

- It is not an easy foundation on which to build in that it recognises complexity in social research and requires a pluralist and innovative development process. It is an approach that requires experience, both in research and in subject matter. As Pawson et al. (2004) suggest, realist review is not for the novice.

- The research generated cannot be taken to be reproducible and has therefore limited generalisability. Expressed differently, this is an honest recognition of the fact that social systems, whilst they contain real structures, are in fact open-ended and informed with individual agency and situational specificity.

- Research based around critical realism cannot provide easy answers, as much as users or researchers would like this to be the case. Conclusions reached are always provisional, fallible, incomplete and extendable and rely upon the reader to draw conclusions about transferability and reuse.

Data Analysis

The researcher might find an unanticipated big idea that provides insight into how the consumer views the product or service. Big

ideas emerge from an accumulation of evidence the words used, the body language, the intensity of comments—rather than from isolated comments. Look for the big ideas not only in the responses to key questions but throughout the discussion (Krueger, 1988, p.116).

As stated this study has critical realist elements as well as being interpretive through the use of grounded theory method. This qualitative approach does have limitations. They are:

- The analysis took time to do (Klein & Myers, 1999). One year was set aside for the collection and analysis of data. This was considered enough time where data collection took 4-6 months of this time. Due to the iterative approach, each stage had a separate data collection and analysis component.

- The focus group as a data collection method may present a version of the world that is not real. Open-ended questions allow the participants to select the manner in which they respond and focus groups by their nature encourage interaction. This allows participants to change their opinions during the discussion with others, maybe due to peer pressure or just to be seen to agree. The complexity of focus group analysis will occur at different levels. This was from a vocabulary and content perspective. The researcher analyst needs to consider how to compare the different answers. Krueger (1988) suggest that analysis begins with a comparison of the words used in the answer. Various items need to be taken into account. These are discussed next.

Krueger (1988) suggests that the following items be taken into account while performing analysis on the data collected from the focus groups

- *Consider the words:* Both the actual words used by the participants and the meanings of those words. A variety of words and phrases were used and the researcher will determine the degree of similarity between these responses.

- *Consider the context:* Not only on the preceding discussion but also on the tone and intensity of the oral comment. The discussion transcript should assist the researcher in the analysis, but this written summary has an inherent limitation where the tone and inflection of the comment might be interpreted in one way but heard in another when read from the transcript.

- *Consider the internal consistency:* Participants in focus groups change and sometimes even reverse their positions after interaction with others.

- *Consider the specificity of responses:* Specific responses based on experiences was given more weight than responses that are vague and impersonal.

- *Find the big ideas.* The researcher can get so close to a multitude of comments and details that trends or ideas that cut across the entire discussion are missed. The trap of analysis is not seeing the big ideas. The intention was to summarise the focus groups critical IS success factors and rank them according to a priority or weighting system.

An area of concern early in the analysis process revolves around the analytical role of the researcher. A way of assisting in this role is to consider a continuum of analysis ranging from presentation of raw data to interpretation of data (Krueger, 1988). Grounded theory by its constant comparison to data and established theory will assist the researcher.

Hermeneutics can be considered to be either a social theory or a methodology. Klein and Myers (1999) refer to it as:

> ” A ‘bridgehead’ for making a contribution to interpretive research methodology.” (Klein & Myers, 1999, p.70)

As a methodology it is used to analyse the textual data obtained during qualitative research. It is primarily concerned with the meaning of text or a text-analogue. The meaning is obtained by a process of interpretation in which both the broader picture, as provided by the text as a whole, and the individual parts are constantly interacting and contribute to create a more accurate and complete understanding of the text. This interaction and mutual revision of meaning between the whole and the detail is known as the hermeneutic circle (Klein & Myers, 1999, p.71).

Hermeneutic theory can embrace meanings that originate from both positivist and interpretivist types of research. As such the principles of the hermeneutic circle (Klein & Myers, 1999) were adopted to negate the limitations stated above with the interpretive approach. The hermeneutic circle means that whatever is being interpreted both the parts and the whole must be considered. This research will utilise all six principles. These are:

- Contextualisation - finding meaning in the specified context or the object of study in context. This was implemented by placing a domain around the meaning of 'performance measurement systems'.

- Interaction between the researcher and the subjects - requires the researcher to place himself or herself and the subjects into a historical perspective and therefore the researcher interprets for the research participants. By utilising focus groups, the intention is to minimise the positivist limitation of ignoring the past and refining the model using the research participants as experts. Case study participants refined the model further by confirming or modifying the success criteria. All communication was formally recorded and interviews (group and individual) were recorded and transcribed.

- Abstraction and generalisation – research information collected is interpreted and compared to theoretical, general concepts that describe the nature of human understanding and social action. By utilising the literature from different fields and utilising the research results, success criteria was extracted and the results generalised. The same occurred for the focus group and the case study cycles.

- Dialogical reasoning - requires sensitivity to possible contradictions between the published theory and actual findings with subsequent revision. The approach described in this section indicates many review points after each data collection stage.

- Multiple interpretations - requires sensitivity to possible differences in interpretations among the participants. By utilising a focus group, one expects group consensus to be applied and therefore restrict the amount of misconception that would apply if individual interviews are conducted. Where individual interviews occur, transcripts of the conversations are available to the participants to correct or provide further information as required.

- Suspicion: - requires understanding that research participants have biases and may put forward distortions (positive and negative) during the research gathering. To overcome these biases it was necessary to stand back from the results and critically analyse them by challenging and maybe even look for results that were not presented and test during the case study to confirm they do not exist.

Research Quality

"Applying Grounded Theory to case study was very successful. It produced a prolific amount and yielded a great richness of information. … The case settings, furthermore, contained more varied data than could be expected from individual, purely homocentric studies. Efficiency and abundance combined to make this method an exceedingly fruitful one." (Lehmann, 2001, p.87, cited in Fernández, 2004, p.43)

While hermeneutic theory was utilised to negate the limitations during the data collection and analysis stages of the research, additional quality criteria was used as an overarching control of the total research to provide triangulation. Triangulation is a method of strengthening the worthiness of research findings by use of multiple theoretical frameworks and sources of data. The quality criteria to be used during the project are:

- Construct validity: enhanced by establishing clearly specified operational procedures during the conceptual categories development stage (Pandit 1996, p.2). This was done during the literature review and was based in the success factors for the various models but was reviewed and updated due to the iterative nature of the method.

- Internal validity: establishing causal relationships whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships (Pandit 1996, p.2). In this sense, internal validity addresses the credibility or "truth value" of the study's findings. An example of the approach taken is illustrated in Chapter Two, Figure 9. The relationships between literature from different disciplines and the associated grouping were iterative.

- External validity: requires establishing clearly the domain to which the study's findings can be generalised (Pandit 1996, p.2). As already stated in the section on the limitations, the specific research subjects are local and may not be generalisable to other samples and contexts. The results are available to anyone who wishes to read, understand and use them as they see fit, but they are not generalisable.

- Reliability: demonstrating that the process of the research study can be repeated with the same results, .e.g. such the data collection procedures (Pandit 1996, p.2).

In this research study the ongoing iterative approach of building a model by first using the literature, conducting the focus group and then confirming and refining the results once again within a case situation reinforces the integrity of the research results. This was done while continually reviewing the literature. This approach meets the principal goal of triangulation which is to strengthen the data analysis through enhanced confirmation and completeness.

Ethics

Ethics approval was required for both the focus group sessions and access to case documentation and employees.

Permission was received to undertake research involving human subjects (Edith Cowan University, 2005) in December 2005. Attachment One and Two contain the template letters and consent forms for the focus group and case study participants (Edith Cowan University, 2005; The University of Newcastle, 2005).

Confidentiality of the participants and their respective organisations was strictly upheld and will continue post this research project. All names, places and dates have been altered in order to achieve this commitment.

The author requested and was given access to “primary” sources of data in the form of reports (both internal and external), documentation available via the intranet as well as project historical documentation in the form of project status reports, minutes and memorandums. These primary sources were also used in the research with structured interviews along with questionnaires during the interviews with the case study organisation representatives as well as the focus group participants. Although important, these proved to be no more than secondary sources during the research phase.

The names of individuals, companies and system acronyms have been changed as the research subjects, although happy to be involved in this research, do not wish to be publicly identified. This is in accordance with the underlying ethical stance, which is, following Schopenhauer (1966) to minimise harm, and following Habermas (1979; 1984), to minimise misconceptions.

Signed focus group participant and case study interviewee consent forms have been kept for filing and will be destroyed after the examination of this report has been completed.

Compliance with the approved research protocol was maintained with an Ethics Report Form submitted at the conclusion of the research data gathering phase.

Conclusion

This chapter described the methodology and underlying philosophical perspectives that have been used in this research. It explained the philosophical stance taken during the research, describing interpretive research and the underlying epistemology, critical realism and the research ontology. The method was explained through examination and discussion of the possible approaches and explains why grounded theory was to be used as the research method, and focus groups and a case study were used for data collection.

Perhaps the greatest benefit of adopting a critical realist underlabouring is the emphasis on deep understandings and context. The emphasis throughout the study has been to try and understand why particular APMS implementations succeed whereas others did not. The underlying contextual emphasis is always on “what works for whom in what circumstance” (Dobson et al., 2007, p.152).

The next chapter reports on the first set of field data from a focus group through data analysis and the presentation of a model. Firstly, the focus group paradigm is explained while detailing the research procedures used during this phase. Reasons for using the focus group, it’s composition and difficulties are discussed, as well as ethical considerations and biases that were identified. It provides insights from the focus group participants’ specific expertise and extensive industry related experience culminating in an analysis of the data and an updated model which is used in the subsequent case study (Chapter 5).

CHAPTER 4
FOCUS GROUPS

The previous chapter described the methodology and underlying philosophical perspectives that have been used in this research. It described interpretive research and the underlying epistemology, critical realism and the research ontology. The method was explained and why grounded theory was to be used as the research method and focus groups and a case study were used for data collection.

> *"…It was everything, the whole thing....because that's how it was in the old days with gold mining. You dug a hole, you drilled, you blasted it. And hopefully at the end of the day you made more money than what it cost"* – A focus group participant answering a question on what their APMS project scope was.

The process followed to this point in the research has defined the problem and confirmed the scope. The research aims to discover CSFs for implementing an APMS and these will be uncovered through in depth, qualitative, observation combined with grounded theory these CSFs will be uncovered.

This chapter reports on the first set of field data from a focus group through data analysis and presents a model (Model 1). The focus group paradigm is explained while specifying the research procedures used during this phase. Reasons for using the focus group, it's composition and difficulties are also discussed as well as ethical considerations and biases that were identified.

The focus group phase collects the first set of field data from domain experts through the creation of a focus group and gains insights into the subject areas through the participant's specific expertise and extensive industry related experience. This chapter documents the process followed and the results derived.

Introduction to the Focus Group

As previously stated in Chapter 3, the focus group is the first stage of the data collection process. It is unlike other qualitative research collection techniques such as interview or recording observations as the use of focus groups is predominately concerned with understanding attitudes rather than measuring them (Krueger, 1988). The focus group therefore gives access to feelings and emotions that comes from putting together a group of domain experts. Usually focus groups are representative samples and not experts (e.g. for toothpaste evaluation or review of government policies). For this method the researcher has used experts. Although unusual, this is consistent with the underlying epistemology and ontology of critical realism.

Focus group interviews first appeared in the 1930s when researchers began investigating the value of nondirective individual interviewing as an improved source of information. They held doubts about the accuracy of traditional information gathering methods. Specifically they were concerned with the excessive influence of the interviewer and the limitations of predetermined, closed-ended questions (Krueger, 1988). Rice expressed concern in 1931, stating that "a defect of the interview for the purposes of fact-finding in scientific research, then, is that the questioner takes the lead...data obtained from an interview are likely to embody the preconceived ideas of the interviewer as the attitude of the subject interviewed" (Rice, 1931, p.561 cited in Krueger, 1988, p.18). This led to a more non-directive approach to interviewing where the emphasis was shifted from the interviewer to the interviewee. The focus group interview appears to have had its origins in the evaluation of audience response to radio programs in 1941 by Robert Merton, where he applied this technique to the analysis of army training and morale films during World War II (Merton, Fiske & Kendal, 1990, cited in Lewis, 1999).

As stated in Chapter 3, focus groups have limitations that can affect the quality of the result, e.g. less control on the interview process, getting people to turn up and the data is difficult to analyse due to the group

interview (Krueger, 1988, p.44). To minimise the potential effects of this lack of control the following considerations were taken into account:

- Both actual words and the phrases used in the interview were taken into account during the analysis. This enabled the researcher to determine the degree of similarity between responses.

- The context, tone and intensity were considered by listening to the digital recording to remove ambiguity. A time stamp was included in the transcripts for this purpose. The transcript did have inherent limitations as the tone and inflection of some comments may have been interpreted in one way when heard but may have been interpreted in another when written down, e.g. "*And then they drove it"* was about the sponsor and business managers driving home the need and benefits of using an APMS and not driving a vehicle. In these cases the context of the surrounding discussion assisted in understanding what was meant by the participant.

- A specific response based on experience was given more weight than a response that was vague and impersonal, e.g. hearsay "I have heard…".

- The discussion was conducted in a conducive environment.

As only one reference group meeting took place there was no mechanism for participants to change their minds or retract their point of view and within the meeting, participants points of view were consistent.

A planned outcome of the meeting was to summarise the focus groups critical IS success factors and rank them according to a priority or weighting system. This did not occur as the focus group determined that they were all as equally important as each other, although two new factors were identified. These factors are discussed later in the 'Unexpected results' section of this Chapter.

The objective for the focus group was to:

- Confirm the suitability of the Wixom and Watson (2001) Success model for implementing APMS and if not, what factor would they add, exclude or modify.

The Wixom and Watson data warehousing success model had specific factors. These are listed in Table 3, below and are derived from Figure 8 in Chapter 2.

Table 3. Wixom and Watson (2001) Success Factors

Factor type	Success Factor
Implementation	Management support
	Champion
	Resources
	User participation
	Team skills
	Source systems
	Development technology
System	Data quality
	System quality
	Perceived net benefits

Focus Group Process

The research steps taken in this phase were:

1. Prepare a set of questions to promote discussion (Figure 15).
2. Prepare a list of possible focus group participants and invite them to participate.
3. Hold the focus group meeting by:
    a. Asking participants to read an Information Letter and for each to sign a consent form (blank copies can be found in Attachment One);
    b. Distributing the questions (Figure 15) and circulating two models for reference during the discussion, Figure 8 and Figure 9.
    c. Digitally record the discussion; and
    d. Thank participants for their involvement.
1. Transcribe the results.
2. Circulate the transcription to the participants to identify errors or omissions.
3. Correct the transcriptions
4. Analyse the data.
5. Analyse abnormal results with the literature to seek some confirmation/clarification.

6. Propose a modified model for the case study.

Each of these steps is described in more detail in the following sections although this differed from the plan. Originally there was a step between 7 and 8 that was to reengage the focus group participants if further clarification was required. This did not occur.

Questions to promote discussion

During this stage of the research (stage 2), semi-structured, open-ended questions (Krueger, 1988, p.62; Stewart & Shamdasani, 1990, p.65), based upon the amended model from DeLone and McLean (with Wixom and Watson derivations) as well as operations management literature, were directed to the focus group. These are listed in Figure 15 below.

When formulating the questions for the interview guide the following principles were considered. The questions started with being general in nature and moved to being more specific while questions considered to be of greater importance were asked earlier (Stewart & Shamdasani, 1990, p.61). The number of questions was limited to six as recommended in the literature (Krueger, 1988; Stewart & Shamdasani, 1990).

Focus Group Discussion Questions

1. How does the organisational structure affect success of the automated performance measurement system?
2. Were there any technical issues with the application that affected the success of the system?
3. How did information quality affect the introduction and acceptance of the system?
4. What factors made the system more useable?
5. What did you do that you would do again during the project and what things would you not do again that impacted on the success of the implementation?
6. What recommendations would you make that would enhance the success of an automated performance measurement system?

Figure 15. Questions circulated to the focus group.

These semi-structured, open-ended questions allowed interviewees to answer from a range of dimensions. The aim was not have to have to reinterview. This was successful and no follow up interviews occurred.

As listed above, the models from Chapter 2 were also distributed. The participants were asked to use the two models as guides and not to be limited to these illustrations. The models were used as method and participants were encouraged to use similar language and phrases as in the models. This approach was successful and the models from Chapter 2 are:

- The research model for data warehousing success (Figure 8, p.60); and

- A model of the literature relationship of potential factors that may lead to APMS success. (Figure 9, p.64).

Focus Group Composition

Focus groups encourage interaction among the respondents and allow people to change their opinions after discussion with others (Krueger, 1988 p 108).

Focus groups as a qualitative research tool, provide a rich and informative, but not statistically valid, understanding of the larger community's attitudes and is a formal method of interviewing a group of people/participants on a topic of interest (Krueger, 1988).

The people invited to participate in the focus group were experts in constructing, designing and implementing business warehousing, data warehousing, ERP implementations and financial forecasting and analysis systems. The participants were also involved in SCM and CRM systems as well as a wealth of other system implementations, including process control and Supervisory and Control and Data Acquisition (SCADA).

In total eight people were invited and four of these attended. Two could not attend due to other commitments on the day of the focus group meeting and the other two did not respond at all. (This was consistent with the problem identified with focus groups reported by Krueger (1988, p.44).) Four of the participants were directly known to the researcher who had previously worked with these people. One of the participants, who could not attend, suggested a substitute the day before the meeting. This person attended the meeting and so the total number of focus group participants was five.

Two other people heard about the group and asked to participate. Their kind offer was rejected as they currently work for, and therefore represent, software vendors who sell components of APMS. Their involvement was felt by the researcher to be a risk and may have introduced a bias in favour of these products. (In hindsight, it could have been argued that they had another side to the story, i.e. customer incompetence, lack of funds, couldn't define their business requirements or no sponsor management involvement to name a few.)

By coincidence all of the participants have been active in SAP's Business Warehouse (BW) area in the last five years. These systems were large and took data feeds from all types of other systems to automatically produce automated performance measures. The participants have managed APMS' for the following types of companies which all have SAP R3 as a common ERP system and have also worked on other ERP systems and APMS components (e.g. Oracle, JD Edwards, Business Objects and SAS), to name a few. Table 4 below describes the firms within which the participants had conducted APMS implementation projects.

Table 4. Profile of focus group companies

Company Description	Type of company	Number of employees (includes contractors)	Region
Large Energy Commodity Supplier	S&P/ASX 200	> 5,000	Australia
Resource Commodity Supplier	S&P/ASX 200	> 5,000	Australia
Oil and Gas Supplier	Fortune 500 company	> 1,000	Global
Large Commodity Supplier	Fortune 500 company	> 5,000	South America
Oil and Gas & Petrochemical Supplier	Fortune 500 company	> 50,000	Global
Resource Commodity Supplier	S&P/ASX 200	> 5,000	Australia
Oil and Gas Supplier	Fortune 500 company	>20,000	Global
Large Utility	Government body	> 2,000	Australia
Heavy Minerals Supplier	ASX 100	> 1,500	Australia
Oil and Gas Supplier	S&P/ASX 200	>2,500	Australia

The participants have performed many roles as indicated in Table 5 below, which demonstrates a high level of experience and exposure to multiple roles when implementing an APMS. The other important aspect is that each participant had experience in more than one role and for each role there was more than one person. This gave a balance view as the experience in the roles came from different customer implementations.

Table 5. Profile of focus group participants

APMS Role	Focus group participant code					
	JB	JBE	JM	JR	VL	R*
Program Director and or Program Manager		Yes				Yes
Project Manager		Yes		Yes		Yes
Change and or Implementation Team Lead			Yes	Yes	Yes	
Technical Team Lead and or Developer	Yes			Yes	Yes	
Finance Functional expert (System accountant)	Yes		Yes		Yes	
Training and End user Documentation			Yes	Yes		
End User	Yes	Yes	Yes	Yes	Yes	Yes

R* - the researcher

Their collective range of expertise ranged from 3 to 18 years in duration in the fields of information system design, construction, implementation and support. This represents a collected mass of 110 plus years of IT experience and 22 years of APMS implementation.

The Focus Group Meeting

The focus group meeting was held in a specially booked board room, from 4:00pm to 6:30pm, 13 December 2005. A white board and butchers paper was also available to help promote discussion and for participates to explain. The discussion was conducted in a conducive environment (Krueger, 1988, p.44) and on conclusion participants were thanked for their involvement and were advised that they would be asked to review the transcript of the meeting.

After introducing themselves, reading the focus group information letter and signing the focus group consent form, the meeting commenced.

A digital tape recorder was used for the focus group discussions and was visible throughout the meeting to the participants, who all agreed to the recording. No specific protocol was discussed although the researcher asked that each person only speak when no one else was and to refrain from interjecting. The researcher facilitated the meeting.

No specific notes were taken except on the handouts and some annotations were made on the models by the researcher. This allowed for clarification if the recording proved unclear. A recording test was taken and no problems were encountered.

The discussion was informal and provided a wealth of information. Each of the participants was friendly and courteous during the discussion.

The transcripts were produced after the meeting and circulated to the participants. This was an opportunity to review the dictation and provide feedback. All of the participants responded on their respective items where simple transcription mistakes had been made. The focus group participants were responsive and very professional.

Focus Group Data Analysis

No follow up was required with the focus group participants and it was not necessary to seek clarification from the focus group participants during the analysis of the data.

The data analysis was purely focussed on the data from the discussion of the focus group participants. This analysis looked for material, concepts, social and psychological structures to analyse why things are as they are and to hypothesise the structures and mechanisms that shape the reported events, i.e. the CSFs. This is line with Mingers (2002, p.302). Examples with respect to the research are:

- Material, “or objects of human need” (Jones, 2003, p.37) – software (e.g. SAP ERP, Business Warehouse), operating and training material and Resources (dollars and people);

- Concepts – data accuracy and frequency as a construct for evaluating data quality as a CSF, screen design and response time for evaluating system quality as a CSF;

- Social – organisational structures and management support as constructs for evaluating management support and user participation as CSFs; and

- Psychological – quality of training and team skills as constructs for evaluating resources, system quality and team skills as CSFs.

Some of these of course could be grouped in more than one structure, for example timeliness could be argued as a concept or part of a psychological structure.

To assist in this process, conceptualisation was used during the analysis of the research data (Corbin & Strauss, 1998).

The transcripts were reviewed to directly identify discussion with regard to the success factors identified in the Wixom and Watson success model. Each factor or variable was used as a primary category for the analysis (Corbin & Strauss, 1998, p7). Due to the large amount of data, a category was first assigned - a raw or "first impression" code. This assisted in the alignment to a Wixom and Watson success factor and assisted in the writing up of the results as it linked similar concepts together within a success factor group. The grouping assisted when analysing the data and allowed a form of drill down into the conversation.

In some cases the alignment to the Wixom and Watson factor was obvious and for others it was not possible. These difficult areas were initially categorised as 'Unexpected results' and are discussed later in this chapter. The focus group discussion relating to the Wixom and Watson success factors are discussed first.

A sample from the completed data analysis sheet is contained in Appendix 1.

To allow traceability of the results, quotations included in the data analysis below have the focus group participant unique identifier and a transcript reference. The unique identifier complies with the requirement to maintain the interviewee's anonymity and the transcript reference allows for identification of the quote source and sequencing in the transcript. This process, adapted from grounded theory (Corbin & Strauss, 1998), helped the researcher identify quickly where the quote came from in the conversation and allowed for the quote to be interpreted in the context of the surrounding conversation if the quote was unclear or subject to misinterpretation. It also helped in tracing data analysis and coding errors (that did occur and were hence easier to rectify).

Wixom and Watson (2001) success factors

The analysis of the data is presented below. It is in direct reference to the Research Model for Data Warehousing Success (Wixom and Watson,

2001) as illustrated in Figure 8, p.60 and Table 3, p.123. Each factor is taken in turn and analysed to see if the focus group supported the factor or not.

Management Support

Management support is defined by Wixom and Watson (2001) as 'widespread sponsorship for a project across the management team' and was identified by them as one of the most important factors for data warehousing success (p.23).

The focus group agreed that management support was a factor for success of APMS and was confirmed on a number of occasions:

> *"If the upper managers are not supporting the project or the concepts then it very hard for even the people willing at the bottom to take hold and run with it."* *FG: JR Ref FG#38*

Further, the general consensus within the focus group was that management support had to come from the top to achieve success.

Management support ensured that the system had validity and was sanctioned. The fact that the data was reliable and came from a single source meant that the whole management team were prepared to accept and therefore legitimate the reports. This was indicated by:

> *"People come into a meeting with six different versions of a report and as it's not authorised you couldn't believe the data in it. With one single repository, you can all come with the one report."* *FG: JR Ref FG#25*

The requirement for executives to have unfettered access to a consistent set of organisational data was one of the reasons that management support occurred. The task of data-driven management decision making is very difficult if there are conflicting sets of data and reports. Management require access that is free from restrictions or bonds as data can be manipulated with no method to trace what had occurred or how it may have been changed. When there is no defined source of the truth, various positions are presented with no one clear on what set of data to depend on. As one participant stated:

"Well ours is definitely top down. We had a Chief Financial Officer (CFO) that just went "this crap we have to get in one system and you know that's when the decision for SAP was made and also BW. And it was…He said we want one system, one reporting system and everyone is going to be held accountable. And whacked it in and then there was buy-in from the top. It has been driven from the top." *FG: JM Ref FG#24*

Management buy-in is typical of the close relationship that exists between management and the sponsor. A sponsor is a senior manager responsible for the overall success of the project or initiative. A sponsor may be a champion but a champion may not necessarily be management. The relationship between a sponsor and champion is discussed at the end of the next section.

Champion

A champion is defined as a person in the organisation who "actively supports and promotes the project and provides information, material resources, and political support" (Wixom and Watson, 2001, p.23). Participants saw the role of a champion as important because:

"it's the person that's driving. That because he's a powerful person and you can see who he is. Where as in your organisation JR, was that more to do with the person himself because he was a strong Character?" *FG: JM Ref FG#9* *"He was a very strong character and I suppose he believed in it…"* *FG: JM Ref FG#10*

The champion role is important because the level of authority of the champion and the organisational structure in which they operate determines success. The personal attributes (e.g. loyalty, commitment, honesty and integrity, enthusiasm, reliability, personal presentation, common sense, positive self esteem, sense of humour, balanced attitude , to work and home life, ability to deal with pressure, motivation and adaptability) of a champion is another aspect of the person themselves, as indicated by the "strong character" comment. The ability of the champion to influence different parts of the organisation is also a very important aspect, as indicated by another comment:

> *"I mean certainly from an organisational structure there's a system of going into the needs, and that it really has a strong champion in the organisation, it has a project steering group and a well funded project so it really needs to have that support within the organisation."* *FG: JB Ref FG#2*

The champion for an APMS implementation is looked to for "overcoming indifference or resistance that the new idea may provoke in an organisation" and "do not necessarily need to be a powerful person within the organisation" (Rogers, 2003, cited in Liptrott, 2006, p.75). The consensus of why a champion is important was best summarised by this comment:

> *"I think what we all agree that you need someone to take ownership and drive it - at the end of the day it's all levels of that organisations structure that can make it work and be a success. Because at every level be it the operator, or a shift supervisor or manager or whatever right up to the president of the company it all has an impact on the overall success of the project."* *FG: JR. Ref FG#28*

With respect to how lack of a champion can cause these projects to fail:

> *"I think part of the reason some of these fail is not the sponsorship at the top, the initiative is not really embedded. Two factors, it's the fact that the person changed and the person who was driving it is gone and the person who comes in quite often doesn't feel the need to drive it. It also exposes a weakness in the approach in that too often these types of systems don't really start from a corporate need and start from an individuals drive so they lack that sort of corporate governance."* *FG: VL Ref FG#65*

As illustrated in the comment above, the participants sometimes got confused when discussing sponsorship and championship. (Sponsors and champions are discussed further below). In Beath's (1991) original champion definition, she stated that "Champions are managers who actively and vigorously promote their personal vision for using information technology, pushing the project over or around approval and implementation hurdles. They often risk their reputations in order to ensure the innovation's success." (p.355) The important point here is that "… they often risk their reputations …". A cynical view of a "champion" from one of

the participants is someone who themselves will be sanctioned or not rewarded if a performance target is not achieved. As stated:

> *"If someone not going to get their butt kicked over a number, their not going to champion it. That's one cynical view or If its not related to their performance, their pay packets? Their Remuneration!"* *FG: JM Ref FG#324*

While a champion can have very positive impacts on project success there is also the negative consequence when they leave. This is evidenced by:

> *"Yeah we have we've got all that so that the month end is pretty quick at the moment but that our major stakeholder's left as well . The guy that drives the whole lot. The new one who is coming through you know is a couple of guys and a spreadsheet kind of guy. So it's kind of lost momentum but it's still you know it's still all in place. You know it's all still being heavily used because it was all driven from that level. We're trying to get the board, the actual board to go onto an internet site. That was a, they were very internet resistant.* *FG: JM Ref FG#311*

In this example the term stakeholder was used instead of champion. This is discussed further later in this section.

A champion is important but if they are the cornerstone, the success is only champion dependent. The group discussed this at length and determined that *sustainability* was a key factor in success. Sustainability in this context is defined as the ongoing use and operation of an APMS as APMS take time to implement and bed down. Success is not just a short term circumstance but must be understood as being measured by the ongoing contribution of the system to organisational performance. This new factor is discussed later in the "Unexpected results" section of this chapter.

For a global organisation there is still a need for a champion. An example given was:

> *"From my experience. You have to be especially from a global sense, need a structure in place that allows buy-in at a zonal level. Obviously the vice president might be the highest, and he might be the key driver and the owner but if you can't get buy-in at a zonal level, and have the structure in place to align your goals and, your all trying to achieve the same, objectives. For instance, at 'The Global Oil and Gas Company' we had a US Zonal manager for Plant maintenance who was really pushing what he wanted. . He was sick of using all these other systems, he wanted to standardise across the whole twenty-(X) refineries so they had buy-in. They had a committee that drove standards in systems and then they got in buy –in at a refinery level. All the mangers had to buy-in and then they then had representatives from each area within plant maintenance. There was reliability maintenance, equipment integrity, turnaround and safety. Rather than one area, i.e. The USA or Europeans driving it, they tried, to push it out to all the industry that had buy-in across all the zones, and because they had buy-in levels they sat around a table and went through to standardised processes which then drove the KPI's. That helped rather than saying these are your KPI's. So I think that's important that you get buy-in across all levels, but it has to be driven, top down. The Vice President was the one who obviously took ownership initially."* FG: JR Ref FG#5

While the above participant statement appears long, it is rich in information as it supports the relatively rare to have global sponsor actively involved in identifying individual measures while also putting in place organisational structures to define and support the APMS. This global sponsor illustrates that success requires a person who is committed to overcoming indifference or resistance that the new idea may provoke in an organisation while understanding the detail with the business. The question is how many senior managers could actually deal in the detail of everyday plant maintenance and production? The researcher believes this is the exception rather than the rule, but could be achieved by ensuring structured standardised processes, which is evidenced in the participant statement. The instigation of a formal standards committee assisted in this process.

Global implementation of systems come with their own set of difficulties and challenges (Biehl, 2007; Garrity & Sanders, 1998) and APMS are no different to any other global implementation, but for a global business an APMS is one way of measuring consistent performance. Some participants came with the experience of implementing global systems and when there were international structures they appear to have been able to

cross borders, culture and time. In the quote above, one Vice President was the champion.

The other concept that was introduced during this discussion was that of a stakeholder or stakeholders as opposed to a champion(s), as raised previously. Stakeholders are defined according by the much-quoted Stanford Research Institute's (SRI) as "those groups without whose support the organisation would cease to exist" (SRI, 1963, cited in Donaldson & Preston, 1995p.72). Stakeholders in this context spread the load of a single champion and could be thought of as a collection (or gang) of champions. APMS in the main, are driven by both strategic and operational requirements and do have traditional stakeholders (e.g. operators, users, shareholders managers, board members), but in the focus group they seem to be the same and are often interchanged. They appear to be a form of user participation, but it is a guiding, leadership role, not participative. No further analysis of the stakeholder term is made in this focus group chapter because it came up only once. In the literature Seddon et al. (Seddon, Staples, Patnayakuni, & Bowtell, 1998) and Mendibil and Macbryde (2005) discuss the relationship between the stakeholders and success for IS as well as how a team performance measurement system requires stakeholder engagement for it to operate successfully in an operational environment. The relationship between champion and stakeholder will be analysed further during the case study review to determine if there is some form of association.

Discussed previously was management support and sponsorship. Sponsorship was raised as another construct for champion by DeLone and McLean in 2002 and this was confirmed by one focus group participant who interchanged sponsor with champion.

> *Suppose you can start of off with a silo type approach where you have a subject area champion or sponsor that knows instigates something that becomes a precedent for others to follow so they basically Finance typically first off the rank and then HR and then others.* *FG: VL Ref FG#40*

While the term “champion or sponsor” was stated, the context was in respect to a subject area or data subject area. Data warehousing literature also indicates that sponsorship is based around specific units (Counihan,

Finnegan, & Sammon, 2002, p.332). These units may well be subject areas, can be functional, organisational or data structures. This was confirmed in later conversation when another participant stated:

> *Yeah, you will have a sponsor for a subject area. For example OILAPMS had different sponsors for XXX and XXX* *FG: JBE Ref FG#187*

The same participant had previously made the point that when APMS fail it was not necessarily because of the sponsor.

> *I think part of the reason some of these fail is not the sponsorship at the top, the initiative is not really embedded.* *FG JBE Ref FG#63*

Sponsorship along with the other constructs, champion and stakeholder will be analysed further during the case study review.

Resources

Resources "include the money, people, and time that are required to successfully complete the project" (Ein-Dor and Segev, 1978 cited in Wixom and Watson, 2001, p.23). They are important to an APMS implementation as like data warehouses, APMS are expensive, time consuming, resource intensive undertakings, but as they are traditionally operationally mission critical, they tend to utilise more resources than if they were just a data warehouse initiative.

The focus group did not give any specific advice on resources as the project/organisations they had worked on/for had always provided adequate resources to complete the projects they had been involved in. The focus group agreed that if the project that implements an APMS is inadequately funded then the project will fail. In the organisations they had worked for, projects in the main would be either stopped soon after commencement or they just would not start. Project Management Office (PMO) procedures had ensured tollgate review and approval was required prior to the next phase proceeding. Further investigation of this review process or return of investment (ROI), or the business justification of an APMS, is not considered to be within the scope of this research and was not pursued in the focus group discussion.

Questions were raised however about the resources provided for ongoing operations and support of the system after implementation. This was evidenced by the comment:

> *"A lot of companies will spend money to get it in then they stop. There's no support, there's no review …"* *FG: JR Ref FG#340*

This rekindled the discussion on sustainability and raised the final comment before summarising and closing the meeting:

> *"That's where I think a lot of systems fail."* *FG Member JR Ref FG#342*

Comments regarding the ongoing operation and support of the systems they had implemented were also raised early in the meeting due to their importance. For example the fourth statement made was:

> *"I mean certainly on an ongoing basis they need to put into an organisation um a support group to, to certainly look after it. … The vital change in a business context changing would be to keep updating the measures so you meet that type of professional organisational structure behind it."* *FG: JB Ref FG#4*

And these continued throughout the meeting.

The focus group agreed that adequate resources were a necessary factor for the successful implementation of an APMS.

User participation

"User participation occurs when users are assigned project roles and tasks, which leads to a better communication of their needs and helps ensure that the system is implemented successfully" (Hartwick and Barki,1994, cited in Wixom and Watson, 2001, p.24). It is considered significant to the success of APMS because user participation can help manage user expectations and improve user acceptance. The participants discussion on user participation is best summarised by:

> *"What your saying is that technically it all works but if you don't get the business buy-in then it fails".* *Ref FG#319.* The response was a very positive *"Um"* *Ref FG#320.*

This statement is interesting as it contains the term “buy-in”. In management and decision making, the term “buy-in” signifies the commitment of interested or affected parties to a decision (often called stakeholders) to “buy in” to a decision or to agree to give it support. Other authors have determined that buy-in affects strategy planning in IS (Earl, 1993, p.24), ERP implementation (Willcocks & Sykes, 2000, p.34), implementing knowledge management (Alazmi & Zairi, 2003, p.201) and dealing with significant change throughout an organisation (Chrusciel & Field, 2006, p.504, p.508, p.512, p.514). The context for “buy-in” though is important as no definition of what is meant by “buy-in” has been found in the literature. The Concise Oxford dictionary refers to aspects of “buying in” to a business enterprise, where “buy” literally means purchase, which in this context is not considered appropriate. In the literature reviewed, the term “buy-in” has been used when referring to top management, line management, organisational, workers, staff, stakeholders and end-users. In the context of CSFs for APMS “buy-in” it is taken to mean by the researcher, as a perception of fairness and individual self gain which in turn is based on the humanistic and psychological interests of those involved.

User participation also depends on data quality and the results produced so that there is individual or group gain, esteem or the ability to do work better or easier, a reward. Users appear to be reluctant to get involved if the data quality is poor, as unreliable information is produced which may lead to some form of individual loss, censure or just make it harder to do ones work correctly. The catch-22 is that users need to be actively involved to fix or correct the data but may be reluctant to get involved if the data is incorrect, there is no self benefit or actually shows up the bad or uncompetitive processes they participate in. Users appear to believe that they did not have to get involved in this data cleansing process as they had their own internally controlled systems (e.g. spreadsheets or their own source application) as evidenced by the next quote.

> *“No, it didn’t have buy-in from the business. They had their excel spreadsheets, a lot of the time they would download the information to excel and massage the data how the wanted it presented. It has changed, but initially I’m talking early on.”* *FG: JR Ref FG#318*

But once an APMS system was embedded the position on spreadsheets changed as commented on by another member and how users and organisations matured and moved forward over time.

> *"I think back in the old days when people were comfortable with having their spreadsheet version of the truth. People were concerned how they have been made. The other factor affecting it, is that they want standardisation of those numbers based around ownership and globalisation".* *FG: JBE Ref FG#195*

The need for user engagement in APMS development and implementation was very dependent on the end user population. The subject area for APMS is typically the whole business and as such functional experts from the business where required to:

- Identify the source;
- Analyse the calculations and manipulation;
- Test the results; and
- Verify (or certify) the output.

Management buy-in and user participation also became blurred. This is evidenced by this quote where user participation was determined necessary by more senior management who diverted a functional expert onto some activities in the project.

> *"I mean something we need to talk about is having a functional expert but obviously you need someone to push that you have a resource (functional expert) that has credibility within the organisation across that discipline. An example is at BMC with plant maintenance KPI and plant maintenance expert, who has been in a number of site positions but is now looking at the performance of maintenance overall. He has been pushed from the executive level , ahh, having Director of Business Improvement running the project, resourced with this functional expert in maintenance um …basically he was able to resolve those issues and get consistency across sites. And …. in terms of the ongoing use of that I think one driver is that those functional experts get turned over as they don't necessarily like sitting in a role … that is across the business sometimes. I guess the ongoing availability of the functional expert is pretty important to the longevity of these things.* *FG: JB Ref FG#26*

The above quote is an example of where there is real need for continuity of expert functional resources which can only be attained by having management support. These functional experts are required due to the complexity of the APMS with respect to the performance measures (the data, the formulas and context, the time dimension and process) within where the system performs. The functional experts understand the complexity and determine the frameworks for relating functional or local performance measurement to overall business level performance or management as well as examining the interaction between an APMS and its internal and external environment (Myles, Dobson, & Jackson, 2007).

APMS to users appears to be a double edged sword. The system success was important as it gave them insights that they previously didn't understand or know about while it may also uncover or highlight issues caused by the expert users involved. The system has a form of 'reverse awareness'.

> *"Credibility amongst the organisation so it was a no brainer because that's what drove - whether the refinery was going to be there tomorrow, is largely based on this. How you perform. So everyone is very aware. It's a bit like safety KPI's or LTI's. If a mine isn't safety conscious you can loose the right to operate just purely on your safety performance."* *FG: JR Ref FG#34*

User participation in the system development was considered essential. This was evident is the design and testing process. During requirements gathering and design an iterative approach is considered important so the requirements are verified as design and construction takes place, as expressed by a participant:

> *"… if your not sort of taking an iterative approach during sort of the design phase even as early as the requirements phase so you can show people stuff, up front sometimes they won't conceptualise it until they can actually see it, and you get a lot more buy-in earlier with a prototype.* FG: JB Ref FG#199

Although this is no different to any other software development and testing was the same, as evidenced by:

> *So a really important factor was the extent of testing - user acceptance testing, was done because I know with the ' Global Commodity Company' maintenance area they pulled people into doing a whole lot of user acceptance testing and that is pretty key to getting the data to a quality that is I guess is acceptable. I kept moving on in terms of wanting greater detail and changes to the rules of KPI's and unless you get the get the functional experts in to do the testing, you get to the stage where they are not satisfied the data's right and so nobody's going to use the KPI's reported.* *FG: JB Ref FG104*

Whether defining the requirements, resolving business issues or ensuring data consistency, functional expert participation was considered very important.

> *"ahh, having Director of Business Improvement running the project, resourced with this functional expert in maintenance um …basically he was able to resolve those issues and get consistency across sites. And …. in terms of the ongoing use of that I think one driver is that those functional experts get turned over as they don't necessarily like sitting in a role ….. that is across the business sometimes. I guess the ongoing availability of the functional expert is pretty important to the longevity of these things."* FG: JB Ref FG#26

User participation was considered essential by the focus group for the successful implementation of an APMS but it was important that the users are backfilled in their role. The prolonged nature of an APMS project means that users are dragged back to their day to day jobs and cannot commit time to the implementation activities. The question of the amount of user participation was also discussed.

> *"I find with the business we have say ..120 people in the team we have 2 people from the business, and if you try and speak to the business they are all too busy trying to do their day to day jobs. So the thing I would recommend is if possible and this even happened at GOC as well, were people were taken out of the business once every month and sit around a table to identify the processes you have to get the business representatives on the team 100% because you'll never ever if you only get them piecemeal approach it never works. They got to be very knowledgeable but they also got be they can't do it as their normal day to day job."* FG: JR Ref FG#214

"Business buy-in" was used interchangeably when speaking about management support and user participation, as one participant put it:

> *So what's the thing out of that model? What, what do you think is missing? Is there any words that you can think of? Business, Buy-in!!! Yeah, Buy-in!!! Buy-in!!! Business By-in. Where's that?* FG: JR Ref FG#335

Team Skills

Team skills are important to an APMS implementation as "People are important when implementing a system and can directly affect its success or failure (Brooks 1975, cited in Wixom and Watson, 2001). In particular, the skills of a data warehousing development team had a major influence on the outcomes of a project (Barquin and Edelstein 1997, cited in Wixom and Watson, 2001).

Team skills include both technical and interpersonal abilities, and a team with strong technical and interpersonal skills is able to perform tasks well. The interpersonal skills are important as team members must work together to complete a task and must also work extensively with non members (Ancona and Caldwell, 1992, cited in Hacker & Lang, 2000, p.225).

It should be stated that there has to be some form of bias in the focus group as the participants are all highly skilled (and highly paid) resources. They would consider themselves and the team members they have worked with as equally skilled team members or "experts". That being stated, team skills were considered to very important by the focus group.

This is evidenced by the following conversation on team skills which confirms this as a focus group critical APMS success factor.

> *"We have major technical issues with being able to quality resources .. to be able . BW is a very sought after skill set at the moment and we have a lot of UM …technically detailed requirements ..UM …and the users get, they want to see things turned around really quick. They want to come and see us and report on KPI's. and all that and if your going to say oh it's going to take a month then they loose momentum because there trying to push to their bosses boss that we're pushing this thing out it's all happening. We are finding BW particularly inflexible as far as being able to turn things around quickly.* *FG: JM Ref FG#82*

Also technical resources being able to support what can become a reasonable complex system – AH ..being developed over 12 to 18 months while rolling in your technical support people have the ability to pick up what's in the system it can be complex, unless your documentation is really, really of a great standard. I guess it can lead to the downfall of the system. I guess in my experience it has in some degree as the technical support wasn't able to keep the system consistent over time. *FG: JB Ref FG#83*

As can be seen the ongoing support continued to be raised as an issue. Discussion also centred on the role of quality of documentation supplied by the project team and handed over to the support organisation. The participants consistently discussed team skills. The interesting aspect to this is the concept of 'functional experts" and their involvement in deciphering embedded meaning in source system data and the need to translate the information into one standard form.

"There is the technical for the functional people and also the support people who we are trying to make manage it. We found with BW you could have, unless you align yourself with the functional technical people because in plant maintenance the system status could be in ten different tables if you didn't get the right one then your getting the wrong information. So its just because SAP delivered the standard business content it doesn't always say technically it's the right information. Do you agree?" FG: JR Ref FG#88

"Yep." FG: JB Ref FG#89

Team skills then also means the need for expert business people or "functional" experts in an APMS team as well as technical experts. This need for functional experts is aligned to not just expert participation but also the data in the source systems and the intrinsic meaning of the data contained (Markus, Majchrzak, & Gasser, 2002).

The focus group agreed that team skills were a necessary factor for success when implementing an APMS.

Source Systems

A source system is a source of data to an APMS. The system maybe a system in it own right or it maybe an electronic data feed, e.g. a PLC

(Programmable Logic Controller) or telemetry point. An APMS may have only one source but typically have many source systems.

"Past studies have found that the quality of an organisation's existing data can have a profound effect on systems initiatives and that companies that improve data management realise significant benefits (Goodhue et al. 1992; Kraemer et al. 1993, cited in Wixom and Watson, 2001). The quality of source system data affects the quality of an APMS so that is why they are an important factor in the success of APMS implementations.

One benefit of an APMS is data integration throughout the organisation as data often resides in diverse, heterogeneous sources. Each unique source requires specialised functional and technical experts to coordinate, define and design the data access so it can be automated to provide data (Goodhue, Quillard, & Rockart, 1988, cited in Wixom and Watson, 2001, p.24).

Data quality was discussed at length in the focus group meeting as there is a strong relationship between data quality and the source systems from where the data originated. An example:

> *"the risk is probably more if you do too much of it and you are just doing it because you have a mess in your operational systems, you shouldn't try and resolve them* (in the APMS)*, you should really put your resources into fixing the operational systems"* FG: JB Ref FG#256

and

> *"All that data, for a point of time for example in the reporting system, in the Global Commodity Company, in the past of course the quality of the systems has been so poor."* FG: JBE Ref FG#193

One aspect that caused a passionate, cohesive discussion was around spreadsheets, their use and their disruptive influence.

Yeah so that's what I am saying just because you think you have the right data isn't always correct and we did that at another Global Commodity Company before JB started when I did contribution margins and we got the right amount and even though they said it was right but then they said at the end of the month we do something because we have agreements with certain customers that we don't have to charge them until.… so even though we had the correct data in the reports .. the accountants would go and change the figures in an excel spreadsheet. Do you remember that? *FG: JR Ref FG#123*

Yeah, I think.

I think when you basically put the system in, you have to ah, part of the training in some of the tools you provide has to support the reconciliation of data, ah , there has been some instances in maintenance which ah until the key operator keeps driving the KPI reporting cycle is trained up in understanding how to reconcile between the operational system and the KPI system and be given some additional reports out of the data warehouse to allow them to break it up in such a way that they agree with the operational system to basically facilitate that. Ah, they weren't in a position to have confidence in the data, but once that training and those tools were provided to help reconcile, they were actually able to proceed and gain confidence in the data. So it was a long process *FG: JR Ref FG#124*

An important learning from the above participant's is the impact of spreadsheets. The use (and misuse) of spreadsheets is covered extensively in the literature (Heiser & Buytendijk, 2005; Panko, 2000; Panko & Ordway, 2005; Williams, Dennis, Stam, & Aronson, 2007). Spreadsheets are important as "the usefulness, flexibility and convenience of spreadsheets are undeniable, but enterprises must nonetheless regard the use of these applications to manage internal key performance indicators, or to create legally relevant statements or reports, as a high-risk business practice." (Heiser & Buytendijk, 2005, p.5) Spreadsheets are a risky proposition and come with many disadvantages due to the errors contained within them that therefore affect data quality. Figure 16 below illustrates the amount of literature on this topic.

Authors	Year	Number of SSs Audited	Average Size (Cells)	Percent of SSs with Errors	Cell Error Rate	Comment
Hicks	1995	1	3,856	100%	1.2%	One omission error would have caused an error of more than a billion dollars.
Coopers & Lybrand	1997	23	More than 150 rows	91%		Off by at least 5%. This amount could indicate
KPMG	1998	22		91%		Only significant errors that could affect decisions.
Lukasic	1998	2	2,270 & 7,027	100%	2.2%, 2.5%	In Model 2, the investment's value was overstated by 16%. Quite serious.
Butler	2000	7		86%	0.4%**	Only errors large enough to require additional tax payments.**
Clermont, Hanin, & Mittermeier	2002	3		100%	1.3%, 6.7%, 0.1%	Computed on the basis of non-empty cells.
Interview I*	2003	~36 / yr		100%		Approximately 5% had *extremely* serious errors.
Interview II*	2003	~36 / yr		100%		Approximately 5% had *extremely* serious errors.
Lawrence and Lee	2004	30	2,182 unique formulas	100%	6.9%	30 most financially significant SSs audited by Mercer Finance & Risk Consulting in previous year.
Total		**88**		**94%**	**5.2%**	

*In 2003, the first author spoke independently with experienced spreadsheet auditors in two different companies in the United Kingdom, where certain spreadsheets must be audited by law. Each audited about three dozen spreadsheets per year. Both said that they had never seen a major spreadsheet that was free of errors. Both also indicated that about five percent of the spreadsheets they audited had very serious errors that would have had major ramifications had they not been caught. Audits were done by single auditors, so from the research on spreadsheet and software auditing done by individuals rather than groups, it is likely that half or few of the errors had been caught. In addition, virtually all of the spreadsheets had standard formats required for their specific legal purposes, so error rates may have been lower than they would have been for purpose-built spreadsheet designs.

**The low cell error rate probably reflects the fact that the methodology did not inspect all formulas in the spreadsheet, focusing instead on higher-risk formulas. However, error has a strong random component, so not checking all formulas is likely to miss many errors.

Figure 16. Audits of Real-World Spreadsheets (Panko & Ordway, 2005, p.5)

While it may be hypothesised that spreadsheets cause data quality issues, that is not always the case. In some cases the only source of some data is from spreadsheets as this conversation testifies.

> *"Did you ever have problems with data quality where people said the data was actually wrong?"* *Researcher Ref FG#139*

> *"Yes, this was consistently popping up. A lot of the time it actually boiled down to their understanding of the data being captured. Or the actual reporting requirements where they had different terminology. One persons budget was another persons forecast"* FG: VL Ref FG#140

> *"So was the source system wrong? Was someone translating the data in the previous manual reporting?"* Researcher Ref FG#141

> *"No. For example, they had planned data, you have planned versions and they were doing … either entering data into different planned versions than what was expected or they were even not entering the planned data at all. They had it all in a spreadsheet."* FG: VL Ref FG#142

> *"So they controlled their own data and the loss of control started to cause problems."* Researcher Ref FG#143

"Yes" FG: VL Ref FG#144

The reported "loss of user control" is a barrier to success but the use of spreadsheets also caused problems when trying to align data between spreadsheets and the source systems.

> *"Yeah we're trying to work out why one organisation was better than another and that was the reason. Because they do all of their detail. They use their actuals. If you have to go use Excel spreadsheets for your plan .. You mismatch and it doesn't make sense and it doesn't which is all tied around data quality".* *FG: JR Ref FG#409*

Spreadsheets are a possible source system for an APMS, but come with inherent risk which is discussed further in the data quality section below.

The focus group agreed that the having reliable and well maintained data from a source system was a critical factor for success for an APMS implementation.

Development Technology

Development technology is defined as "the hardware, software, methods, and programs used in completing a project" (Banker and Kauffman, 1991, cited in Wixom and Watson, 2001, p. 25).

The development of quality technical systems have a number of risk factors including technology, human resources, systems development methodology and project management (Ballantine et al., 1996, cited in Martin, A., 2003, p.1). As discussed in Chapter 2, APMS are typically integrated components from many different technologies and the more complex or diverse these components are, the more complicated the APMS solution is. Wixom and Watson, state that "the development tools that a project team uses can influence the effectiveness of the development effort as much as other factors, such as people. The tools can impact the efficiency and effectiveness of the development team, especially if they are not well understood or easy to use" (Wixom and Watson, 2001, p.25). If the tools are complicated or immature the APMS may become problematic, unreliable or

flawed. Development technology is therefore an important factor for the success of an APMS.

The focus group agreed that in the early days of APMS the technology was an issue and but as it has matured it is becoming quite reliable and stable. As stated by one participant:

> *"One of things I have never been able to understand is the earlier adopters of this technology didn't mature, and didn't actually get anywhere with it, whereas the people who adopted the technology later, like JM organisation, seem to take all of the benefits from all the different people who worked on the project and experience and thing….But, the other thing that was really interesting was that it was actually was adopted and embedded and sustained and is actually increasing whereas the other organisations who were the early adopters don't seem to be going anywhere with this."* FG: R Ref FG#223

and,

> *"I think there was a lot of technical barriers for the early adopters that came with the territory . … I think there's also in terms peoples experience in building these systems, just accelerated so quickly in terms of their expertise and I guess they learnt some lessons that went into new organisations so, the later adopters got the benefit of that".* FG: JB Ref FG#226

When asked what the participants would do again during an APMS project that impacts on the success of the implementation, the answer given was prototyping. Prototyping is the creation of an early version of a system that exhibits the essential features of the later operational system (Alavi, Maryam, 1984, p.556). Prototyping was one method that appears to have been effective in the development of APMS. The following response was given by one participant.

> *"I think one of the big one's is UM in terms of what you should always do is a UM a fair amount of prototyping. To basically get your design right 'cause these areas can be complex."* FG: JB Ref FG#197

> *"Very True".* FG: JR Ref FG#198

No mention was made of whether the prototype evolved into the actual production systems or was only for experimentation, eventually replaced by the production system.

And later another participant confirmed the prototyping approach assisted with explaining what they were producing as most users where unaware what online measurement reporting was.

> *"A lot of users are still unaware of what online performance measurement is about, and they are just used to analysing data and if you have a user group that have a low experience to online analytical processing then a prototyping approach would be to build a basic cube on the subject area and let them play with it. And then enhance that development. But you can end up progressively going round in circles. Areas were I have found where the development point of view more successful is where the users know enough know exactly they want, how they want it reported and where the information is coming from."* FG: VL Ref FG#260

The focus group agreed that development technology was a factor for success but in the main most of these issues were no longer a problem. Getting the right people with the right skills to install, setup, develop and maintain the systems was however, still an issue.

System, Data Quality and Perceived Net Benefits

As discussed in Chapter 2, Wixom and Watson (2001), determined that certain factors influence implementation success and that data quality and system quality influenced system success which impacted on net perceived benefits. As stated:

> "Drawing on the work of Seddon (1997), three dimensions of system success were selected as being the most appropriate for this study: data quality, system quality, and perceived net benefits. Empirical studies (e.g., Fraser and Salter 1995; Seddon and Kiew 1994) have found that these three dimensions are related to one another: higher levels of data and system quality are associated with higher levels of net benefits." (Wixom and Watson, 2001, p.19)

Wixom and Watson's classification of system success is built around data and system quality which they hypothesised was driven from organisational, project and technical success which in turn drives data and system quality for system success and perceived net benefits. While these relationships were not within the scope of this research, the data and system quality factors were raised during the discussion and are discussed further below.

Data Quality.

Data quality is defined in an operational context as the accuracy, comprehensiveness, consistency, and completeness of the data provided by the warehouse (Wixom and Watson, 2001, p.26).

Data quality is an important APMS success factors for a number of reasons. These are:

- Data quality (in a generic way);
- The measures;
- Auditing and reconciliation;
- Budgeting and forecasting;
- Business processes; and
- Timeliness of the data.

These are discussed below.

Generic Data Quality

Data quality as discussed in the literature review has received considerable attention regarding its definition, component measures, and importance. Data accuracy, completeness, and consistency are critical aspects of data quality in an APMS (Buytendijk et al., 2004b, p.13). When asked "The question of information quality in relation to introduction and ongoing acceptance of the system have you had any experience with that particular factor?" The participants responded:

"We had a major emphasis on information quality, that was the number one priority before we even looked at reports. So we were very conscious that as soon as confidence was lost in reports you could potentially loose the whole thing … so because we also went live with BW and R3 at the same time ….. that was a major." FG: JM Ref FG#100

So data quality was very important and affected the confidence in the APMS. Later another participant added:

"Data quality is what is critical and that what's driving it, that's what sort of one of the things that starting to being driven from the desire by… the project is done on the basis that of the sponsor knows its rigor etc Yeah I think frequently, what happens is that the quality of the data could be better, but the sponsorship of the data is not high enough. What's changing of course is that with the global nature of business, companies are becoming more exposed to discovery orders. Whatever so there is a becoming a much greater drive to secure data quality and it is helping some of these initiatives in terms of it adds to the reporting systems." *FG: JBE Ref FG#146*

Data quality, as a success factor for this participant, brings together some key relationships of which one is the understanding of the project sponsor and his belief of the APMS systems quality. "Rigor" may have to deal with the sponsor's ongoing belief in the APMS as the sponsor must protect the organisations from legal discovery and external compliance, e.g. SOX. Reasonable data quality within an APMS therefore supports the business transparency objective that arises from possible compliance audits and legal discovery orders.

The measure

The focus group discussed at various times, actual measures and their definition. The measure itself was determined as a potential problem area (Tangen, 2005, p.5). The participants concluded that as part of data quality the measure needs to be succinct and agreed. In the focus groups collective experience they believed that users did not always really know what a measure was or how to define it, where it was created, used or modified within a business process, understood its definition (or meta-data) and when or how to use it. For example one focus group participant said:

> *"Some people do some people don't. Usually it works. Plant maintenance for instance TA has gone up through the system to a manager level they tend to have a fairly good idea. A lot of them don't understand KPI's so you almost have to discuss and almost guide them to the information that they should be looking at. A lot of people I have found, do you agree, don't understand the concept of what measures they should be looking at."* FG: JR Ref FG#212

The maturity of the user base with respect to performance measurement frameworks appears to also affect the success of an APMS (de Waal, 2003, cited in Martinez, Kennerley & Neely, 2004, p.7). This was confirmed later by another participant when it was stated:

> *"They never were able to get the data because it was too manual or its in disparate system and then all of a sudden it all get presented in one place and they just can't get their head around what they want to measure or is it because there is too much information in front of them?"* JB Member R Ref FG#217

The cultural aspect of an organisation aiming to improve is another factor (de Waal, 2003, p. 693 & p.694). Another participant stated that performance measurement is in its infancy and he had not seen anyone who had actually understood or implemented it. While they could "Talk the talk" they could not translate this into action.

> *"Performance Management seems to be if you take the KPI route, pretty in its infancy, from what I have seen. What I am saying before no has done it. 85% fail, etc. But what I've seen work best is like the Solomon's thing were they come in and Go OK there are your KPI's it's been proven, like… borrowed from other places, instead of opening up a blank canvas and saying "what are your KPI's?" You can come with proven measures."* FG: JM Ref FG#220

The measures affect data quality right through the organisation. An example given by another participant on how one measure is part of a hierarchy of data reporting was:

> *"…They have measures even at an operators level which then aggregate and feed up to the supervisor, which feed up to the refinery manager. The plant maintenance costs for instance, the operator or shift supervisor might only be interested in his plant, the refinery manager is interested in not just one plant, he's interested in total costs of .. preventative versus pro active, plant maintenance. The Vice President looks at it at a refinery level, he doesn't care about at the lower more detail levels.* FG: JR Ref FG#8

One small error can therefore affect all levels of management and reporting. In this case a whole refinery could be affected. The degree of error and the importance of the measure, determines the impact.

Industry agreed performance measures or sets of measures can also assist with data quality. For example the Solomon's Fuels Refinery Performance Analysis is an oil and gas industry-wide study of comparative performance of the participating refineries in the areas of profitability, operations, maintenance, manpower and safety.

"So that was the driver, but he was also, in XXXX's case had 23 refinery's all doing shutdowns, the driver behind it was a global performance management system (PMS) called "Solomon indicators" and that was a standard …approved oil industry PMS. …It was a set of benchmarks that you could be tested on every couple of years and all these measurements had to fed in and there was a standard set of indicators that you would then, not tested, AH. Its almost like where you sat in a quartile, so you know there were top quartile for certain indicators but you might have been bottom in another but overall its your ranking amongst all the other Exxon, BP, Shell, all the, where you stood and that helped … That was very important to the way you ran your business, So that's what the driver was pretty much. And to do that you then had to standardise the way you do work across all refineries." FG: JR Ref FG#14

Credibility issues with the system are removed when using industry standards as one focus group participant commented:

"I think that Solomon indicator thing that you said, and this is probably getting off the question but if you haven't recognised things your measuring that are been proven elsewhere then your just saying we're whacking this in then your credibility is already there as far as the process". FG: JM Ref FG#33

"Except for Oil and Gas as they have a proven set of indicators that is agreed across industry and it's across the whole organisation, its not just (one area like) *plant maintenance."* FG: JR Ref FG#239

External, industry standard measures were an important acceptance characteristic when implementing an APMS as they have already been determined to a credible form of measure and are widely accepted.

Audit and Reconciliation

Data quality issues also require formal audits of the data being used in APMS systems as well as methods to formally reconcile the measures reported.

"Going forward you really need reconciliation processes. So periodically it gets reconciled. You only have it processed and reconciled back to." FG: JM Ref FG#105 "*What we did in finance you actually have an owner of each cube and you don't release that or before you release it to the public you actually get a Financial guy to QA that the data has been updated correctly".* FG: JR Ref FG#106

Standard audits scheduled regularly are necessary to ensure confidence in the data quality. This confidence is a behavioural factor of the users, the management and the project team. This confidence is required because:

> *Well because we were producing board reports or we are producing board reports out of the system and we are drawing it from different areas. We have a staged reconciliation process, so in R3 we reconcile you know console to CO/PA and that's a major .. once that's done … then you get a net profit number out of the board report which should reconcile t o your P&L and that's process is followed religiously ever month. So there is no chance of the board report to be giving screwed numbers. And that's …cause that's been implemented since day1 they can, they can miss out on one step and it will cause it to get out of whack but because they have had, they not have notice that, you know because its ingrained in their culture."* FG: JM Ref FG#109

Credibility of the data and audit process was also considered an import characteristic of data quality. As stated by one focus group participant:

> *"This is where these system have there downfall so they have been consistently reporting the wrong numbers people are unaware until someone does an audit and then all of a sudden there is a big smear(of the APMS)."* FG: VL Ref FG#380

The discussion also looked at how you independently reconciled data as you need to use an agreeable tool or method. In most cases this is a spreadsheet. The user community have trust in a spreadsheet but when errors occur in the reconciliation/audit process which system is correct? Panko and Ordway (2005) put it another way in their recommended training for users on spreadsheet. "It is important to train all employees to be wise consumers of spreadsheet results. This includes creating healthy scepticism about the trustworthiness of spreadsheets in terms of both errors and deception." (P.29)

While a spreadsheet can be wrong so can the source system data. An example:

"The other thing is you may have the right data. I'd have say that "the large Oil and Gas supplier" where we did plant maintenance and the business owner said that a figure was wrong, he was adamant the figure wrong and but I could prove down to a work order that the information was correct what it did was highlighted a deficiency in their work processes, so they actually had had to go back change, the way they entered work orders. It was a catch 22 but the manual process prior to that was wrong and the business, business people using the system didn't believe that the number was right coming out of the system because their old numbers have always been wrong." FG: JR Ref FG#110

Another aspect introduced into the discussion is that APMS are self auditing. Erroneous results stand out and they identify there is a problem which can then be rectified.

… as the data comes to be used for various other purposes it flows up out of the data, forecasts, processes for regular purposes provides that provides self reinforcement of the data." FG: JBE Ref FG#179

Business Processes

APMS therefore challenge long existing beliefs of the quality of the data contained in the source systems. In some circumstances it is not the source system itself but the actual business process that creates this data. For example different processes at various plants for one global oil company caused numerous reports for the same purpose and they all reported different values for the same KPI's. As stated:

"…, the other thing, Global Oil spent $50M writing ABAP reports, and the trouble is every area had a different version of the same report. So there might have been with each refinery there might have been they had to write an ABAP report which was one dimensional and very costly. So that is why they are trying to use a BW, is that you can get your information, wrong or right, and your cubes you can write lots of reports and hopefully a lot cheaper." FG: JR Ref FG#245

Also business processes change over time and the data recorded in one timeframe may not be the same as it being recorded in another time frame.

"We did have data consistency issues where over time they changed the process as to how data was captured." FG: VL Ref FG#134

Budgets and Forecasts

Measures also need to be compared against budgets and forecasts. One reason is to verify the actual measure against something else. Something that is known and true. As one focus group member put it:

> *It's very important for success that users must have budget and forecast information as well as the actual because if they don't they can't use it as a comparison and they won't necessarily, it's very important"* FG: JR Ref FG#407

Without budgets and forecasts, monitoring of measures affects both the strategic and operational aspects of the organisation (Melchert & Winter, 2004). (Refer Chapter 2 for details.)

Data quality issues with master data are also highlighted. The example below is where the primary key for one product is 'known' by the various systems as something else.

> *We're doing one at the moment where we've got MES our middle layer which is a Honeywell data historian database and we've got it feeding to SAP ERP. The MES layer is getting data from SCADA Citect. SCADA is using a product called X, at the ore body the common name is known as X1 and X2 (lump and fines). MES sees it as Z1 and Z2 product and SAP sees it as U1 and U2 products. So when you have different layers and you're trying to measure getting standardised master data as well is also important.* FG: JR Ref FG#97

In this case, a middleware or EAI layer transformed the data that then allowed for it to be processed and reported in a standard way. The transformation also allowed the business to see, in near real time, the end to end production processing cycle. This identified bottlenecks not seen before and opportunities for improvement. The previous process was to collate the data into spreadsheets and report it at the end of each month. One improvement was that the business obtained near real-time accurate stock levels. It also identified an issue where they had been overstating stock levels in the spreadsheet system. "No wonder they couldn't understand why they were always short of stock at the port".

A side benefit of the process was that business processes were defined and documented. In one case, the actual measures had been

introduced some time ago and people currently in the area did not know why the measure was collected or reported and as a consequence, processes were sometimes changed. As stated:

> *"Well I like that we wrote a lot of swim lanes identifying all the business processes and out of those swim lanes KPI's and the measures that we needed were identified. And we …we could buy-in and agreement of the way you standardise the way we do things. So it was an agreement amongst all the users that they were the right KPI's for instance and then, we were able to design based on – basically they were the requirements. So rather than try to…. build reports you think they would use they actually do your work behind the scenes. "* FG: JR Ref FG#202

> *"The vital change in a business context changing would be to keep updating the measures so you meet that type of professional organisational structure behind it."* FG: JB Ref FG#4

Data Timing

Data quality also involved the timing of the data. A reported measure in an operational context only appeared to be valid for a particular period of time. Strategically the data maybe of value to identify a trend or provide some long term forecast but operationally the time had passed for the measure to be of benefit to the organisation. This became more apparent when APMS systems used data interchange from a PLC or SCADA system. These systems produce 'time series' data and by using data historians or operational data stores (ODS) the detail can sometimes be lost when the original data is refined or trended. This issue is discussed further in the unexplained results section later in this chapter.

System Quality.

System quality is about the computer technical aspects of the system. IS research now accepts that technical system quality is necessary but it is not necessarily sufficient to ensure information system success (Garrity & Sanders, 1998, p.49), as many technically successful systems have been failures because they often do not take into account the human element in computing (Garrity & Sanders, 1998, p.27).

Commonly used performance measures for system quality include system flexibility, integration, response time, and reliability (DeLone and

McLean 1992) while decision-support applications have described flexibility and integration as particularly important (Van den Bosch and Huff, 1997 , cited in Wixom and Watson, 2001, p.18). Flexibility allows for applications to be easily modified while integrated data from assorted sources is seen as an aspect to improve organisational decision making (van den Bosch & Huff, 1997 & Wetherbe, 1991 cited in Wixom and Watson, 2001, p.18-19). Flexibility and integration was also one of the most important aspects for data warehousing because the warehouse provides the infrastructure to integrate multiple sources of data as well as the flexibly to support future application requirements (Gray and Watson, 1998 & Sakaguchi and Frolick, 1997, cited in Wixom and Watson, 2001, p18-19).

System quality is a success factor for an APMS because an APMS requires, flexibility, integration, reliability and must be responsive. An APMS typically integrates data from disparate systems.

When discussing the factors relating to system quality the focus group discussed the following characteristics:

- Response time;
- Infrastructure;
- Usability; and
- User Control.

Response Time

Response time was considered by the focus group as a primary characteristic of system quality. As one participant stated:

> *"Probably one of the major technical things in terms of the performance management system is the speed of reporting. There is a world of difference between waiting thirty seconds for your numbers or your graph or your trends versus five to ten seconds. People seem to switch off after that. If you don't get the performance right then they switch off very quickly from using the system."* FG: JB Ref FG#67

Infrastructure

Infrastructure issues had been a concern in the early days of APMS technologies and during this time it led to failures.

> *"Data Volumes is critical and also your WAN speed of your network. I put in the first version of BW at the other Global Commodity Company…. in 97 and we did this great BW Version 1.2 system and we got the reports built and we tried to implement it in Beijing and it just died it because it was the WAN it was a thick client so we had to use another tool called Business Objects using the web thin client to publish reports over the internet. So that's a technical issue. You might have the best system in the world but if you can't deliver it, then it's going to fail. The system is a failure.* FG: JR Ref FG7*4*

Infrastructure issues were sometimes generalised into the terms technical or technology issues and sometimes this confused the researcher as well as the other participants, For example:

> *"There have always been heaps of technical issues of course and of ... I don't think I would say that technical issues have caused the failure. Performance has always been an issue; quality of data is always an issue.* FG: JBE Ref FG#96

The majority of participants did not believe that infrastructure issues were a problem, but if not correctly sized, installed and configured they did directly impact on the level of success.

Reliability was raised as a characteristic and an example given was of a system that had no automatic alerts to report to administrators that data was not loading and hence the results being reported were incorrect.

> *"What about when we had LIS and we had to refresh the cubes using LIS and we found out that they hadn't actually updated LIS for ten months. So your quality of data was, even though you thought it was right, was actually incorrect. So that s the type of thing. That were the aligning , it's not just where you think your sourcing the data it's actually how that data is sourced where it's getting its information from and how you administer it. FG: JR Ref FG#101*

Usability (Use)

Usability of an APMS was considered to be a very important characteristic. Catering for all needs across an organisation was considered very difficult to achieve and the access, presentation or 'use' was a critical characteristic of system quality.

Simple system issues like single sign-on, ease of use and user control were three characteristics discussed.

> *"I think the other technical barrier is something as simple as logons and passwords. People can't just click on a manual option on a web page or the internet and can't just go straight into their KPI's or performance indicators and they …. it's actually a real barrier to get there. Especially for a performance measurement system in the sense AH….that if it does take time AH….to get credible base data in place and people very quickly forget passwords and logons and things like that."* FG: JB Ref FG#68

> *Single sign on was a major factor.* FG: JM Ref FG#163

The focus group also explained that there were underlying expectations from users on what an APMS would look like and the limitations of the existing offerings. As explained:

> *"Like there is a perception that the new millennium and new information age and all that, the expectations are massively high were as when we try to push it out with the presentation of XX we are getting a bit of high level resistance because of the dash - They are really big on the dashboard and the Speedo and all that kind of stuff. So we are undergoing a bit of a period where we are looking at other products to use as a front end to the XX. Just for the presentation."* FG: JM Ref FG#71

Ease of use was discussed and "What that meant by look and feel. What is usable?" (Researcher Ref FG#155)

> *The best one I have ever used is where I've had a guy who took …started off at requirements, he understood the design, I went and built the system, he then tested it, helped write the reports, and he did the training. So all of a sudden he stood up and gave the training and people under him thought well if he can do it he's using it he's he believes it then I'll use it. So it was like, rather than IT standing up and going Oh this is the best query I've every written and its going to help your job. They believed in it because the key user stood up. Does that make sense?* FG: JR Ref FG#156

Ease of use in this context didn't just mean the presentation and ability to navigate in the system but also the ability to understand the underlying meaning of the data (or information) being presented, its context and it origin. People need to understand what they have and why it exists. "It means understanding that the only way you can change anything is by

changing your practice— your praxis—in relation to the totality" (Bhaskar, 2002, p.68). In this case the person understood their situation and their surroundings.

User Control

User control of the process and data was a characteristic of system quality identified by the focus group. Users need to feel they are in control. APMS systems by their nature can be argued to be "Taylorism gone mad". The situation is that users at the lowest level of the organisation can be exposed in the same degree to the Board or CEO, as can be any level of management. This review is immediate and decisive. Nothing is sacred and all is exposed.

To overcome this potential barrier, users feel that they should have control over the system and data. As stated:

> *"The real issue is the control of the data and if it is not driven from the top demanding they get the data out of their performance system and people have the option providing KPI's they can sanitise, ah, and there is not a commitment to get it right at the functional expertise level. It means you have a system that's drifts out of date and not get used."* FG: JB Ref FG#323

And in one case where the users felt they no longer had control they just stopped using the corporate APMS and went out and got their own as one focus group participant explained:

> *"The thing a lot of people are scared in that respect is losing control. You need to actually define up from what they want and where they are going. It's a fear thing. I have seen it in several places in "large Oil and Gas Supplier" where in fact the people that are using the system are controlling the system to the point where the APMS is too hard to control because external parties supporting us will go to Hyperion so they can become the super users of the system."* FG: VL Ref FG#54

User control also manifested itself in the ability for users to define how their APMS front-end looked and the ability to customise or personalise it.

"The ability of the APMS to have personalised settings. So they just go to a Web link it would automatically comes up with the current month report for their area, no parameters to enter and then in the reports side having same format for different versions, for example different currencies, so there is a tab for Australian dollar currency and a tab for US currency. So, the simpler it was made to use , so if you took away all the variables that made them have to think what they wanted and just gave them a standard set of options, a lot of people enjoyed using it for that reason because they didn't have to."
FG: VL Ref FG#167

Perceived Net benefits.

A perceived net benefit is defined as the return on the APMS investment, be it tangible (measured or quantifiable) or intangible (unmeasurable or unquantifiable) once the APMS is implemented.

The quantifiable benefits of the APMS identified by the focus group were different and varying. They varied because in some cases they spoke about the evolution of the systems and compared successes using data warehouses with that of data marts. While these are components of APMS they are not an APMS. Immediate wins were discussed while quantifying the returns, e.g. One APMS paid for itself in the first week when it identified that storage containers could be loaded with an extra X tonnes of Ore. At $10+ a tonne and with 300 containers a day the system paid for itself in just under three months. Information sharing, reliability, SOX compliance, standardisation of business processes etc all became additional benefits. APMS cost "big bucks" but if used correctly they can have huge returns in short time frames. The social impacts also appear to be considerable. Most things are exposed with an APMS in either real or near real-time. While progressive organisations may choose to use this information for improvement it could also be used to someone's disadvantage.

Intangible benefits identified by the focus group included standardisation of processes, a common set of organisation definitions for measures and "one measure of the truth".

Unexpected results

A number of results were difficult to map to the factors identified by Wixom and Watson. These are:

- Sustainability; and
- Timeliness.

During the focus group meeting, ongoing support of the systems was raised many times and was specifically discussed around the timing of changes that occur once the APMS is implemented. The ability to provide timely information is determined to be very import to data quality, so the ability to report changes is equally important.

Organisations are not static, they change and so do the measures that are being recorded and reported (Bititci, Turner, & Begemann, 2000, p. 696; Kennerley & Neely, 2003b, p.215). The focus group stated that change and the ability to change quickly was critical. This led to the discussion on sustainability and the timeliness of an APMS system and the factors that make it a success.

Sustainability.

When questioning the participants on their experiences to date and why certain projects had failed the following comment was made:

> *"What you wouldn't do again and I just wanted to get in. Doing a lot of transformation on the data warehouse side is a big no-no in my mind because basically trying to make up for inadequacies in the operating, operational systems. Your inability to get data out of the operational systems easily that was a major I guess impact on making something too complex in sort of a APMS environment. I UM and a lot of the stuff that was built for 'the Global Commodity Company' wasn't useful or sustainable."* FG: JB Ref FG#247

Complexity and the effect on ongoing support was raised many times and through most of the conversations it always came back to the fact the APMS are complex and take time to bed down and for users to become engaged. For example:

"When they put it (the APMS*) in they have 12 months of a focussed project team where everything is dotted and that what they are doing. Where is when it is in you have all these piecemeal projects that never ever get the full momentum that a full implementation is going to get so you can tell they are playing catch-up. Whereas if you look at this new one idea ERP 'Another large Global Commodity Company' Project where they have got multiple business units who have gone through it, they have a project team, who have been through that, and now they are starting from scratch that will be very interesting to see how that turns out. As I saw it a presentation that business intelligence event management from <Project persons name>, whose the BI guy driving all that but that had everyone from 37 business units. And that sounded very impressive, from what he was saying it's massive what they are trying to do. Um in 5 years or whatever but that would be a different story. But that could work except they are trying to put in standard costing in the mining which (Laugh)".* FG: JM Ref FG#228

Sustainability means covering the requirements of the present without removing the basis for meeting the requirements of the future generations (CIMRU, 2002, p.10). Generations in this case, can be said to be the organisation state sometime in the future. The model for achieving this sustainability could be derived from Kettinger, Grover, Guha and Segars (1994, p. 34) but this is not considered to be within the scope of this research.

Organisations constantly change and are continually improving and even after an APMS has been implemented there is a need for ongoing change. As one focus group participant said early in the meeting:

"I mean certainly on an ongoing basis they need to put into an organisation um a support group to, to certainly look after it. Make sure that the data remains consistent. Ah …then obviously be subject to continuous improvement. Um perhaps enhancement and handle project changes. The vital change in a business context changing would be to keep updating the measures so you meet that type of professional organisational structure behind it." FG: JB Ref FG#4

Management support and champions are important. Long term commitment for a system like an APMS is essential. As stated by a focus group participant:

> *"I think that is one of the key things for success for this type of system is that long term commitment. I've heard 5 years mentioned, most organisations had a go at a project at 3 months, 6 months or 12 months, big organisations maybe a bit longer but it needs that long term commitment . It's as if you almost need a permanent resource focused on that area within an organisation. And then you obviously use project resources to do the major developments but you really need to have a continuing focus and commitment."* FG: JB Ref FG#229

This drives the user involvement but it needs to be embedded in business process by the users. They are the only ones who really understand the processes and they are the ones the system impacts directly.

Another aspect of sustainability was ongoing governance as explained by a focus group participant who worked with a global oil and gas supplier. The client he has been working with had an APMS for many years and had a mature organisational structure around the APMS and had implemented a role called a Process Improvement Leader. As he stated:

> *"… The idea of process improvement leader type concept where a person then also drives usage of the system. The Projects haven't really, as I said before, thought enough about the KPI model. So for example all they did was pick up and join the data together. The Process Leader embedded it into the business and guided it."* FG: JBE Ref FG#412

Continuous improvement was another aspect of ongoing support and sustainability. While reviewing the Wixom and Watson model, towards the end of the focus group meeting one participant suggested:

> *"I think having a long term view is something that is ah .. continuous improvement, is sort of not in that model. There is lots of wholly words.* FG: JB. Ref FG#339

This continuous improvement is typical for most organisations as they engage in TQM and Six Sigma like programs. Out of these programs come new performance measures, reports and alerts. Updates and or modifications are therefore required to APMS which maybe user or developer initiated.

Sustainability within the IS success literature is not extensive and even within the IS field it is not widely discussed; although the 20th

International Conference on Advanced IS Engineering (CAiSE'08) to be held in France in June 2008 has its theme as Sustainable IS. Further details can be found at: http://www.lirmm.fr/caise08/index.php.

Sustainability is therefore worth exploring in the next step of the research and was added to the model as a CSF.

Timeliness.

"Timeliness is important because understanding the circumstances behind the numbers is often essential in diagnosing problems."(Kaydos, 1999, p.52) The timing is also important to be able to relate information to other events. In some cases the relationship between the data is based on the data and time of the events that created the data. If the frequency of a data load or refresh is long, important information maybe unavailable for reporting, or when it is available, other circumstances or events could have overtaken that previous event and the data is no longer as relevant as it was. This maybe acceptable when looking at historical trends strategically but operationally this may not be the case and it may cause serious implications, e.g. waiting for stock to be produced to load a ship. In this case there are financial penalties, demurrage costs, but there maybe also a KPI that many customers place on suppliers which determine future orders by measuring a supplier's ability to deliver to an agreed schedule. e.g. Iron ore, coal, manganese or nickel for a stainless steel production. For example, one focus group participant reported:

> *"The data he was getting and the information he was getting was once again the timeliness of it took so long and it wasn't accurate and he didn't believe in it."* FG: JR Ref FG#8

Timeliness may also be because of technical issues akin to:

> *"Data loads are a huge one. Especially on a global nature. If you have got three boxes in each zone all feeding into one. Then you've only got a small window of time if you are running a large ERP system and doing backups and you're doing BASIS work to do a data load without impacting… you only have a small window of time so that probably an issue.* FG: JR Ref FG#80

There are also technical issues with running an APMS in a global organisation. Just finding processing time that does not conflict with peak processing times in different parts of the world is quite a challenge. Most of the focal group businesses were typically 24 hour, 7 day a week operations so transferring data from one operational zone to another zone without conflicts was a real balancing act when loading a centralised APMS. Issues had also been experienced with date and time stamping across geographic time boundaries where source systems did not support Coordinated Universal Time (UTC). These examples though are not to do with timeliness but rather data quality (the date attribute on the data) or system quality (the system design should cater for UTC conversion).

Timeliness was also a critical factor affecting operational reporting when organisations where trying to track and determine their actual spend against their budgets. As one focus group member reported:

> *"You know we originally planned to have monthly forecasts in the APMS but they took too long to turn around in the APMS so we are looking at an external forecasting tool. Which is potentially a threat to the adoption of the reporting."* FG: JM Ref FG#411

The issue with data being late or not on time affects the way a business operation will function. Business managers who require timely data will work around the corporate APMS if the data they need is not there, i.e. it is either late or non existent.

The question of whether data is wrong or late is sometimes blurred. We live in a world where 'Star Wars' and other fantasies have left people with an expectation of immediateness. Mobile communication means most people are contactable immediately. We live in an immediate world.

One focus group member commented on the effect timeliness has on the take up of an APMS. The member stated:

> *"It's the timeliness of the data but it also that, that data is being used in reports that is being used and reviewed, this leads to clarity in the data which makes data sources more visible and to a much cleaner data take-up."* FG: JBE Ref FG#181

The same focus group participant also stated later that the quality of the data had been historically poor. As he said:

> *"Like you might have the exploration data set, which is a forecast from the explorers, production in time, that data in 'Global Commodity Company', in the past of course the quality of the systems has been so poor."* FG: JBE Ref FG#191

The question is "was the data poor or just not available when required?" Operational and strategic activities have different requirements with respect to timeliness. As discussed in the literature review, Melchert and Winter (2004) looked at "shortening the period of time between the occurrence of a business event that requires an appropriate action by the organisation and the time the action is finally carried out" (p.539), this in effect is the timeliness of the information.

Timeliness is therefore worth exploring in the next step of the research and was added to the model as a CSF.

Summary of Data Analysis

Human experience is rich and complex and so this phase of the qualitative research study has focussed on a group of industry practitioners. Their input on CSFs for APMS has been presented in the context of the factors themselves and has been based on their collective human experience. The focus group has revealed how the factors for success for APMS interrelate, interact and influence each other and grounded theory has been used to analyse the results.

A summarised view of the results from the focus group is illustrated in Table 6, below. When asked to rate the importance of one success factor over another one response was:

> *Its not one thing that will make a performance measurement management system work, its combinations. You gotta have the business, you gotta have the quality of the data, you gotta have, ah, technology in place. Its all those things, they gotta have the business processes in place. If you drew a mud map it be a combination of these.* *FG: JR Ref FG#328*

Based on this response no specific factor was deemed to be more important than any other, it was either a critical factor or it wasn't.

Table 6. Mapping of Success Factors to focus group Research

Success Factor	Source	Supported by focus group	Comment
Management Support	(Wixom and Watson, 2001, p.20)	Yes	Sponsorship term also used
Champion	(Wixom and Watson, 2001, p.20)	Yes	Stakeholders raised as a term in lieu of Champion.
Resources	(Wixom and Watson, 2001, p.20)	Yes	Yes required. Total commitment required for the entire project including support an ongoing operational.
User participation	(Wixom and Watson, 2001, p.20)	Yes	"Business buy-in" was a term that tended to be used interchangeably when speaking about Management support and User participation.
Team Skills	(Wixom and Watson, 2001, p.20)	Yes	Includes "functional" experts to be part of team.
Source Systems	(Wixom and Watson, 2001, p.20)	Yes	Reliable and well maintained data required from source systems.
Development technology	(Wixom and Watson, 2001, p.20)	Yes	No longer a problem but necessary. Getting the right people however was still an issue.
Data Quality	(Wixom and Watson, 2001, p.20)	Yes	Has many different characteristics and is very critical to the acceptance and success.
System Quality	(Wixom and Watson, 2001, p.20)	Yes	Includes response time, usability and user control.
Perceived Net benefits	(Wixom and Watson, 2001, p.20)	Yes	Benefits must be quantifiable.
Sustainability	focus group	Yes	New factor based on ongoing / sustainable support and continuous improvement.
Timeliness	focus group	Yes	Very important - New factor contributes to relevance of data.

Behavioural Factors

In a continuation of the grounded theory method, i.e. abstracting to another higher level concept, behavioural factors became evident in the constructs used from the first round of codification, i.e. the raw code assigned to the data. These behavioural factors appeared to represent actions of the people that the participants had interacted with during their careers in APMS implementations. Words like accountability, business buy-in,

business process, champion, complexity, continuous improvement, credibility, governance, key user, management buy-in, maturity, responsibility and sponsor all represented personal, social or organisational behaviours. There were of course many other codes used and these others were typically related to functional or technical aspects like audits, budgets, data, source systems, technical etc. A complete list is included in Appendix Two.

Behavioural factors are important to an APMS because like all systems, an APMS exists within a social context. The focus group discussed organisational structures and mechanisms for managing and utilising an APMS and these require further analysis as they would be missed if only the high level markers are reported. The behavioural factors indicate social and psychological aspects that may affect APMS success. A review was done of the literature at this point to identify any possible link between these behavioural characteristics and APMS.

Vagneur and Peiperl (2000, cited in de Waal, 2002, p.689) suggests that individual psychological factors should be considered with respect to performance management while Holloway, Lewis and Mallory (1995, cited in de Waal, 2002) propose that successful implementation of performance measurement is based on the understanding and accommodating of the human element. de Waal (2002) links literature from the Balance Scorecard (Kaplan, R. S. & Norton, 1992; Lipe & Salterio, 2000), management cogitative limitations (Vagneur & Peiper, 2000) and the influence of users 'use' of the system (Krause, 2003; Vagneur & Peiper, 2000) to show how behavioural factors are important to the success of implementing performance measurement systems. de Waal also states that behavioural factors can adversely affect worker management separation, cross-boundary conflict, and job-related tension while positively affecting outcomes generated by better strategic alignment of employees and motivation to support underlying relationships that exist between performance management system design, management control, use, managerial and employee behaviour, and performance (2002).

An important learning from the de Waal article is that all of the above comments seem to be still focused on its relationship to the budgeting system when discussing the human element and he suggests further research is needed into other factors, such as environmental or organisational factors.

The literature reports that a combination of performance-driven behaviour and regular use of the performance management process leads to improved implementation results for performance measurement systems (Ahn, 2001; de Waal, 2003, 2004; Sandt, Schaeffer, & Weber, 2001). de Waal (2003) argued that a performance management system is regarded as successful if managers use the system on a regular (daily) basis. In the 2004 paper he went further by stating that specific factors have a positive effect on performance-driven behaviour and therefore enhance the regular use of the performance management process. By stating these 'positive' factors, organisations can actively work on these factors to achieve the desired result.

In total, 40 behavioural factors were identified but these were summarised and grouped into aspects. These aspects are listed in Table 7, below.

Table 7. Aspects of the performance management analysis (de Waal, 2004)

Aspect	Type	Description
Responsibility structure	Structural	A clear parenting style and tasks and responsibilities have been defined and these are applied consistently at all management levels
Content	Structural	Organisational members use a set of financial and non-financial performance information, which has a strategic focus through the use of CSFs and key performance indicators
Integrity	Structural	The performance information is reliable, timely and consistent
Manageability	Structural	Management reports and performance management systems are user friendly and more detailed performance information is easily accessible through information and communication technology systems
Accountability	Behavioural	Organisational members feel responsible for the results of the key performance indicators of both their own responsibility areas and the whole organisation
Management	Behavioural	Senior management is visibly involved and interested in the performance of organisational members and stimulates an improvement culture and proactive behaviour. At the same time it consistently confronts organisational members with lagging results
Action orientation	Behavioural	The performance information is integrated in the daily activities of organisational members in such a way that problems are immediately addressed and (corrective or preventive) actions are taken
Communication	Behavioural	Communication about the results (top-down and bottom-up) takes place at regular intervals as well as the sharing of knowledge and performance information between organisational units
Alignment	–	Other management systems in the organisation such as the human resource management system, are well aligned with performance management, so what is important to the organisation is regularly evaluated and rewarded

The structural typing of the aspect deals specifically with the content of a measure and the way it is organised. The behavioural aspects deal with the way organisational members use performance management.

While no further analysis was done within this phase of the research these characteristics were added to the model of relationship to current literature for IS success. The model with the de Waal characteristics is illustrated in Figure 17, below. This is used in the case study as a guide for participants.

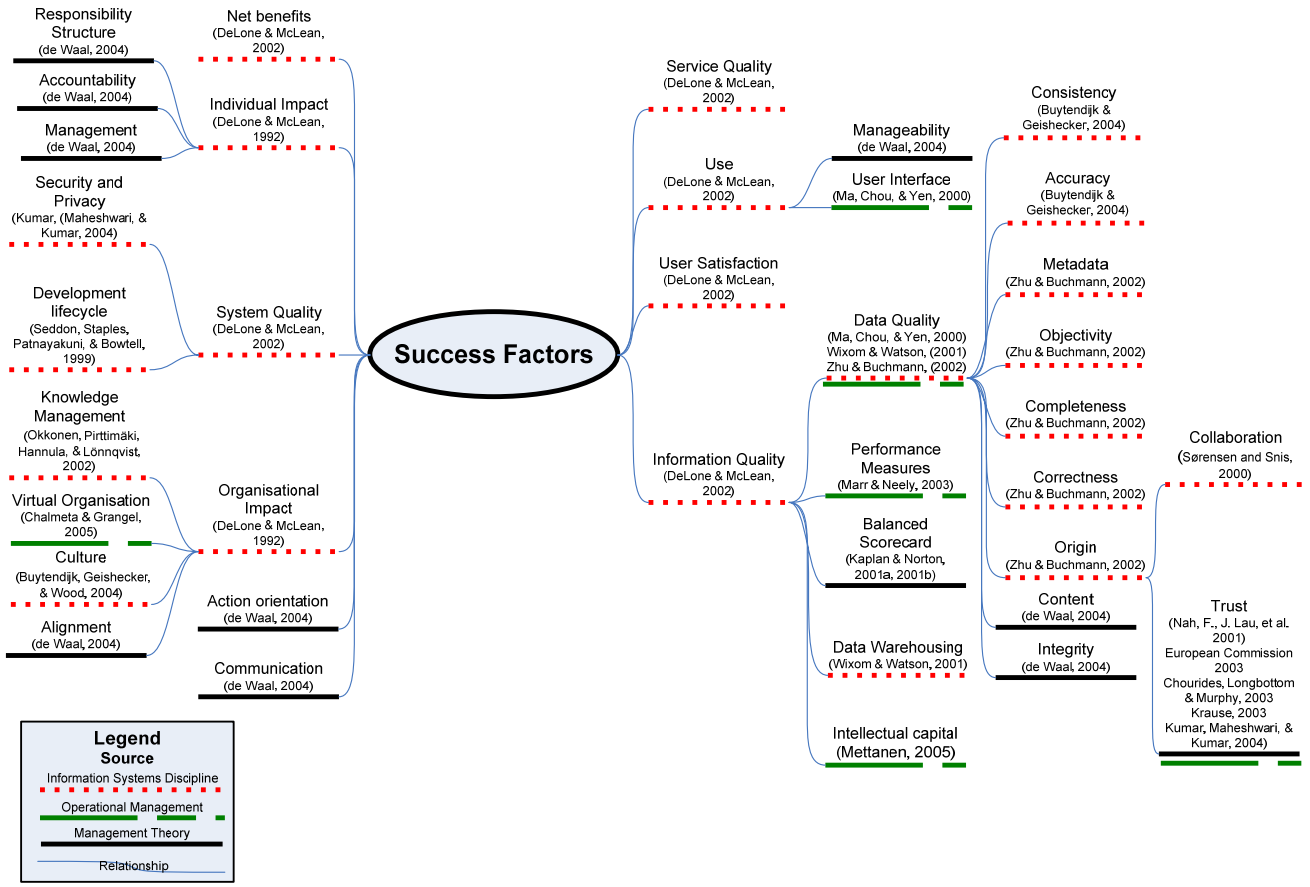

Figure 17. Model of relationship to current literature for IS Success with de Waal (2003) behavioural factors included.

Findings

The findings arising from the focus group phase of the research project are:

- The Wixom and Watson success factors for data warehousing were suitable for APMS implementations

- Two additional factors were added to the model. These are:

  (i) Sustainability and

  (ii) Timeliness.

The updated model (Model 1) is illustrated in Figure 18, below.

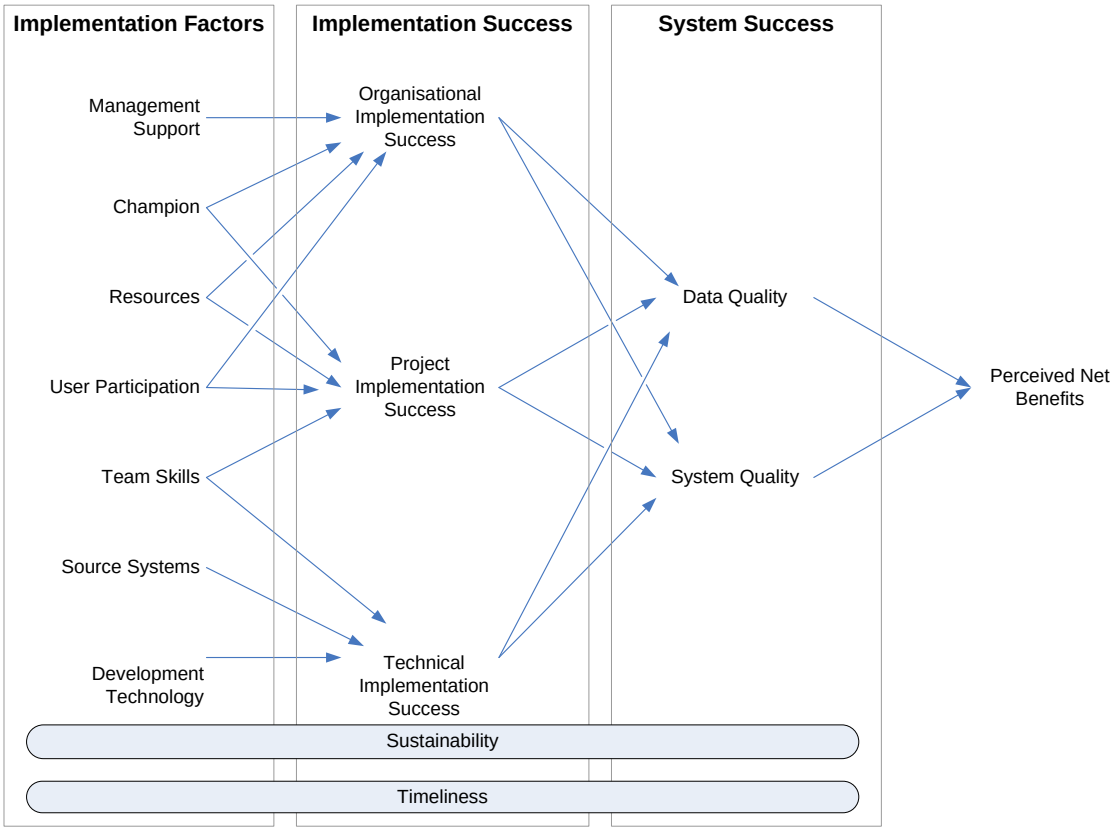

Figure 18. Draft Research Model for APMS Success resulting from focus group data analysis – Model 1 (derived from Wixom and Watson, 2001, p.20)

The updated research domain is illustrated Figure 19, below. The additional success factors will be investigated during the case study, Chapter 5.

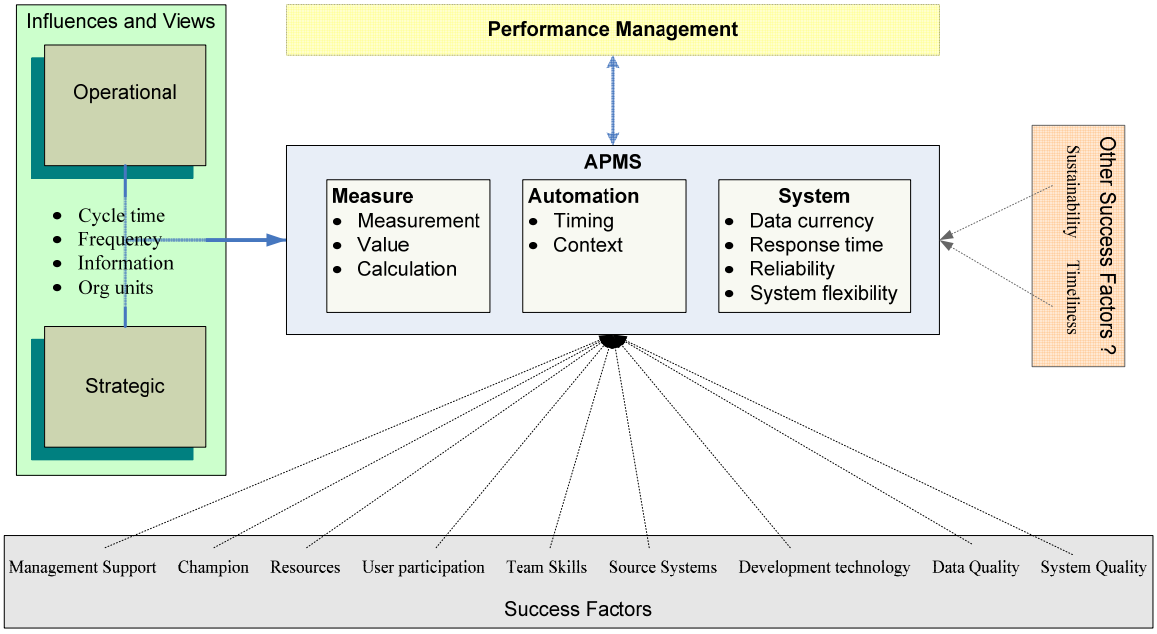

Figure 19. Updated research domain and associated theory with possible new factors.

Bias and faults during the focus group phase

As discussed in Chapter 3, during the analysis and capturing of the data from the focus group, the personal bias of the researcher may have influenced the way questions were put to the focus group, the way the discussion was focussed and the subsequent analysis and reporting of the data. Hermeneutic theory was used to assist in minimalising this bias.

Apart from two invited people not attending the focus group meeting no specific faults are known to the researcher for this phase of the research. Although this study has critical realist elements as well as being interpretative through the use of grounded theory method, this qualitative approach does have limitations. They are:

- The analysis did take time to do and work and private commitments extended the time for the analysis of the focus group data. Data collection for the case study took only two months with a further two months for analysis.

- The focus group as a data collection method could have presented a version of the world that is not real. Open-ended questions were

used to allow the participants to select the manner in which they wished to respond and there was interaction between members. Opinions did change during the discussion but this may have occurred due to peer pressure or just to be seen to agree. While this did occur often the researcher ensured that additional questions were poised to determine if the context of the answer had changed.

Research Quality

During this phase of the research the activities and experiences from the focus group were positive and as there was only one meeting the data and the subsequent results are considered solid, except for possible researcher bias. This section therefore deals with how the researcher ensured research quality during the data collection, the analysis and reporting of the focus group findings.

The focus group transcriptions were circulated to the participants who returned them with a number of corrected transcription and typing errors. In the main the errors were mainly to do with specific project acronyms or technical business terms and some typing errors, e.g. some project names were incorrectly transcribed as they were strange and had geological and geographical names. These corrected items were later changed to ensure ambiguity and to not allow identification of companies or focus group participants.

A record was kept of key events, dates and people, as well as the transcripts. This allowed the researcher's personal experiences and thoughts (good and bad) at the time to be used when reflecting on the issues and actions raised by the researcher and associated University supervisors.

As discussed in Chapter 3, the principles of the hermeneutic circle (Klein & Myers, 1999) were adopted to negate the limitations with the interpretive approach to the focus group data. The individual parts of data were interpreted while taking into account the context of the discussion before and after the response, i.e. both the parts and the whole were considered. The quality criteria used during the analysis of the focus group data included:

- Contextualisation - was implemented by defining the meaning of performance measurement systems and giving industry examples.

The Wixom and Watson model (Figure 8, p.60) and the model illustrating the relationship to current literature for IS success (Figure 9, p.64) were circulated for reference during the focus group discussion.

- Interaction between the researcher and the subjects - by utilising the focus group instrument, this minimised the positivist limitation of ignoring the past and refining the model using the research participants as experts. This has been done and evidenced by using direct quotes from participants (bad English and all). The focus group meeting was recorded, transcribed and then verified by the focus group participants to ensure no error in what was stated.

- Abstraction and generalisation – utilising a raw codification to map passages of focus group discussion allowed the data collected to be interpreted and compared to theory and general concepts that describe the nature of human understanding and social action. By exploiting the literature and utilising the research results, success criteria were extracted and the results generalised and compared to the seed model. This assisted in confirming success factors and to identify possible new ones.

- Dialogical reasoning - possible contradictions between the published theory and actual findings have been identified in the focus group results. Examples include the possible renaming of management support and champion to sponsor and stakeholders, respectively, as well as possible new candidate success factors. The very nature of the study is to discover success factors by utilising the Wixom and Watson model as a seed model, while utilising literature from two disparate fields. This allowed the research to build on already accepted theory.

- Multiple Interpretations - by utilising the focus group, the researcher believes that group consensus pertained and therefore restricted the amount of misconception that may have occurred if individual interviews had been conducted.

- Suspicion - it was understood that the participants have biases and probably put forward distortions (positive and negative) during the research gathering. By having a group of people from different projects and different companies but still known to one another, they were less likely to state untruths or distort the truth. Some characteristics and factors raised by the focus group will be examined during the data collection and analysis of the case study.

In this research study the ongoing iterative approach of building a model by first using the literature, a focus group and then confirming and refining the results once again within a case situation, will reinforce the integrity of the research results. This analysis has been done while

reviewing the literature. This approach meets the principal goal of triangulation which is to strengthen the data analysis through enhanced confirmation and completeness.

This quality approach will continue in the next phase of the research, the case study, through to the conclusion of this report.

Conclusion

> *"... to produce accurate and useful results, the complexities of the organisational context have to be incorporated into an understanding of the phenomenon, rather than be simplified or ignored.' (Orlikowski, 1993 p 311)"*

The Wixom and Watson Success model (2001, p.20) contains many factors and is based on the original model formulated by DeLone and McLean (2002). The Wixom and Watson factors were presented to a focus group and using an open discussion forum they discussed these factors and determined that they were all necessary for a successful implementation of an APMS, although there were also two others, sustainability and timeliness they considered necessary.

Through discussion, the focus group raised questions as to whether some of the terms were relevant and when the term management support was used they preferred sponsorship. The same occurred when the term champion was used, they preferred to use stakeholder.

Sustainability is a new factor based on ongoing / sustainable support and continuous improvement. Timeliness is also a new factor that contributes to relevance of data. These two factors have been added to the original Wixom and Watson model and will be verified in the discovery of success factors for APMS during the case study.

Human factors also became apparent in the codification stage of the data analysis. Like all systems, APMS exist within a social situation and an examination of performance management literature identified behavioural factors that lead to improved implementation results for performance measurement systems (Ahn, 2001; de Waal, 2003, 2004; Sandt et al., 2001). In total, 40 behavioural factors were identified but these were summarised

and included in an updated model of success factors for IS Success. These factors will be looked for in the case study data collection and data analysis phase to confirm their relevance.

By utilising grounded theory concepts and infusing operational and IS success factors, the new collection of factors will be tested during the case study, resulting in an updated APMS implementation success model.

> *Its not one thing that will make a performance measurement management system work, its combinations. You gotta have the business, you gotta have the quality of the data, you gotta have, ah, technology in place. Its all those things, they gotta have the business processes in place. If you drew a mud map it would be a combination of these.* FG: JR Ref FG#217

This chapter introduced the reader to the focus group and collected the first set of field data from these domain experts. The method was explained while detailing the research procedures used during this phase. Reasons for the focus group, composition, and difficulties were discussed as well as stating ethical considerations and biases that were identified that may have impacted the findings. The focus group provided insights into the subject areas due to the participant's specific expertise and extensive industry related experience and expertise. The results of the focus group data collection are presented as well as an analysis of the results. A comparison is made of the results with respect to the literature and the seed model and a modified model was proposed for verification in the case study.

The next chapter follows the same structure as this focus group chapter. The major difference is that both updated models are seeded into the case study interviews where a mixture of roles reflect and comment on the model from different experiences and viewpoints. It concludes once again by proposing a modified model with respect to the research problem and associated theory.

CHAPTER 5
CASE STUDY

The previous chapter introduced the reader to the focus group and collected the first set of field data from these domain experts. It provided insights into the subject areas due to the focus group participants' specific expertise and extensive industry related experience and expertise. The results of the focus group data collection resulted in a modified model for verification in the case study, this chapter.

This chapter follows the same structure as the focus group chapter with the difference being that the updated models are presented to the Case subjects at the commencement of the interview, which allows them to comment from their specific experiences and individual viewpoints. It concludes once again by proposing a modified model with respect to the research problem and associated theory. The model is then further refined in the concluding two chapters.

Introduction to the Case Study

> *".. to produce accurate and useful results, the complexities of the organisational context have to be incorporated into an understanding of the phenomenon, rather than be simplified or ignored''*
> *(Orlikowski, 1993, p.311)*

As stated in Chapter 3, the case study is the second stage of the data collection process. In this stage an organisation that has implemented an APMS successfully is explored to discover why this was a success and what factors contributed to this outcome. The case uses the concept of group accountability, a matrix organisation structure, to assist in the measuring and improvement of business efficiency and effectiveness through business process modelling.

Justification for the paradigm and methodology

As described in Chapter 3, the case study was selected as a method of data collection and this approach is consistent with the grounded theory methodology (Strauss, 1987).

This case study allows for evaluation and reflection of the model produced from the focus group. It helps explain how and why situations occur while putting the results from the focus group into a real context. This is an accepted approach and provides a rigorous basis for the refinement of any assertions that are formulated (Yin, 1989).

According to Yin (2003), what distinguishes case study methodology from other research strategies, such as an experiment, survey, archival analysis or history which makes it the preferred research methodology for this dissertation, is its fit with three key conditions:

- The type of research question posed;
- The extent of control an investigator has over actual behavioural events; and
- The degree of focus on contemporary as opposed to historical events.

The research question is "What are the CSFs for successful implementation of an Automated Performance Measurement system?" These are not known at the moment and the researcher wants to uncover them, so an in depth, qualitative, observation, grounded theory investigation is appropriate.

As stated in Chapter 3, utmost care must be taken when combining methods like case study and grounded theory (Glaser, 1998, p.40-42). Theory development prior to the collection of any case study data is an essential step in performing case studies (Yin, 1994, p.28). Usually, a grounded theory approach attempts to begin a research project without being prejudiced by prior theory and assumptions. However, it is not only practically impossible to achieve this, a non-dogmatic and open-minded use of a theory or working hypothesis can significantly aid collection and identification of data that may have a bearing on the project outcome.

Case Study Process

The research steps in this phase after selecting the case organisation were:

1. Prepare a set of questions to promote discussion (Figure 20);
2. Prepare a list of case organisation roles and request the IS Manager for the case organisation to nominate people who match the roles and may participate;
3. After receiving the list of names and email addresses, email the identified participants an interview invitation;
4. Upon receiving advice that they would participate, schedule an interview;
5. Hold the interview and:
   (iii) Ask each interviewee to read the case study information letter and for each interviewee to sign a consent form (blank copies can be found in Attachment Two);
   (iv) Distribute the questions (Figure 20) and circulating two models for reference during the discussion, Figure 8 and Figure 9. These are the models arising from the focus group study.
   (v) Digitally record each interview; and
   (vi) Thank interviewees for their involvement.
6. Transcribe the results;
7. Circulate the transcription to the interviewee to identify errors or omissions;
8. Correct the transcriptions;
9. Analyse the data;
10. Analyse abnormal results with the literature to seek some confirmation/clarification; and
11. Propose a modified model arising from the results of the case study.

It was originally planned to speak to members of the case study interviewees for clarification and or follow up after Step 9, but this was not required as there were no further areas to follow up.

After Step 11, results from the case study will be compared with the focus group and are reported in Chapter 6.

Questions to promote discussion

During this stage of the research (stage 4), semi-structured, open-ended questions were put to the case study interviewees (Krueger, 1988, p.62; Stewart & Shamdasani, 1990, p.65). The updated models resulting from the focus group analysis were presented to the case study interviewees for referral and discussion.

Figure 20, below, contains a list of the questions that were used during the case study interviews, and are based on those used during the focus group (except the context was more specific to the case organisation and environment). The questions contained the CSFs discovered in the focus group research, i.e. timeliness and sustainability.

When formulating the questions for the case study interview guide, the principles used for the focus group were also followed. Starting questions were general in nature and then moved to be more specific and questions considered to be of greater importance were asked earlier (Stewart & Shamdasani, 1990, p.61). The focus group questions were refined and prioritised after the focus group to make them more appropriate for the case study interviews. For example, the focus group questions assisted with group discussion whereas the case study interviews were one on one, i.e. interviewee and researcher, and the number of questions increased from six to nine and although open, were more specific.

Case Study Discussion Questions

1. What is your role with respect to your APMS and for what purpose do you use the system?
2. What are the critical success factors for your APMS?
3. How does the organisation structure affect this system?
4. What technical issues have there been with the system?
5. What level of information quality does the system have? Please explain.
6. What features have made the system useable and what features would you add to make it more useable?
7. If you were on the project team that implemented your APMS, what did you do that you would do again during the project and what things would you not do?
8. What recommendations would you make to enhance the success of your APMS?
9. Given the Draft Research Model for APMS success (Figure 18, p.174), are the criteria correct and if not which ones would you exclude and what other criteria would you include?
10. Rate the two highlighted criteria with respect to importance to the updated criteria and can you tell me why?

Figure 20. Questions for Case interviewees.

These semi-structured, open-ended questions allowed interviewees to answer from a range of dimensions. The aim was not to have to reinterview; this was successful as the clarity of the responses meant that no follow up interviews were required.

Case Description

The case organisation (subsequently referred to only as the "Case") was chosen as the researcher was aware that the organisation had tried on three separate attempts over five years to construct and implement an APMS without success. On their fourth attempt, the latest, it was reported as a success. The history of the projects is well known within the general technical community as the organisation recruited large numbers of skilled people to perform the various roles for each of the projects. As the researcher wishes to discover the reasons for APMS implementation success this organisation was considered appropriate.

The Organisation

The Case agreed to participate in the research study and although happy to be involved in this research, does not wish to be publicly identified.

The Case is a large commercial enterprise operating within Western Australia that caters for four distinct product categories and associated services. It has a myriad of SCADA and process control systems that remotely manage and monitor their production sources, while they utilise a wide gambit of other systems utilising a mixture of Unix and Windows platforms, using Oracle and SQL Server databases. They heavily use SAP R3 as their ERP system for Finance, Plant Maintenance, Supply, Human Resources, Payroll, Real Estate, Project Costing and Scheduling, Contract Management and Costing. Their presentation layer is via the SAP portal for access to the Intranet and Employee and Manager Self Service. They utilise industry standard data historian software and the SAP Business Warehouse. The Case also has a proprietary Customer Relationship Management (CRM) package for their 200,000 plus customers. They also utilise a state of the art internet for B2B, B2C and general communication and information sharing with their customer base.

Data was obtained from formal interviews and numerous public documentary sources. Semi-structured interviews were conducted with all the key players in the APMS project (as identified by the Cases business project manager). The researcher's aim was to interview as many people with different roles in the latest project as possible, although some had also participated in the previous attempts, which provided richness to the history and lessons learnt. The roles ranged from the project sponsor, the project manager, process owners and members of the core APMS team as well as to users of the system (both complex and simple users). Users include an executive manager through to an everyday user.

The Interviewees

A request was made to the Project Manager for the APMS to interview a number of people in various roles, n.b. the Project Manager at the completion of the project had been promoted and was now the Finance Manager for the organisation.

A request was made to interview people who would have undertaken the following roles:

- Project Sponsor – person who provides management, financial support the project while also providing overall guidance for key business strategies related to the project.

- Project Manager Business – person who managed all aspects of the project from the business point of view without any technical involvement.

- Project Manager Technical – person who managed all technical aspects of the project.

- Business Support Manager/representative – person who performed application support for the APMS which is provided on demand.

- Technical Support Manager – person who provided or managed the technical support to maintain or fix errors with the APMS.

- Developer – person involved in technical coding or architecture.

- Business Analyst - business person who performed analysis and defined requirements.

- Trainer / User Documentation – person who provided training and or end user documentation.

- Complex User - performed complex queries and produced reports. Also had the ability to add measures and add and edit data and textual information, where possible. Frequency of use was regular and at least once a week.

- Moderate User - performed standard queries and ran standard predefined reports. Had the ability to add and edit data and textual information, where possible. Frequency of use was regular and at least once a month.

- Standard User - performed standard queries and ran standard predefined reports. Frequency of use was ad-hoc.

- Chief Information Officer (CIO) or IS Manager or IS strategist.

- Business Administrators of subsystems where the data is sourced from.

- Plus anyone else the APMS project manager deemed relevant.

The request was made to the Case through the Information System Manager in November 2005 to undertake the case study on their organisation. Formal approval was received late January 2006 and interviews were scheduled through the Business Project Manager in March

2006. The Business Project Manager identified a list of people who met the above criteria and sent their details through to the researcher.

The Business Project Manager identified 17 people who could be interviewee candidates and he advised these people via email that the research activity was company-approved and they could participate if they wished. An email was then sent by the researcher to each person detailing the research and requesting their voluntary involvement.

Of the 17 people, 14 were employees and the remaining 3 were from contracting partner companies involved in the project. Table 8 below provides further detail on who was a project member or user. The Project Sponsor, the CFO, left the organisation at the commencement of the research and was not interviewed.

Table 8. Composition of case interviewees

Organisation	Project Member or User	Interviewed		Grand Total
		Yes	No	
Left case organisation	Sponsor		1	1
case organisation	Project Member	3	1	4
	User	6	3	9
Multinational IS Integrator	Project Member		2	2
Top 4 Consulting Company	Project Member		1	1
	Total	***9***	***8***	***17***

None of the focus group participants had been directly or indirectly involved in the Case's successful implementation, although two members of the focus group had participated in one of the previous attempts.

There were difficulties, or challenges, with the selection of a case organisation and the subsequent interviews. These are discussed further in the next section.

Case Study Challenges

A number of challenges were encountered during the selection, nomination and subsequent data collection with the case study. These are listed chronologically below with a description of each event and its impact. The overall impact on the research was a delay to this report of somewhere between 6 and 18 months.

1. First organisation approval withdrawn. An initial request was made to another organisation. It was a large global commodity company

who agreed to be involved as an anonymous case but subsequently withdrew their permission. This request and subsequent approval was obtained in January 2004. The research dissertation proposal was drafted in June 2004 with a planned start in January 2005 but permission was withdrawn in November 2004 with no formal reason given. The researcher subsequently heard that the company was having problems with their APMS implementation and did not want it publicised in any form, although this cannot be verified.

2. Research proposal adapted for second case organisation. The research plan was redrafted and another case sort. An informal approach made in August 2005 to a second organisation indicated that approval would be attained if a formal request was made. The dissertation proposal and plan was then adapted to include a focus group as a risk mitigation measure. This was to ensure the research could still proceed in the event that the second case organisation withdrew their approval.

3. Proposal, ethics approval and focus group. The dissertation proposal was submitted in September 2005, with Ethics Board approval granted in November 2005. The focus group meeting was conducted in December 2005 with final participant approval of the transcript in March 2006.

4. Case approval and interviews. Formal case approval was requested in November 2005 with formal written approval obtained in January 2006. The case interviews were conducted in April 2006 with the transcripts finalised by August 2006.

5. Problems with the external organisation providing technical services to the case organisation. As illustrated in Table 8, the development team consisted mainly of employees of a large multinational development company. Once their senior management learnt of the study and the request for their involvement, they instructed their employees not to respond to the request for interview. As they were not spoken too, no reason is known as to why they would not participate. Although unfortunate, the value of the loss of their input

will never be known but other areas that were involved reported that the technical solution was the least of the problems encountered, and the technology, although challenging, performed adequately as it had done in the previous APMS project attempts. The technical maturity of the case instance confirmed the data collected during the focus group meeting, that technical issues were not really a problem during the implementation of an APMS.

These challenges did not stall or impact the research result, although the original research schedule slipped at least 12 months. Before commencing with the data analysis it is important to understand the history of the organisation with respect to the APMS.

APMS Case History

The following history was obtained during the case interviews and the researcher's knowledge of the prior attempts. References to the people who volunteered the information are noted with their interviewee ID (C_ID) and the sequence number from the transcripts. This is the same process used previously and allows traceability as described in Chapter 4.

The Case started to seriously look at performance management in the early nineties and one of the first activities was to reorganise the regional business groups into business process lines within geographic areas. This created a management responsibility matrix where an area manager, although responsible for the end to end process, also had functional managers who could become involved and assist for their specific process, e.g. Human resource manager is responsible for all HR functional issues across process, reporting and geographic lines of responsibility. The reorganisation was done as the previous region system was considered "an inherently inefficient system as each area did the same process across six or seven regions in many different ways" *Case: BK Ref C#278*. Under a new CEO they started thinking about the process and about getting consistency in the way people did things. There was a "three, four, five year hiatus in terms of that process. So even though you were a manager of HR your mandate for the driving of consistency in the process wasn't all that strong" *Case: BK Ref C#278.* Year 2000 (Y2K) also focussed resources and energy into other

activities during the late nineties and work was suspended on process improvement.

One of the first activities the Case performed in the early nineties was to obtain and store operational information. This commenced in 1992 with the implementation of its first SCADA system. Once this was implemented the issue then became the large of amount of time series data that highlighted operational issues that had previously been masked by manual reporting inaccuracies and or adjustments, e.g. recurring problems occurred every 2-3 months and became visible through automatic reporting as previously they had been manually modified during the reporting process and were therefore unknown at higher management levels. The system also led to an acceleration of an operational data storage system, which interfaced to the additional 1992, 1994, 1996 and 1998 SCADA systems. These systems increased the automation process across the various production plants and enhanced operational analysis and reporting. Systems to store information about product quality then followed, and this information was also stored along with the operational data. Not all systems were automated and the operational data storage system allowed manual entry of data while also allowing for comments or textual remarks to be made against readings, e.g. small country installations were not automated and recording measurements continued to be done manually. While the data sets expanded over time there became a need to reduce the data and commercial of the shelf (COTS) data historians were used to summarise the time series data while maintaining data integrity and without reducing the accuracy.

During this time legislative and statutory changes increased the amount of reporting required of the organisation. Investigations then took place on ways to automate and to reduce the amount of time and effort that was being used on the manual compilation and reporting process.

Late in 2000, the Case started to look at automated reporting as it was considered one way of providing increased efficiency. The Case believed they could leverage off their new SAP ERP system and purchased

the SAP business warehouse product which uses data stored in the ERP system to generate reports.

In 2001 a project was spawned to deliver an automated reporting system. This project went for a year and although delivering a data warehousing environment, it failed to engender use of the system. No one used the reports as they were simplistic, typically out of date or just incorrect. This system used Microsoft Excel spreadsheets as a front-end and business users just didn't use it, so the system languished. The Project Manager subsequently left the organisation.

A second attempt was started in late 2002, focussing on a new conceptual approach using KIO's or key information objects. This broke the information domain down into key object areas and these are listed below. They are included in this report as they give context to the Case as well as an understanding of the breadth and depth of data and information required.

- Asset: is an identifiable item of corporate interest that the organisation owns. An asset may be a single item or a composite item. Assets can be broken down into two main groups – operational assets and non-operational assets.

- Contact: is any communication from a customer or a customer's representative (e.g. his/her solicitor) which requires a response or action by the organisation.

- Cost: total operating costs is all expenditure incurred relating to the operation of the organisation, excluding items of a capital nature, and includes depreciation.

- Debt: is owed to the organisation. A debt owed to the organisation is a liability or obligation to pay the organisation by a specified date.

- Delivery point: is a generic term used for the purpose of the definition analysis to cover the following KIO's: Customer, Account, Location, Service Point, Household and Bill.

- Incidents: are any unusual occurrences that cause, or have the potential to cause any of the following:

    - Interruption of service to customers (product or service, secondary product, additional product or service, business service, advice or other services).

- Threats to health and safety (of staff, customers, or the public).
- Threats to the environment.
- A shortfall in the Case's ability to meet the expectations of any of the stakeholders (quality, delays, damage, social inconvenience).
- Threats to the systems (either potential or real loss of capability of processes, procedures or assets).
- Threats from the systems to other systems (water, sewerage, storm water, traffic, rail, power, gas, telephone, pedestrians, etc).
- Threats to public or private property.
- Requirements for urgent action to comply with relevant Acts or Regulations.

- People: are those persons who are employed by the organisation and paid via the organisations payroll system.

- PM Order: a Plant Maintenance (PM) order records task details and resource requirements for activities undertaken by operational staff. It is the basic costing object for recording actual costs and event history for these activities. It is a concept supported by the SAP PM module, where uniquely numbered PM orders are created for tasks to be undertaken.

- Population : the number of Australian residents, that is, people who usually reside in Australia. (Source: Australian Bureau of Statistics – 3228.0 Demographic Estimates and Projections: Concepts, Sources and Methods – Chapter 1).

- Reporting boundary: is a reporting area by which a performance indicator is reported.

- Revenue: is comprised of external revenue is all money accrued from external parties as result of business operating activities; and Internal revenue is all revenue from internal customers.

- Production volume consumed: the volume of consumption is the volume of product supplied to the system. It is also the sum of authorised consumption and all product losses across the system.

- Production volume produced: is the term used to group the volume measurements of products (product, secondary product and additional product) that are handled by the business areas: product services, secondary product services and additional product and services.

- Product quality: as stated in the Quality Management Manual. This data was both quantitative and qualitative. The qualitative data was due to some of the results being *"biological and they have different tolerances and plus and minus variations and yeah a number of chloroforms to the square power yeah that's all medical mumbo jumbo.* *Case: EM Ref C#939*

This second project produced detailed requirements but failed to go any further. The reason given by the CFO was that he could see no value in producing such a system.

One of the interviewees, now the IS Program Manager and user of the successful APMS, was the second attempt (failure) business Project Manager. He explained the difference between this and the latest attempt:

> *"The scope of this project (successful APMS) was quite different to the previous attempts and what it ended up as. The previous project had issues with the scope, the sponsorship and the team involved. I'll say this up front, me as Project Manager was wrong for that. I shouldn't have been in there because I was out of my depth. However when the latest APMS project came along it seemed to get all those things right, certainly over time, maybe not immediately as it took a long time to get up and going.* *Case: EM Ref C#830*

A year went by and in 2003 the business once again resurrected the need for an APMS and the benefits it would bring. The catalyst on this occasion was an external review by a "big four" consultancy company who recommended the project be started due to the explicit performance gains the organisation could obtain from such a system.

The Program Manager then sat down and explained what he thought had gone wrong previously. He continued:

> *"…we've got to do this but I think what they did was they then sat down and took most of that on board and then they over time developed the right scope, they got the right scope sponsorship, they got the right business involvement and they then carried that through very, I should say with a lot of focus. They didn't let themselves get distracted, they had a strong business representation, strong technical side, project side as well. Now if you like, I'm going to say sponsorship for example, I mean right from the start, very key sponsorship from, well from executive, much to say from organisation executive as a whole you say you had general sponsorship, a good sponsorship there, very specifically from one General Manager who was very, very keen on it.* *Case: EM Ref C#830*

The project commenced and the system went live in 2005. As stated by the Program Manager, there was a period of two years between project start and final delivery of the first release of the APMS. During this time a

number of internal events and actions occurred within the Case that influenced the APMS success. These were:

- The development of an accountability framework;
- Business process maturity;
- Matured technology;
- Expert skills;
- Learning's from previous attempts;
- Simplicity – a paradigm shift;
- Timing was right.

And to a lesser extent:

- Sponsorship.

These are discussed further below because they are significant changes in the Case, although no clear relationship is made to CSFs as this discussion is covered in the case study Data Analysis section of this chapter.

Cases Accountabilities Framework

The Case's Accountabilities Framework, illustrated in Figure 21 below, sets out the business processes of the organisation, identifies who is accountable for those processes and explains what those accountabilities mean. It is unlike other frameworks in that people are not only accountable for processes but also for data created, modified or deleted within that process. It was developed by the organisation in order to clarify accountabilities for successful performance of the key business processes and empower managers and employees to achieve this. Accountabilities are a key platform for the organisations process improvement, a key enabler of cultural change (accountability with empowerment), and is the foundation for the organisation's key business systems. It was first approved in mid 2004 by the Chief Operating Officer (COO).

The Case's Accountabilities Framework consists of:

- Processes – These are the core processes and enabling processes which allow the organisation to provide products and services to its customers.

  Each process is broken down into a number of second-level processes. Details of the processes are recorded in the organisations information modelling system. (For this they use the product ARIS process modelling software from IDS Scheer).

- Process owners and process managers – Each process has a process owner and each second-level process has a process manager.

- Process accountabilities – Process owners and process managers have organisation accountability to provide strategic leadership and direction for their process across the whole organisation. Branch Managers, Area Managers, Line Managers and Employees have line accountability for implementing the processes within their business areas.

Review of the framework and policy relating to it is ongoing and occurs when a business process changes. Formal release occurs after review by the COO who has overall organisation accountability for ensuring that the provision of product and services achieves business outcomes through the integration of processes.

The manager responsible for organisational planning is accountable for maintenance and review of the framework as part of the strategic planning process. The framework is reviewed at least annually and process owners are responsible to provide recommendations for any changes to their processes to the planning manager. Process Managers are accountable for maintaining their processes, including appropriate documentation within the organisational wide business management system and recording the results in the organisation information modelling system (ARIS).

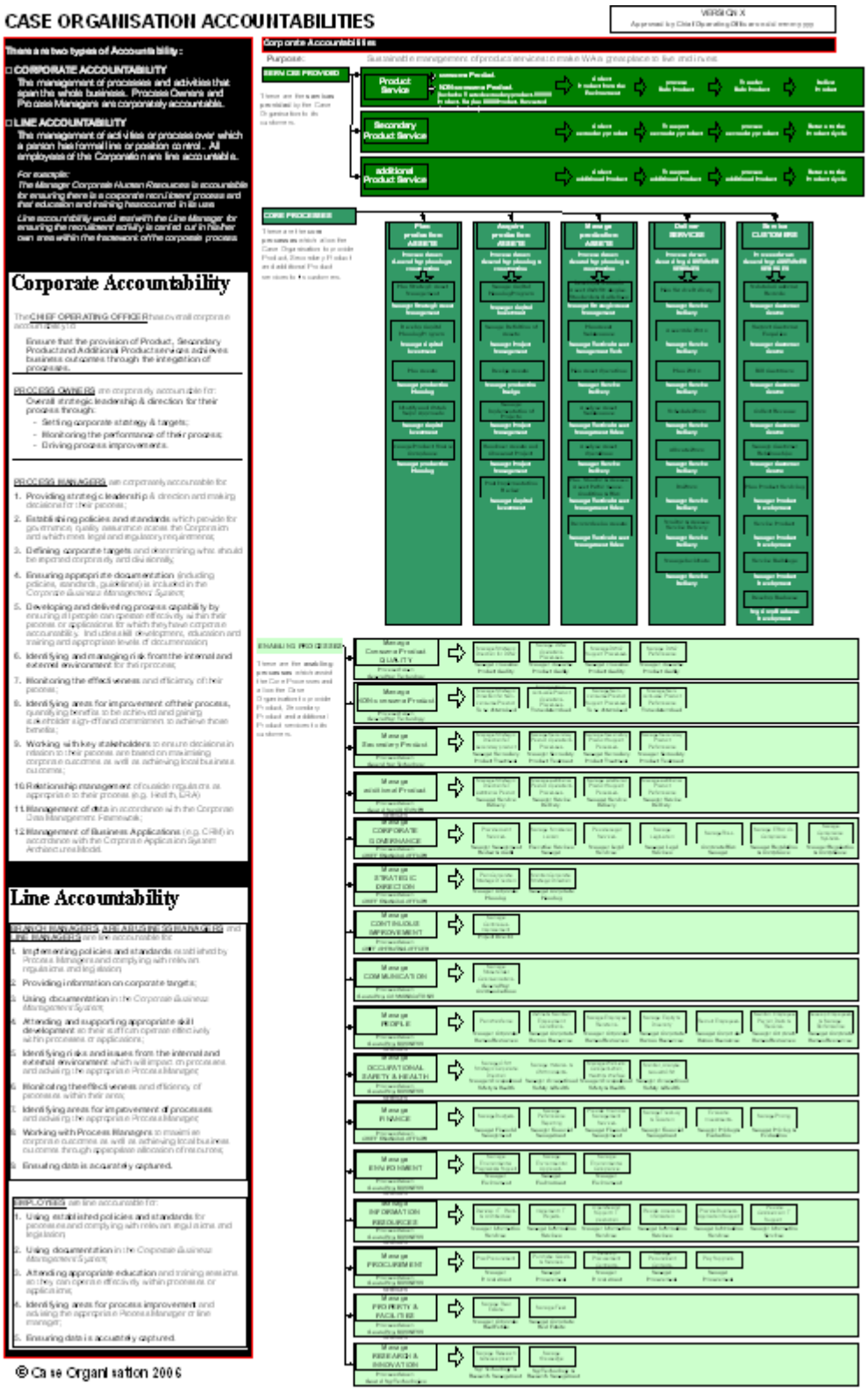

Figure 21. Case's Accountabilities Framework (case organisation, 2006)

For each process in the Case's Accountabilities Framework a business process map is defined in ARIS. An example of an ARIS process model is illustrated in Figure 22, below.

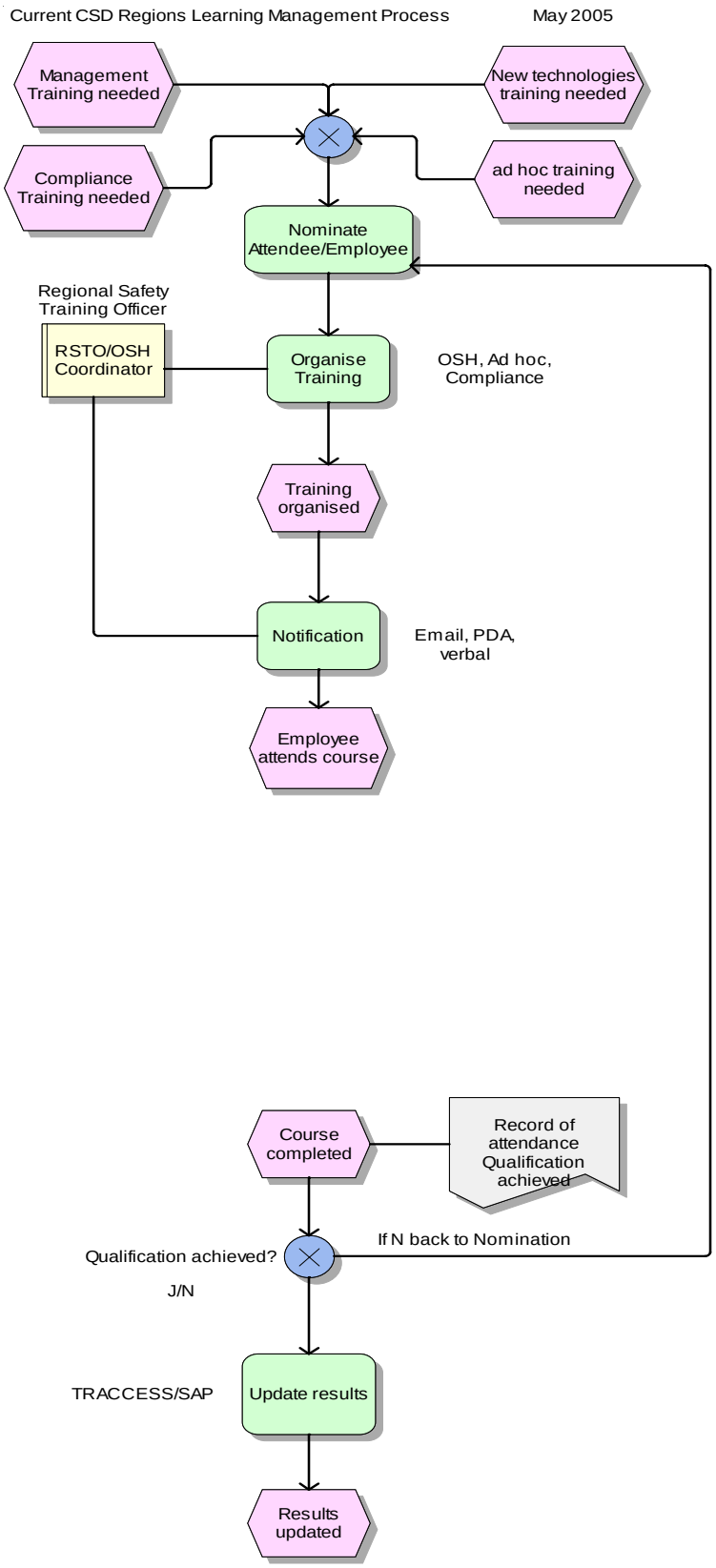

Figure 22. Example of ARIS Process Model.

The importance of ARIS to the case organisation is that all employees can access the Framework through the intranet and can drill down on the process to see lower level processes as well as other details,

e.g. Process Owner, Process Manager, KPI's collected, data collected, the source of the data (systems or processes) and examples of reports. ARIS as a tool supports formal change control when updating the centralised database or publishing processes or other models to the intranet. ARIS supports many types of models some of which are business process models (called Event-driven Process Chains or EPC's), entity relationship models and object models. Examples of these and other types of models are contained within Appendix 5.

ARIS through its internal controls does not allow duplication of a named process which means that users, when they create processes, must either select existing defined processes or use unique names, e.g. Production product 1, Production product 2 and not just "Production product". This then reduces the risk of misinterpretation. Another aspect of the Case's ARIS implementation is that a large number of employees (100+) have been trained to create and modify processes, while the IS group are responsible only for standards, procedures and administration of the ARIS system. This means that most employees can manage or have input to control their respective business processes which after approval by a process owner or manager, are then available to all employees and contractors via the intranet.

The Case's Accountabilities Framework empowers managers to make decisions and follow up across the organisation, which was lacking previously. As one interviewee stated:

> *"I guess with the accountability model and your brief, your mandate as manager of HR is to mandate organisation processes is considerably strengthened so that we were then in a position both the technology platform in terms of systems and a capability to drive singularly consistent process across the organisation and an interest in measuring the performance of that process. Now I guess we were there as an organisation and by early 2000 but I believe that getting those, a group of people together who saw measuring and reporting as a single important capability for the organisation or one of the things that would enable us to respond to those drivers for efficiency."*
> ***Case: BK Ref C#280***

What this says is it that even though the organisation structure was in place there was no mechanism to allow a manager to be resolute on improvement and consistency. The endorsement of the Case's

Accountabilities Framework by senior management allowed a process manager to go out of their functional comfort zone and tackle inconsistent process and performance measurement in operational areas.

The Case's Accountabilities Framework empowered not only process owners and managers but clarified and set a framework for accountability and responsibility across the whole case organisation. In the prior APMS attempts, the organisation managers were responsible but were not accountable for performance measures, had no formal structure to report and therefore had no requirement or need to engage or become involved in the previous projects.

As put by the IS Manager, the Case's Accountabilities Framework supported the IS group and their APMS project.

> *"…so support the accountability (framework) in terms of the intent of clear accountability, being able to report on process, process performance, those things…. it's a very useful tool for us, particularly in the higher levels.* ***Case: DC Ref C#729***

Bovens (1998) puts a different view where he describes the "problem of many hands" (Thompson, 1980), i.e. in complex organisations it is difficult to attribute responsibility to the organisation as a whole and where attributions to individuals are made, impediments to accepting full responsibility abound and he uses the example of the Challenger space shuttle disaster as an example (p.4). More information on "responsibility but no accountability" and the affect in complex organisations can be found in Bovens (1998) and Thompson (1980). The Case's Accountabilities Framework assists in solving the "problem of many hands".

Business Process Maturity

'Maturity' has been proposed in other management approaches as a way to evaluate "the state of being complete, perfect, or ready" and the "fullness or perfection of growth or development" (Oxford University Press, 2004, cited in Kueng & Kawalek, 1997, p.1355). Business process maturity is not within the scope of this research but the amount of time allocated and the number of resources increased over the last number of years in the case organisation to improve the effectiveness and efficiency of business

processes. According to Maull, Tranfield, & Maull (2003) time allocated and resources are factors that provide a "weighting for readiness to change" (p. 605). Another example of how to define maturity (or in their case "process condition") is provided by DeToro and McCabe (1997, cited in Rosemann, de Bruin, & Hueffner, 2004), who use effectiveness and efficiency as two dimensions to rate maturity. Given the increase in these factors this thesis will argued that the business process maturity has increased in the Case and through this process maturity, business then derives value from IS (Mooney, Gurbaxani, & Kraemer, 1996, p. 74).

The Case's Accountabilities Framework works extremely well in enforcing responsibility and accountability but this activity also occurred when there was an increased level of process maturity, i.e. there was a collective agreement that having defined and operating standard processes was beneficial for the organisation as a whole. As illustrated by one interviewee:

> *"When you talk about organisational structure we had our certain geographical hierarchy but also our divisional also our process hierarchy and in the last year or so the business has shifted more towards managing along process lines".* *Case: AD Ref C#29*
>
> *"Is that the accountabilities framework?"* *Case: Researcher Ref C#29*
>
> *"Yes the Accountabilities Framework exactly. In the past the reporting wasn't aligned with that. It was all aligned with Divisions – CSD, Finance and Communications Business Services. It was all aligned to divisional structure rather the processes. I guess at a time that we are trying to move towards the accountability model this project was really important in that it changed reporting to try and reinforce that message because until the APM system started delivering those reports along process lines the message was out there that OK accountabilities framework was in but without the reporting line to it, it didn't have a great deal of acceptance. There was one message coming from one side of the business but from the reporting side it was the old way still. Ultimately people were relying on reports to judge their performance so they thought well we're not being judged along process lines then."* *Case: AD Ref C#30*

The process models in the beginning were defined using a brown paper method. "..so basically what we had was brown, a big brown sheet, roll of paper with text cells, diagrams mapped out, you know, this is the

board level, this is senior management, this is branch and, and we sort of linked them all up with circles, and this will feed into that, and conceptually that was it." Case: MG Ref C#324

And as put by the IS Manager:

> *"And I guess as organisations evolve, us like a lot of others, where we started to lever is to provide well like this, management information and performance information which is not about individual processes, it's about bringing, matching information at a higher level and deriving some intelligence out of that".* *Case: DC Ref C#737*

As the organisation process maturity increased, the organisation as a whole started to understand that individual processes were not what they should manage and measure; so they began to look at a more holistic view, hence the agreement to implement the Case's Accountabilities Framework.

The ARIS tool used for modelling organisation information cannot be overlooked as an enabler in the organisations ongoing business process improvement. As already stated, the tool allows all employees and contractors access to the "approved" business processes, enforces a standard way of defining and documenting business process improvement while also providing a consistent standard "language" for communicating processes throughout the organisation. Other (or better) tools may also provide this functionality but only ARIS is used within the organisation although some working documents were also found to be in Microsoft's Visio file format.

Matured technology

From the first instance of the project in early 2000 and 2001 the Case embarked on implementing an APMS with a number of SCADA systems, an updated SAP R3 ERP system and a new data warehouse. The reporting was batched and the presentation layer was via a set of spreadsheets. The data was always late and mostly incorrect. It was very ad-hoc. As put by the IS Manager:

"But so what are the issues so the extent to which we would use standard SAP functionality versus building extra stuff, the extent to which we would try to improve the underlying warehouse capability or build that rather than just follow it on. We have a few versioning type things in there so I guess nothing, they weren't, there was all sorts of stuff you work through." *Case: DC Ref C#741*

And as confirmed by the then project manager:

"Technical issues did exist." *Case: EM Ref C#875*

The Case had decided to use the existing components and build an APMS. As time went by, the next attempt in 2002 never got past the logical level when defining the "KIO's", although other projects continued on delivering SCADA, data historians and data warehouse solutions (and environments). Technical upgrades were made to the ERP system and SAP R3 was joined with a B2B and portal environment in late 2003.

The successful project started in 2003 culminating in the project cutover for the APMS in 2005. When questioned about the technical issues typical interviewee responses indicated there were no technical problems, or minor ones that were solved, with the environment.

"Not Technical problem." *Case: AD Ref C#62*

Technically it picks it up really well and there is a high level of integrity because there is no manipulation of data once it's pulled in." *Case: LT Ref C#1783*

The technology had changed and had become reliable, "it matured".

A General Manager that was interviewed expressed the opinion that the technical environment had to be expected to have problems and would improve over time. As he stated:

".. so while it's a novelty in terms of you know using new technologies and being able to control things locally. I think people tire of that quite quick and obviously PC's and local data bases and those things are not new anymore and people want to move on it's how you want to get benefits of Corporates and Enterprises and you know that's the new domain rather than doing the old domain of data integration and so yep there will always be, there will never be the perfect situation where you push a button and you get the total amount of data and information from an organisation but I'm absolutely sure there will be less and less and less as you go forward. *Case: KC Ref C#1645*

The successful Project Manager opinion was that although there were problems with the technology, it was easier to deal with than the organisational and business management change. As he stated, "As far as the technology cause, generally you work around the technology issues." Case: MG Ref C#49. When asked to rate the APMS technology, where 1 was low and 10 high, the response was "Upward 7." Case: MG Ref C#49, indicating that technology issues were not an important project management issue.

The General Manager also expressed a point of view that the APMS approval to proceed was given four times as they believed that the technology issues would be overcome and that there were significant benefits in an APMS. As stated:

'Those are the decisions that will be made without undue fear about the technology risk as it was known that the benefits would come."
Case: KC Ref C#1659

Expert Skills

As with the technology, the corresponding skills within the project team improved from the start of the initial project in 2000 through to its third restart in 2003.

As stated by the Project Manager, "*The critical success factor is good people."* Case: MG Ref C#376., and from another interviewee, "*Yah it was due to the skills, the skills and the approach as well.*" Case: AD Ref C#90

Skills were also imported into the team from external consulting firms as stated by the Project Manager.

"So don't try and reinvent the wheel but try and examine other systems, bring in people that have had experience in other systems so in terms of an advisory capacity or consultant capacity." *Case: MG Ref C#454*

But the IS Manager stated that one external consultant caused quite a bit of "angst" due to his expert knowledge but this may have been also due to the ongoing change management and professional follow-up that the consultant performed during the project. As stated:

"Large Multinational Outsourcing Vendor arrangements and all of those things... professional change management and consultancy role … I think that was a key success factor and also caused some angst but appropriate angst giving all that I suppose, you know he was driving us all up the wall b... that strength of the whole change management stuff and it forced us to deal with a lot of those issues that we might well not of so some of that clarity so exactly what are you doing and why is this and have we sorted this out, what about this, we said this yesterday and that. ..... So I guess his role or that sort of person in a project" *Case: DC Ref C#777*

In the main the IS Manager agreed the consultant had worthwhile traits but maybe could have approached the issues and daily problems in a less confrontational way. He went on to say:

".. having kind of third party organisation created some interesting tensions that were probably a significant factor in this. So at the end of the day you'd have to say he contributed, probably had a reasonable contribution to the success but at the same time caused some sort of tension and angst along the way particularly in the early days" *Case: DC Ref C#777*

The Project Manager also agreed that the external advisor was valuable and an essential team member.

I think I know now that, and I guess that was one of the good things having an external advisor in, that we're saying that this is what we did, these were the issues that we came up with and you need to focus on that one there. So I guess having an understanding of that, and understanding where we wanted to go in terms of that organisation's culture, you know, it has helped to say we need to focus a lot more time in that area there, so. *Case: MG Ref C#588*

One important observation was that the consultant, although with the project team for nearly three years, was considered an "outsider". Words

like “external organisation”, “external advisor” and “vendor” were commonplace during the interviews. Never the less, the team was well skilled and even given the extended period of time when people left the team, they were either replaced by someone as skilled for their area of specialisation or it was covered by another team member. Some team members were promoted or left the organisation for better jobs. As explained by one project member.

> *“It was a good time to reposition yourself. It wasn’t about and it wasn’t internal and I don’t know that it was about individuals they were thinking more once this project ends, where do I go to from here and is there going to be anything more exciting in this organisation that’s going to feed my need.”* *Case: LT Ref C#1898*

Learning’s from previous attempts

One important aspect that came out of the interviews was a belief by a number of the interviewees that the success was due to the previous attempts.

But were the previous APMS attempts failures? The previous IS Manager, who is now an area manager, did not believe so. When he was asked on two occasions, “Were the previous attempts failures?” he replied on both occasions “No, they didn’t deliver.” Case: BK Ref C#198. He never really explained what he meant but the same sentiment was echoed by the previous attempt Project Manager when he said:

> *“…I think the previous APM attempts possibly was a good learning one because I mean people saw then that there was a lot to this”.* ***Case: EM Ref C#901***

The General Manager that was interviewed added some background into the strategic thoughts and reasons for approval to implement an APMS. He believed the journey started way before the year 2000 and was continually refined.

> *"Based on the history of that I guess you know the way the system was before we started the APM system was I'd say 5, 10, 15, 20 years of evolution and of failure and frustration and other sorts of things and so you know I think it's not easy but it's much easier to define what we wanted as an outcome and the option of modify that in terms of and maybe enhance it and modify it in terms of what the technology could deliver. And then sort of drive it through but in terms of a starting point the I think we were much further down the way in terms defining an outcome and I guess from my experience in with IT systems the more vague you are in terms of what you want as an outcome the more problems you're going to have because the technical people can't steer the business solution. Ah they can try and write flexibility all the way through and you know with something which has infinite amount of flexibility but misses the target. [39:35]* *Case: KC Ref C#1718*

The previous IS Manager, the previous Project Manager and the General Manager, set a scene where there were real learning's by the Case from the previous attempts. They learnt that this was a very difficult undertaking and would take time and needed the business requirements to be clearly defined. It could be argued that this is no different to any IS implementation but going by the comment by the General Manager that they started this 5, 10, 15 or 20 years ago, indicates an evolutionary requirement while the business and organisation changed and matured.

One of the project team members interviewed, a financial analyst, who had not been employed by the Case as long as the other three had a more modern view. As she stated:

"The question is that during the years, because this has been tried many times here, did those iterations have to take place and people building their spreadsheets and their Access data bases and all those sort of things to define what the KRA's and the performance, was that all necessary? Yes, I think so. I suspect yes unless you had some, because basically it's just a learning curve. Basically you're just going throughout your business and you think oh, I think I should measure that because I really think that it's quite helpful. Can you go off and get all that information. So it's really just a learning curve and it's actually growth. I mean you're growing from this point to here now. Do you really want to develop a KPI that you haven't tested the ground and is it useful? I mean we may have even done that in the APM system. We may have KPI's out there that perhaps aren't that useful but, do you want it, because bear in mind there is a big cost to developing it up, so I think you have to really have some test of the ground a little bit. So, it probably wasn't a bad thing to have gone through all that. I mean, what else did they have available to them. We're talking about people that probably are one of the first lot of guys, probably one of the first users of Excel 20 years ago. So that's where it's grown from and I mean it's been a long period of growth. *Case: LT Ref C#1934*

She substantiated the 20 years growth through her view of spreadsheets and individual learning. Not only from a spreadsheet perspective, but from an organisation learning perspective, where business process, measures, KPI's and individuals gave their collected knowledge into the system to make it a success.

Simplicity – a paradigm shift

The previous projects had a history of trying to replicate the reporting and analysis that was being done manually, it resulted in many thousands of individual detailed requirements, .e.g. the weekly and monthly statutory and regulatory reports were very large. The measures were still required but the way they were presented needed to be simplified as 'Making something simple can be hard' (Personal reflection of the researcher). This simplicity was achieved as:

"Because I remember when the packs were done before they used to be like six inches thick and. Yeah now they're really thin. And double sided and landscape and now they're only like three pages or something. Oh well, up, up to twelve, say." *Case: JC Ref C#1471*

And as stated by the General Manager:

".. one of the things people have said to me so far is that what they love about the technical system is it's simplicity". *Case: KC Ref C#1629*

Similarities can be drawn with the approach adopted by the Case as it parallels the approach taken with the balanced scorecard where "the simplicity and intuitive logic has been a major contributor to its widespread adoption as it is easily understood by users and applied to their organisation" (The Centre for Business Performance, 2005, p.9). This simple concise format was confirmed by a project team member.

" But primarily that was definitely an opportunity to move away from how we were reporting before; that it was too big, too much, so much that people weren't interested in even looking at it, obviously not every single line of the report. It (the APMS) simplified it, it made it standard so there's a lot more people who will be more inclined to view it." *Case: LT Ref C#1843*

Timing was right

One aspect that can't be discounted is that it was just the right time for the case organisation as all of the factors came together at the right time. As one expert user put it:

"It was the right time yeah the timing was great. We got our new reporting coming in to coincide with a change in the accountabilities framework, a new accountabilities framework so that worked well. I think it was just a continual reinforcement of the message that " Hey there are some real benefits with this, this was all going to be standardised and simplified". And they had their, it was under the guise of the wider PIP initiatives as well - The Process Improvement Program and that was all about simplifying and standardising. So it was already that backing if you like in place as there was a lot of projects going around the organisation pushing those principals so it wasn't as though this reporting project was the first time they heard there was a real push on to standardise and simplify. So I think because there was that wider PIP project going on it made a bit more sense to people and they warmed to it a bit quicker. And they could see how it fit in with other changes that were going on in the organisation as well." *Case: AD Ref C#141*

The Case over the years tried unsuccessfully to implement an APMS but never lost sight of the final goal and continued each year until it succeeded with a successful implemented APMS. On each attempt it appeared to learn from the previous attempts, culminating in getting it right.

There is always the chance that it was good luck and not good management, and the set of critical factors aligned without any management involvement, although the case organisation may well have just reached the capability maturity to make it work, i.e. the tools, technology, management structure (Case's Accountabilities Framework), cultural and behavioural appreciation of its importance, etc, all lined up at the same time (Maull et al., 2003). On previous occasions they had tried to go from the initial level through to a more quantitatively managed level without going through the intermediate steps (repeatable and defined) (DeToro & McCabe, 1997; Harmon, 2004; Herndon, Moore, Phillips, Walker, & West, 1993; Paulk, Curtis, Chrissis, & Weber, 1993b; Rosemann et al., 2004).

Sponsorship

Sponsorship was referred to during the interviews many times. Historically the sponsor, the CFO, had been involved in the previous attempts as well as the successful attempt. The researcher did not interview the sponsor as he left the organisation a week prior to the interviews commencing.

Most of the interviewees had similar opinions about his involvement and the effect. One question that came up time and again during the interviews was "what was the sponsor's degree of involvement between the previous attempts and the last successful one? Generally the answer was yes – no involvement in the any of the attempts, including the successful one. The Project Manager saw it slightly differently. He believed the sponsor was a hindrance as he was highly political. The sponsor was more interested in aligning himself with senior management as he saw risk to his career with implementing a system that had been seen to fail many times before and as the sponsor was an accountant he felt that only accountants should deal and report the performance measurements and that they should not be readily available to all. The Project Manager felt therefore that he had to take on the champion role as the sponsor would not do it. As he stated:

> *"It was because I guess I, I meant, I think I'd be handed the de-facto champion of it, I had the CFO there as a sponsor there, but he was hedging his bets, in politics.* *Case: MG Ref C#444*

And previously he stated:

> *".. the sponsor of the project being the CFO, okay he was a barrier at that point there, and, and we were saying, look this is where, this is where it's at and, and I had to tread wearily on that one but certainly I, we kept on pushing and pushing and pushing and I was also having discussions with the Chief Operating Officer and the other General managers so I was building a bit of a groundswell and then we went back. He finally, he finally agreed to have that in scope for them for them."* *Case: MG Ref C#440*

One finance user though believed the CFO had performed in his sponsorship role.

> *"Who was the Sponsor? The sponsor was as far as I know was the CFO ahh he did. He didn't have a lot of hands on involvement but he did what he needed to do in his role. In other words he pushed the message at the right level with his pitch he pushed the General Managers he pushed that message and he pushed the CEO as well."* *Case: AD Ref C#23*

Sponsorship was really pushed down and through the organisation via the structure established by the Case's Accountabilities Framework, i.e. process owners and managers.

What actually happened is that sponsorship became less important as "ownership" had taken over. As explained by the IS Manager when asked about the Case's Accountabilities Framework and its impact.

> *"Largely probably invisible, we don't necessarily have the, which is an issue, maybe we should but we can't sitting in there, I guess as a tactic for me, I mean it's finding that right balance. I think it's, I mean I think these things work better when the business really has ownership, it would be nice if they acknowledged that we've sort of facilitated but if they go we did this and we did that, I think that's really the key ."* *Case: DC Ref C#751*

The learning here is that this senior manager was unaware of the role of the Case's Accountabilities Framework and its impact on sponsorship. As stated previously the Case's Accountabilities Framework was devised and established by the strategy group within IS but even its manager was unaware of its impact until asked directly about its influence.

Case Study Data Analysis

Data from the interviews obtained from the case interviewees was the sole source of data for the analysis in this section. This analysis, as per the focus group analysis, looked for material, concepts, social and psychological structures to analyse why things are as they are and to hypothesise the structures and mechanisms that shape the reported events, i.e. the CSFs. As stated in the previous chapter this is in accordance with Mingers (2002, p.302) and examples include:

- Material, "or objects of human need" (Jones, 2003, p.37) – software (e.g. SAP ERP, Business Warehouse), operating and training material and resources (dollars and people);

- Concepts – data accuracy and frequency as a construct for evaluating data quality as a CSF, screen design, response time as a or evaluating system quality as a CSF;

- Social – organisational structures and management support as constructs for evaluating management support and user participation as CSFs; and

- Psychological – quality of training and team skills as constructs for evaluating resources, system quality and team skills as CSFs.

As before, some of these may be grouped in more than one structure. For example timeliness could be argued as a concept or part of a psychological structure.

To assist in this process, conceptualisation was used during the analysis of the research data (Corbin & Strauss, 1998).

The Case interview transcripts were reviewed and the same process used in the focus group analysis was applied, i.e. assigning success factor codes from the Wixom and Watson success model to relevant interviewee statements. To facilitate cataloguing, a raw category was first assigned and this "first impression" was used as a guide to then align a Wixom and Watson success factor.

This approach assisted in the writing up of the results as it linked similar concepts together within a success factor group. It also allowed for

common factors to be aligned between different interviews as different interviewees statements were grouped together.

In some cases the alignment to the Wixom and Watson factor was obvious and for others it was not. These difficult areas were initially categorised as 'Unexpected results' and are discussed later in this chapter. The focus group discussion relating to the Wixom and Watson success factors are discussed first.

A sample from the completed data analysis sheet is contained in Appendix 3.

To allow traceability of the results, quotations included in the data analysis below have the case interviewee's unique identifier and a transcript reference. The unique identifier complies with the requirement to maintain the interviewee's anonymity and the transcript reference allows for identification of the quote source and sequencing in the transcript. This process was the same as followed for focus group data analysis. It was adapted from grounded theory (Corbin & Strauss, 1998) and helped the researcher identify quickly where the quote came from in the conversation and allowed for the quote to be interpreted in the context of the surrounding conversation. This assisted when the quote was unclear or subject to misinterpretation, and helped in tracing data analysis and coding errors (that did occur and were hence easier to understand and rectify).

Wixom and Watson (2001) success factors

The analysis of the case data is presented below and references the success factors in the updated model and previously discussed literature. Each success factor from the updated model is taken in turn and analysed to see if the case interviewees provide support for the factor. While defined in Chapter 4, the success factor definitions are repeated in this analysis to assist with readability.

Differences between the focus group and case study are not specifically discussed in this chapter but are covered in the next, Chapter 6. This allows for a more distinct view of the case organisations success factors.

Management Support

Management support was defined by Wixom and Watson (2001) as 'widespread sponsorship for a project across the management team' and was identified by them as one of the most important factors for data warehousing success (p.23).

Case interviewees generally agreed that management support was a factor for success of APMS. This, in the main, was due to the numerous previous attempts and the Case's Accountabilities Framework that gave the Project Manager the ability to make managers accountable. As one area manager put it:

> *"Yeah. It (Accountabilities Framework) enabled us to then to get it to a point where you could command the resources and the line managers needed to cooperate, would cooperate actively, as opposed to sort of, some saying, thanks XXX{Project Manager) we'll get 'round to it".* *Case: BK Ref C#282*

The Case's Accountabilities Framework puts a structure in place to compel or coerce management support as the framework was already endorsed by the COO and no further approval was required. The Case's Accountabilities Framework therefore focussed management support.

Management support also came from the Board once the APMS was operational as stated by the IS Manager. Case: DC Ref C#761

While the users of the APMS believed it was endorsed from the beginning of the project.

> *"I suppose the key factor in the APM system success is the board took a stand and said there'll be one report and one report only and that message went right through to the top to the bottom."* *Case: GB Ref C#972*

Champion

A champion is defined as a person in the organisation who "actively supports and promotes the project and provides information, material resources, and political support" (Wixom and Watson, 2001, p.23). Not all interviewees understood the role of a champion and for those that did, they did not believe it was required. An example:

"The champion of the project as far as, there's no single person. They had [the project manager] and [senior consultant]. The champion for the business side? We had a group of stakeholders that actually would sit down and discuss where we were going and don't ask me who they are." *Case: LT Ref C#1948*

The Case worked with agreed structures that supported the APMS initiative. So as a concept, employees and contractors working in the Case did not actually make a distinction of who the champion was. In fact one project member did not even believe a champion was necessary.

"Well, well, I'm just thinking about things, if you don't have management support it can't happen, if you don't have champions it would still happen I reckon. Resources gotta have them, user participation gotta have it, gotta have the team together to do it, gotta have the source systems, gotta have the technology, so that's how I, you know. "

So champions are not important to you?"

"No". *Case: JC Ref C#1569*

The General Manager interviewed even struggled when asked "Who was the champion for the project?" His response was *"I think it was our CFO".* Case: KC Ref C#1683

Unlike the focus group, the Case interviewees mentioned stakeholders rarely and when they did it was always within the context of the Steering Committee for the APMS project. Typically they spoke about stakeholders, problems or review points. As stated by the Project Manager:

"As we were moving through the key gateways and milestones for the project we'd go back to our critical stakeholders. You know we must have gone back to the executive team a dozen times, as a group." *Case: MG Ref C#3803*

In contrast to the focus group, no evidence of a link between champion and stakeholder was found within the case other than that they existed, but were distinct roles. This is discussed further in Table 12, Chapter 6.

As one focus group participant commented, some interviewees mixed up champion with sponsor. As evidenced by:

"The sponsor was as far as I know was the CFO": *AD Ref C#19*

The concept of sponsorship was well established in the case organisation project management structure. In the main all interviewees identified the Project Sponsor as the CFO, but his actual role in the success of the project differed. As substantiated by the Project Managers statement:

> *"… the CFO who was the project sponsor, he was going to go and meet two of the directors on the board and give them a lot of one on one discussion with it. That didn't happen and whether he procrastinated or he was sort of taken by events, that didn't happen. He mentioned that at his last, last board meeting that he attended that there's going to be changes to the reporting system and then he left. So then I had to go to the CEO and say look I'm in a bit of a quandary now, this is all the things we agreed and you've talked about this, now are we are to go or no go to the board with the report, either in hard copy or online. So I had to spend a lot of time with him again and I let him look at it and then he came back to it about a week later with some changes that he wanted done, and some of those we're considering and some of them I said well you know that, we had looked at that but that wasn't part of the overall, you know we have, we have dismissed that for a reason, so I've gotta go back and have those discussions with him."* *Case: MG Ref C#630*

When questioned about the management support, sponsorship or championship and asked who the "champion" of the project was, the Project Manager replied:

> *"Okay. That's a good question. When you say champion of the project? Of the system, of the concept that, was it a whole, was it management support in general or was it a group of managers, or was it one in particular? That's quite interesting because I talked about this being a cultural change project in change management at that level. In the start I felt that I was doing this project on my own, whilst they had a 'champion', I'll use that in inverted commas.* *Case: MG Ref C#404*

Generally the Project Manager did not believe there was a champion and that was consistent with the findings from other interviewees.

'Champion' as a success factor, therefore cannot be substantiated, but sponsorship as discussed earlier in this chapter can be. Although there

was only one identified sponsor for the Case APMS, sponsorship resulted from the Case's Accountabilities Framework representing what the researcher believes is a form of 'management collective'. This collective is a senior management team empowered to execute and represent all of the operational and strategic management facets of the Case's business. They are all encompassing and as a group are all powerful.

Resources

Resources "include the money, people, and time that are required to successfully complete the project" (Ein-Dor and Segev, 1978 cited in Wixom and Watson, 2001, p.23). As stated in the focus group chapter, skilled resources are important to an APMS implementation as they are typically expensive and resource intensive undertakings are traditionally operationally mission critical.

Technical resources did not seem to be an issue and there was sufficient computing infrastructure available to the Case. Technical skills were also satisfactory and readily available. The project team's business resources seemed critical to the success and when the project manager was asked about "obtaining resources", he responded:

> *"I was very careful in terms of the people that I recruited on the project, from the business, I wasn't involved in the recruitment of the technical people but certainly for the business people, but there it was really quality and not quantity. We're under resourced but I think that was offset by having quality people on the team."* *Case: MG Ref C#306*

An expert user, now the user administrator, who provided ad-hoc assistance during the project, confirmed this by stating:

> *"It was always a stretch with resources but yeah I would say they were just barely adequate."* *Case: AD Ref C#112*

When asked about resources, one finance specialist on the team did not respond and in fact refused to answer the question. The interesting point is that this interviewee had taken over from a person who had left for a promotion and had lots of work to fix up and catch-up on. Case: LT Ref C#1958 She also did not truly seem to understand the amount of business

involvement. When questioned further, she would not provide any further explanation.

Ongoing support was catered for from within the project and like the focus group was a point of discussion, although it seemed to have been sufficiently catered for as confirmed by the system administrator:

> *"It's(support) not really a big ask. As far as skills go there is the IT technical side and we have those skills within the organisation anyway. They will obviously be working in other areas and on other projects but when we need them they are available for us. And at our end we have got a handful of people that look after the maintenance and it's not that complex so if the staff change it's a fairly easy handover. It's not as though you've got to go and study for 12 months to understand how to use the system. From a user point of view it's very intuitive and from a maintenance, support/maintenance point of view as long as you understand the Corporate systems this one pretty intuitive too. You know what you need to do."* *Case: AD Ref C#131*

The Case's APMS design and system quality seems to have catered for minimal ongoing resources for support and maintenance. For a system that is used for all performance measurement across this fairly large organisation, i.e. "shop floor to board", it is quite an achievement. System quality was catered for within the Case's APMS implementation.

As raised with the focus group, comments were also made about sustainability of the system itself and these comment are discussed later in this chapter.

User participation

"User participation occurs when users are assigned project roles and tasks, which leads to a better communication of their needs and helps ensure that the system is implemented successfully" (Hartwick and Barki,1994, cited in Wixom and Watson, 2001, p.24). As stated by the focus group, user participation was considered essential to the success of an APMS implementation and this was achieved at the Case. The IS Manager reiterated this:

> *"Huge business engagement. Huge business engagement. Business, yeah but not just business engagement but business involvement or allocation to the project."* *Case: DC Ref C#808*

When subsequently asked if this included 'leadership' he stated:

> *"Yeah so the leadership of MG (the Business Project Manage) was absolutely key …and three or four highly experienced people on the project team full time, that's what I mean, commitment of the business to the project."* *Case: DC Ref C#808*

He went on to explain what had happened in the previous attempts:

> *"I mean previous APM attempts have, you were struggling to get bits and pieces from them so that's what I meant about the team. And I think, I mean arguably I mean credit to him, I think we had a stronger technical team for previous APM attempts (2) than we did for the APM system. … I think those are the two so what are the gaps? I think we had a stronger technical capability that made things a bit more possible, I said I think, like business warehousing, you know the APM system, a few of those things in place probably helped."* *Case: DC Ref C#810*

The Case learned from their previous attempts, had business engagement and a strong technical team.

An important quote by one interviewee is where he explained that people were their business processes and that these people need to be involved. As he said:

> *"So our process is people, especially the report controllers, should go into these ones and have a look and see if there's some data error or data correction or something that they can see it's not correct, that has some flexibility to go in and change it (in the source system) but not true the APM system.* *Case: GB Ref C#1054*

The fact here is that this user understood that to correct the APMS all he needed to do was correct the data at its source and it would flow through. While this may appear trivial, it is an important example of the success of the training and the impact of data quality and its impact on process.

As in the focus group discussion, spreadsheets were mentioned briefly but mainly with respect to data quality and having them replaced by the APMS for corporate performance measurement, management and reporting and not the threat of their removal as stated in the focus group sessions.

Team Skills

Team skills are important to an APMS implementation as "People are important when implementing a system and can directly affect its success or failure (Brooks 1975, cited in Wixom and Watson, 2001).

Team skills in the Case included both technical and interpersonal abilities. As already stated, two interviewees believed the success was due to the skills of good people and the approach. Case: AD Ref C#90 & MG Ref C#376.

The ability of the business and technical team to work side by side was also considered to be an important factor as the previous project manager observed from looking into the project:

> *"One very good thing I think maybe which is not so emphasised is a significant business change project team working side by side with a technical team and a lot of effort and almost as much resources, time and so on and in many senses they've got the more difficult job, they got to sell it to the business, they got to change the business culture, they got to keep the business interest there, they got to handle the business expectations so that really was very strong."* *Case: EM Ref C#905*

The Case project team not only had strong team work and technical skills, but this was also complimented with strong interpersonal and advanced communication skills to enable them to perform their tasks well. This is best typified by the reference given by the Project Manager about his team:

> *"Coming from finance, but the personal attributes of those people, you know they were very motivated, they were good communicators, they were self motivated to actually go out and do things so they, like effectively self starters in a lot of respects. So they were the type of the attributes that I saw that these people had, so you didn't have to, I mean you had to push them but they were also, we've got an issue here, go out and do something about it, and they would go out and do something about it and they realised that at the end of the day, no other person within the team knew more about it than they did effectively, you know so whilst I, you know."* *Case: MG Ref C#398*

This confirms the work by Ancona and Caldwell (1992, cited in Hacker & Lang, 2000, p.225) that interpersonal skills are important, as team members must work together to complete a task and must also work extensively with non members .

As identified in the focus group some form of bias from the Case interviewees must exist as they believed that they were all personally instrumental in the success of the APMS and they all considered themselves "experts". They agreed that being a member of a team or having good team skills, was considered to be very important.

Team skills then also means the need for expert business people or "functional" experts in an APMS team as well as technical experts. This need for functional experts is aligned to not just expert participation but also the data in the source systems and the intrinsic meaning of the data contained (Markus et al., 2002). This was confirmed by the General Manager when he spoke about SAP being a "back office system that only experts and specialists should ever tackle" and that they had these people on the team to assist with data identification and hence data quality. *Case: KC Ref #1693.*

Team skills were a necessary factor for the successful implementation of the APMS at the Case.

Source Systems

A source system is defined as a source of data to an APMS. This maybe a system in it own right or it maybe an electronic data feed, e.g. a PLC or telemetry point. An APMS may have one, but typically has many, source systems.

As stated in the focus group data analysis, the quality of source system data affects the quality of an APMS and that is why it is a success factor in the success of APMS implementations.

The Case does not yet have all available systems connected to allow the automatic feeding of the APMS. Implementation is progressing in a phased approach and subsequent phases will automate more data feeds from additional source systems, with the more important first. As the General Manager stated:

> *"There are some things that would be as part of the, my normal divisional performance reporting, aren't reported by the APM system but that's more because those feeder systems are not linked into the APM system, rather than any deficiency in the APM system and in time those other feeder systems will become part of the APM system. …For example at the moment a lot of data, or a reasonable amount of data from my division is distorted by what we call our ODS or Operational Data Storage system."* *Case: KC Ref C#1589*

To overcome the time lag between phases, the Case APMS design allows for manual data entry for measures that are either not yet automatically available or are new. The manual data entry, or MDE as it is known, allows for all types of measures, either as the sole measure or as a "source" measure for other calculations, as described by one operational data user.

> *"Okay, but it's the same source and it's semi-automated because there are some corporate systems, you know there is another system type information we have to do what we call MD entry or manual data entry to the system. But nevertheless we are getting what I call the KPI ready information which means you don't have to do the calculations of human interdenominator to get a, it's there, bang. The result is there."* *Case: GB Ref C#970*

While the ability to enter data manually is opposed to the aims and objectives of an APMS, this functionality does allow for flexibility and the ability to respond quickly when a new measure is required, e.g. new legislative reporting requirement. The Case objective, however, is to automate the loading of as many data sources as possible to ensure data quality but there was a realisation that this is not practicable and will not be achieved, i.e. the requirement for manual data entry will always be an ongoing requirement. Reasons for this include poor data quality from some source systems, non cost effective and new source systems take time to be developed.

With respect to data quality and the need for manual data entry, one interviewee put it quite well when describing why some source systems were not automated:

> *"Because it was too big. It was out of scope, it was far too big. We couldn't actually go back and physically, within the scope of our project, fix all of those source systems."* *Case: LT Ref C#1972*

Subsequent projects have been spawned to correct those possible automatic feeder systems. The flow from the source systems into the APMS, where line and process managers are responsible for data correctness, underpins the integrity, credibility and subsequent acceptance of the system. It's not just reliability etc of sources, but also the user knowing what they are and having confidence

Some measures occurred infrequently and others were occasional so automation of these sources was not cost justified. Taking a few minutes once a period to manually enter the data was considered appropriate although the risk of such activities was understood as manual data entry introduced the risk of people entering incorrect or "bad" data.

Another issue with source system data loads was that new measures sometimes require new source systems to be built and this takes time. The time for development of these systems usually meant that manual interim processes are put in place to overcome the lag between when the source system is operational, and the business measures being available for reporting.

When asked about the ongoing need for manual data entry, one interviewee responded:

> *"Yes, there will be a need for it and I think it's smart. The good thing about it is that the application is smart enough to handle it and I think there will always be a need. We don't want to have too much of it."*
> *Case: LT Ref C#1930*

When asked if the manual data entry would allow people to shift back to collecting their own data and therefore setting up their own spreadsheet systems the answer was:

> *"No, they won't revert back."* *Case: LT Ref C#1930*

There was a realisation that the APMS was beneficial and has been embraced by the business.

Manual data entry therefore overcame the spreadsheet issue raised by the focus group as the control rested with the user community. This functionality was important as it allowed flexibility and convenience.

Manual data entry was also only available to data administrators and not to the general user community, therefore ensuring some form of data reliability checking and quality control. Data administration was responsible for correcting data errors and responding to error reports generated for the APMS. They therefore had personal answerability to ensure that the manual data entry was correct.

Case interviewees agreed that having reliable and well maintained data from a source system was a critical factor for success of an APMS implementation, but manual data entry was required for exceptional circumstances.

Development Technology

Development technology is defined as "the hardware, software, methods, and programs used in completing a project" (Banker and Kauffman, 1991, cited in Wixom and Watson, 2001, p. 25).

As discussed previously, no actual developers or technical team members were interviewed, so their perceptions, views and or difficulties are not known. Development technologies did however come up in the interviews with the business team's members and their perceptions and views are discussed below.

The Case APMS used the standard operating environment set of enterprise products. When the successful project started they found that this set did not work. As the Project Manager espoused:

"We tried to use the existing data sets within the organisation and that was really imposed on us, so we didn't go out and look at other products, so we did go down and try and use what was there. We did. We did. We did, we did a, a scoping exercise and then we tried to do a prototype and it didn't work, and that was using a component of SAP and basically we said. And basically, it could've worked but it wouldn't have met our business requirement and at the end of the day, we said well these are what the business requirements are, and I don't think the organisation was mature enough to be using SEM in a way that SEM intends people to actually develop the KPI." *Case: MG Ref C#484*

The technical team went back to basics and utilising components from SAP they built a front-end to the APMS that allowed for integration across all the underlying data sources. Requirements definition and system design phases took time but both were a success according to all team and user representatives interviewed. A typical response was:

"…So that part of it, the business requirements and the design of it needed a good chunk of time, and that's why you get a better product at the end of the day." *Case: LT Ref C#1877*

The technology, human resources, systems development methodology and project management took time but in the end they got what they wanted.

The solution was based on EAI with a mixture of components from different vendors and some of it custom built. Case: DC Ref C#741. The SAP standard functionality that the Case expected to use had limitations and therefore they constructed the manual data entry component, which took time Case: DC Ref C#757. Development technology therefore was considered an important factor for the success of an APMS and although difficult at first, the Case found that utilising pure off the shelf systems was not possible and some custom development was required.

System, Data Quality and Perceived Net Benefits

As discussed in Chapter 4, Wixom and Watson (2001) determined that certain factors influence implementation success and that data quality and system quality influenced system success which then impacted on net perceived benefits.

Data and system quality were raised by Case interviewees and these results are discussed below.

Data Quality.

Data quality is defined in an operational context as the accuracy, comprehensiveness, consistency, and completeness of the data provided by the warehouse (Wixom and Watson, 2001, p.26).

As stated in Chapter 4, data quality is an important APMS success factors and include generic data quality, measures, auditing and reconciliation, budgeting and forecasting, business processes and timeliness of the data or data timing. These are described in Chapter 4 on p.150.

The Case believed that through the use of manual data entry they had an advantage with data quality. When asked "what's made the APMS more useable than previous systems and why do people use it?" one interviewee responded that it was easy to use, but also a user had confidence in the level of data integrity.

> *"Because it's one stop shop, easy to use. It is easy to use. At the end of the day that's what's going to get people on board. Plus they have a confidence in the level of integrity of information. So there's the two key factors. It's very easy to use. It gives you far more information than you've ever had because it stores great pieces of information about a KPI etc but also you have much more confidence in the level of integrity because there's little to no manual manipulation of that information."* *Case: LT Ref C#1807*

When asked why they had confidence, the response was because a user could drill down into the measure and see where it came from. Users had confidence as the APMS provided traceability to the source of the reported measure. Case: LT Ref C#1807

During discussion about information quality, the General Manager interviewed responded:

> *"I think it's a good quality, I think it's there for a, I think it's a good quality probably for a couple of reasons, one is I think most of our front end systems where our data comes in has a degree of quality control about the data checking, obviously you can always do more of that and I think as systems become more sophisticated techniques for validating data on entry you know will enhance all of that but the other is that the APM system process goes through a couple of stages before the final data is released so it's certainly a high level, the process managers, line managers get a chance to look at it make their comments and if the numbers look wrong, you know can tell pretty quick, ah you can tell pretty quick so certainly by the time you get general manager executive board level there aren't too many, their pretty rare exception where there is a data quality issue."* *Case: KC Ref C#1631*

This response illustrates a high level of process and organisation maturity to performance measurement and to the importance of reliable, timely and correct information within the organisation. The flow from the source systems into the APMS, where line and process managers are responsible for data correctness, underpins the integrity, credibility and subsequent acceptance of the system. This level of maturity in the overlying framework supports the success of an APMS as reported be de Waal (2003, cited in Martinez, Kennerley & Neely, 2004, p.7).

As well as generic data quality, aspects like sophisticated measures, auditing and reconciliation, budgeting and forecasting, business processes and timeliness of the data where all highlighted by the Case interviewees.

The cultural aspect of an organisation aiming to improve its performance was another factor according to one interviewee. When managers were told they would get less data in their reports and that they would have to trust the numbers this resulted in significant cultural change. This aspect was an interesting realisation as the quality of the data was a critical factor and the project team undertook cultural change in this regard as one of their initiatives during the implementation of the APMS. Users didn't trust the manual process and system reports of the past, so they had insisted on including the underlying numbers on their reports so they could personally validate the data reported and hence self check the results. This resulted in increased amounts of information that added to complexity and the feeling of "drowning in information". As he stated:

> *"I guess part of the culture of the organisations is detail. Everyone's been so engrossed in detail in the past it was a bit of a challenge to get manager's to warm to the idea of getting less of it. Letting go is Ok"* *Case: AD Ref C#15*

The organisational culture focused on the use of a performance management system to improve, this was consistent with that reported by de Waal (2003, p. 693 & p.694) for the successful implementation and use of a performance management system. The reduction of information also allows people to focus on core processes and objectives and become an effective information system due to the system being comprehensive and flexible (Al-Mashari & Zair, 1999; Kettinger, Teng, & Guha, 1997; Zhou & Chen, 2003).

The case organisation put a lot of emphasis on data quality, from their source systems through to the APMS, but they also understood that the world would never be perfect and full automation would not be achieved. Therefore they needed to cater for exceptions through the use of manual data entry (MDE). MDE is discussed in more detail in the next section, system quality.

Spreadsheets have not gone away but are no longer part of the formal performance measurement/management reporting process. Everything now comes out of the APMS, and the errors that may have come from spreadsheets were not discussed in detail. MDE once again was used for this manual capture and reporting and was seen as the mechanism to replace spreadsheets. As one interviewee stated:

> *"I think it just replaced the manual process so probably lots of spreadsheets are gathering dust .. everyone's confident their numbers are coming in and they're going to be consistent now, consistency and all that sort of stuff"* *Case: EM Ref C#935*

Data quality issues with master data alignment between source systems was also apparent in the Case and took time to fix. Fixing the master data was seen as a positive outcome for the project. As one interviewee stated:

> *"They (the source systems) were problematic and we did have to deal with some issues about relationships between existing source systems and the APM system. For instance the hierarchies used in existing systems were diverse and not consistent"* *Case: EM Ref C#1968*

Data quality also involved the timing of when the data was available and when it would be reported. The Case used MDE to overcome technical or organisational difficulties to ensure the right measure was available at the right time, but this was done by exception and was not the norm. Positive experiences in the Case highlighted that the automatic availability of data was reducing reporting and analysis cycles and was improving response times for action. Operational and strategic content within the Case was not considered an issue because the APMS changed the fundamental process. Previously, strategic monthly reports were given priority and other reporting came next, i.e. Board and statutory reporting was first and operational reporting and analysis was a lower priority. As explained by one interviewee:

> *"… it is quite a significant change actually. What we did in the past was we always got the core level report out first and everyone was beavering away providing information we needed to do the high level reports and then they would do the lower level reports. We've now flicked that around the other way on the basis that if we've got data we want to report at a high level the best way to do that is to roll it all up, so you've done all your analysis at the lower level first. You've got all your commentary and explanations you need and then you roll that up. So we've actually turned that around and we now release them in stages, so we release operation reports, then Branch and Area Reports, Divisional and then the Corporate Level Reports."* *Case: AD Ref C#101*

Operational reporting now drives the rest of the strategic cycle and operational people no longer need to adjust their figures to fit the strategic figures. This could not have occurred if the processes had not been clearly defined and flowed together. Data is also aligned within each process. The cycle time for board reports is now down to four working days after the end of month as opposed to twelve under the manual system. The other benefit has been that more time is now spent on analysing the data as opposed to physically compiling data and producing reports as reported by a financial analyst.

"In fact it's improved timeframes. Basically what used to happen, was that a large amount of time was spent gathering results for the reports and very little time on the analytical side. So pretty much now where it's an actual automatic source you're spending no time at all running and preparing that information. It's good." *Case: LT Ref C#1857*

Most of the features that positively influenced data quality within the Case's APMS were system features attributed to APMS system quality, i.e. timeliness, reliability and MDE.

System Quality.

System quality is about the computer technical aspects of the system. As stated in Chapter 4, system quality is a success factor for an APMS because an APMS requires system attributes such as flexibility, integration, reliability and responsiveness.

Although no technical team Case project members were interviewed, the people who were, believed that the APMS "product" had high system quality. When discussing the factors relating to system quality the Case interviewees discussed the following characteristics:

- Usability;
- Reliability;
- Flexibility; and
- Alignment to business process.

Usability.

"Yeah, It was really, it was so simple to use." *Case: MG Ref #542*

Usability was considered by the Case as a primary characteristic of system quality. It included features such as user entered commentary against measures and ease of use. The Case's APMS is intuitive for new users and was both flexible and adaptable to allow non technical end-users to add new measures or maintain users, and was always up to date, i.e. it was timely.

"Yes. As soon as I say change this, they just go online, change it, bang it's there within a couple of minutes. Alright, so it's pretty quick" *Case: GB Ref #1152*

Errors were easily identified and once changed in the source system, reflected back in the APMS. Authorised end users can change and modify formulas, and users found the reports and screens simple to use and "pleasing".

> *"And you do all that yourself, there's no techo stuff? There's a little bit of techo stuff".* *Case: AD Ref #122*

The APMS catered for manual data entry of measures and provided a high degree of end user control with little need for technical administration. The APMS had lots of other features, e.g. exporting data and reports, plotting, graphing, drill down and contained an auditable history on line and available to all. This additional functionality made it more useable. Due to its intuitive interface training, staff found it easy to train end users in no more than an hour or two.

As raised by the focus group, ease of use didn't just mean the presentation and ability to navigate in the system but also the ability to understand the underlying meaning of the data (or information) being presented, its context and it origin.

> *"But we, we're actually delivering 100% of the information in the board pack."* *Case: MG Ref #346*

In the Case APMS they had the ability to drill down and view where the data originated from, i.e. full traceability. This traceability provided some trust as it allows a person to understand their situation and their surroundings. People need to understand what the have and why it exists (Bhaskar, 2002, p.68). People find comfort in knowing where they have been and where they are going.

> *"Success? It's been the ease of use of the system".* *Case: BK Ref #205*

Reliability.

Reliability was raised by the interviewees as a characteristic of system quality, which differs from DeLone and McLean, although there was a relationship also to data quality. This was similar to that raised by the focus group participants when describing this as a factor for success. In the

Case's instance the reliability was seen to enable data reliability and once trusted, other uses for the APMS started to be looked at and its use expanded. An example was external compliance reports were added to the project scope because the APMS data was accurate and reliable. As one user explained:

> *"…that's another side benefit so we had to do a lot of work on the data so that it would feed through and service the APM system so we now got that available for the external compliance report. …It was originally outside the scope of the project but we have recognised that we have just about got it there. We have all the data required so with a little bit of effort we can have that reporting."* *Case: AD Ref #159*

Flexibility.

Flexibility to the case organisation included user control over the validation and verification process. User control was a characteristic of system success identified by the focus group as they believed users need to feel to be in control. The Case had achieved this by end user administration and manual data entry, and therefore the control characteristic barrier, evident in the focus group, was expressed as a positive aspect of the implementation by the case interviewees. Users at the lowest level as well as management are exposed through the measures and reports to the senior executive (Board or CEO), but the users group knows that they have the ability to control the process as they are the administrators. Their review and possible intervention is immediate and decisive, i.e. the APMS users are in control. Although all is exposed, the underlying information is still controlled by the user base by means of a data approval or publishing release function.

> *"They built in that flexibility, the whole release mechanism for the staff and the comments and the additions and the changes that had to happen as things go up the line … all of that was built in, and you know, from what I saw the final product, it looked pretty good.* *Case: EM Ref #840*

This functionality though meant deviations occurred in the overall enterprise architecture principles insisted on for IS projects at the Case.

"… in order to build in all that flexibility they had to deviate a bit from the standard architecture that we would normally have maybe pursued by you know, the design team." *Case: EM Ref #877*

It is unknown, what these deviations actually were, but they are not considered relevant, as they were required to enable this functionality to work.

Flexibility was also evident in that authorised users could themselves update or insert formulas for measures, although some complex ones still required support from a technical resource.

Alignment to business process.

"So everything within the APMS is process driven? Yep, yep, yep." *Case: KC Ref #1605*

The previous attempts and manual performance measurement process were aligned to the organisational divisional structure rather than to business processes. This misalignment of performance measurement to the core business process structure resulted in measures being reported that were not strategically or operationally as important as those identified along business process lines. The Case's Accountabilities Framework resulted in the alignment of both data, organisation and people resulting in all areas working towards the same measures. The APMS also supported business process change in that it paralleled and reinforced organisation and business process structure changes by delivering performance measures along the affected process line(s). Case: AD Ref #30

The APMS, through its design and system quality, also allows for the business processes to change without being held back by the APMS, through either user configuration or to have data entered manually until it is available automatically. The requirement as articulated by an APMS user:

"But, but to me the system can only be valid if it's continually changing and actually adopting business process." *Case: JC Ref #1543*

Sustainability.

Sustainability as defined in the focus group data analysis means covering the requirements of the present without removing the basis for meeting the requirements of the future generations (CIMRU, 2002, p.10).

Sustainability was a new factor identified in the focus group data analysis and was tested in an updated model presented to the Case interviewees for comment.

Sustainability to the Case was very important and while they tried to ensure the system was "future proofed" they also described sustainability with respect to usability, timeliness and flexibility.

Continuous change is an ongoing part of the Case organisation, so the APMS needed to parallel this change or it would become irrelevant. Case: LT Ref #1918. Continuous improvement, which leads to change, as reported by the focus group is typical for most organisations as they engage in TQM and Six Sigma-like programs.

To reinforce this ongoing change, interviewees reported that changes continued to occur after the implementation of the APMS. As described by an interviewee:

"Sustainability? "Yes".

Is it going to be the big key to this?

"Yes, in keeping it going. And there's lots of different models for this but it's like a spiral model. You're going to continually spiral forever down closer and closer to what you need to do and then it shifts like a tornado I suppose. It jumps around, but it spins around and then jumps around to the next point that you need to do. And the other point is, I'll hark back to the manual data entry that needs to be reduced. That needs to get to be nearly nothing. Will it ever be nothing? No. There's always going to be need for that isn't there? Yes, there will be a need for it and I think it's smart. The good thing about it is that the application is smart enough to handle it and I think there will always be a need. We don't want to have too much of it (MDE)". Case: LT Ref #1924

The realisation of the need to cater for continual change, for automation as well expressing the desire to be in charge of the system, is led by the Case users, process owners and their representatives. The IS Manager also had the need to ensure that that the APMS solution was sustainable and reasonably cost effective to maintain alignment with current system architecture strategies, as he had "an information management business to run". DC Ref #723

The APMS Project Manager did not see the relevance of sustainability as a CSF as it was a project requirement and had to be delivered. As the project team had identified the requirement and had catered for it he thought it was minor. As he said:

> *"In terms of sustainability going forward, I think that it's here to stay now and it's sort of locked in and we're, the business has embraced this."* *Case: MG Ref #680*

Sustainability has clear relationships between data and system quality, and perceived benefits. Interviewees discussed that both data and system success affected the sustainability of the APMS which therefore affected the ongoing perceived net benefits. Benefits for the APMS were not expected to be available for some time while the system became embedded in business processes and ongoing support.

Sustainability was spoken about as a CSF and appeared to have no relationship to other CSFs. It is existed after "go-live" as a separate CSF.

Sustainability was confirmed as a CSF to the Case's APMS implementation.

Timeliness.

Timeliness for an APMS was explained by the focus group as the ability to make changes quickly and be responsive while also providing the data within the required window of time. The literature expresses this as the time lag and this timing was also important to relate information to other events. "Timeliness is important because understanding the circumstances behind the numbers is often essential in diagnosing problems."(Kaydos,

1999, p.52). Some members of both the focus group and Case also referred to timeliness as “reactiveness to change”.

Timeliness was a new factor identified in the Focus Group data analysis and case interviewees commented on it directly as it was included in the updated model presented for their comment.

The Case confirmed timeliness as the capability to respond to a requested change, as well as the ability to be able to change a report, e.g. the end user having the ability to display a measures within the APMS through a simple configuration setting, or determine its ranking with respect to other measures. The use of MDE enabled success by being able to respond quickly (if not automatically when new measures came on line). COTS packages though did not always cater for this scenario and the Case developed this capability within their APMS.

The Case did not identify time lag as being technical in nature or a data quality issue, even though this was identified by the Focus Group and in the Cases instance this barrier appears to have been overcome. As stated by one interviewee:

> *“It works very well. It’s been set up in such a way that it enables the reports to change very quickly in response to change in the business. There’s been practically no hard coding in there so any structures that come in, organisational structures etc, that come in are being sourced from source systems so they are not being built separately in there. So it means that if there is a change in a source system that will be reflected very quickly in the APM system as well. So yeah there are very few things that were hard coded in and the ones that were hard coded are going to be replaced as well that was a quick fix. So reaction to change I would say is excellent - very competent.”* *Case: AD Ref #128*

The Case through MDE and automation, overcame the barriers identified by the focus group, and had succeeded with both timely data as well as the ability to respond quickly to changes to meet operational and strategic business requirements.

Interviewees discussed that both data and system success affected the timeliness success factor of the APMS. Timeliness has understandable relationships between data and system quality, as these both impacted user

perception of whether a measure is correct or available. If the system has technical problems, the timeliness of the system is affected and if the data is incorrect or missing, the user observation is that it is late. Late operational data can cause a problem which means benefits may not be realised.

Timeliness was confirmed as a CSF to the Case's APMS implementation.

Perceived Net benefits.

A perceived net benefit is defined as the return on the APMS investment, be it tangible (measured or quantifiable) or intangible (unmeasurable or unquantifiable), once the APMS is implemented.

Benefits of the APMS identified by the Case interviewees were very specific and included:

- Standard definition of measures;
- Implementation of the Case's Accountabilities Framework;
- Improved data quality;
- Simplification; and
- Alignment of business processes.

Definitions of measures had been identified as a barrier in previous implementation attempts for the Case but with this implementation it was considered a success. Previously, regions had different ways of calculating a common measure therefore making it impossible to compare business performance. Case: BK Ref #237. This had created disagreements between regional managers and had led to local systems being built to report performance measurement. Accessing data from the APMS was considered a significant success as it gave perceived business improvement benefits through standard definitions and the ability to compare business processes across regions to identify possible methods of improvement. Case: JC Ref #1529.

The implementation of the Case's Accountabilities Framework was also considered a benefit, as the APMS complimented this framework while

also aiding in its implementation and acceptance. Case: AD Ref #141. This was confirmed by another interviewee, who said:

> *"I mean even the accountabilities framework, I suspect that the APM system was integral to passing that bit of information on to managers that, although they saw the accountability in this framework and they saw that they were actually now process owner or process manager, what the APM system actually really persisted in focusing that they were going to get a scorecard that would include KPI's about that process that they manage. I think that helped."* *Case: LT Ref #1881*

The same person also stated (in this context) that a "paradigm shift took place" when the APMS together with the Case's Accountabilities Framework formed a symbiotic relationship that both empowered and notified process owners about proposed business changes. This allowed them to influence and guide the change through the performance measures required to measure the future business process.

Data quality across the organisation also improved due to the APMS implementation. Projects were created to fix data in source systems and by the nature of the system itself, data errors normally became immediately apparent. Another aspect of data quality has been the exposure of "other people's data". Data ownership within a system had been an issue as islands of information existed and were owned by individuals. These systems (and their owners) also controlled specific business processes and with the advent of the APMS "their data" became visible throughout the case organisation. Disagreements had previously developed about where errors occurred and who was to blame, as the organisational and business system structures did not cater for resolution of this conflict. The APMS removed this confusion and through automated bridges, the personal data islands became both visible and accessible. People then found that automated performance measurement reporting meant systems needed to be fixed at the source as they could no longer manipulate spreadsheets or local system reports. As one interviewee commented:

> *"Well people have to fix the source, not do it just for themselves, yeah."* *Case: JC Ref #1329*

Fixing this data at the source was also seen to be a benefit to the organisation as a whole. As put by one interviewee:

> *"… You use the effort to fix the problem as opposed to find out there is a problem. So I think everybody would benefit, any business would benefit."* *Case: LT Ref #1944*

The Case looked at the performance measurement and management process as a whole process with an objective of simplification and establishment of a team to analyse the whole process and to value add. Childe, Maull and Bennett described this as process base change (1994, p.29). The Case achieved this simplification by innovation (Gottfredson & Aspinall, 2005) and it led to a reduction in the number of measures (or KPI's). The team though believe there is more reduction to achieve, but this will come in time. This reduction means people have more time to spend on KPI's that have been identified as core to business improvement and/or for ongoing business success as confirmed by another interviewee.

> *"… yes there are a bit, there are a few too many things there that are dedicated as KPI's, but it's, that's what I meant it's gonna probably be an ongoing process."* *Case: JC Ref #1529*

Innovation is illustrated in the APMS itself. The Case removed complexity from the process and the system through simple innovations like adding rich formatted textual comments to allow qualitative information to be recorded against a measure or manual data entry (e.g. changing the font, font style and size, colour). MDE in a data warehousing world breaks one of the golden rules of only obtaining data from source systems, but the Case wanted to make it simple so they broke the rules to make it functional.

> *"It simplified it, it made it standard so there's a lot more people who will be more inclined to view it. You don't want it to grow too much, no.* *Case: LT Ref #1845*

The General Manager agreed that the APMS user interface was also intuitive and easy to use which he said had attributes of a quality system.

> *"One of the things people have said to me so far is that what they love about the technical system is it's simplicity."* *Case: KC Ref #1629*

Innovation and complexity have appeared as concepts in lean manufacturing literature which has ties into operational management literature. Refer to Gottfredson and Aspinall (2005) and Corbett (2007) for more details.

The APMS has assisted in the alignment and standardisation of business processes by focussing on key measures and having one source of the truth. As explained by the Project Manager:

> *"Features, standardised and across the business. Information was coming from one source. Very clear, very transparent in terms of the information and where it's coming from. So for instance: standard definitions, ability to enter comments, ability to drill down on information, ability to look at past performance, ability to look at graphical information, ability to look at sub organisational units and follow down through those organisational units, an ability to summarise."* *Case: MG Ref #536*

Tangible benefits have not yet been compiled although a benefit realisation phase will be conducted 12-18 months after the system has been fully operational where benefits will be formally identified and measured.

> *"I think that the ability to assemble information from multiple sources and track those things I think that functionality that capability will be used more broadly in terms of driving our business."* *Case: KC Ref #1667*

Behavioural Factors

The Case interviews also displayed behavioural factors discussed in the focus group data analysis (refer Chapter 4, p. 169, for an explanation of behavioural factors). Words in the case interviews like accountability, benefit, champion, cultural change, flexibility, organisational structure, sponsorship, stakeholders, and user participation were codified as belonging to personal, social and organisational structures. These can be further classified as general behavioural factors.

The Case also displayed organisational structures and mechanisms for managing and utilising an APMS that can be associated with behavioural factors. These factors indicate social and psychological aspects that may affect APMS success. This became evident during analysis of the focus group data (a review of the relevant literature is contained in Chapter 4). In

summary, individual psychological factors should be considered with respect to performance management (Vagneur & Peiper, 2000, cited in de Waal, 2002, p.689) and successful implementation of performance measurement is based on the understanding and accommodation of the human element (Holloway et al., 1995, cited in de Waal, 2002). de Waal (2002) believes that behavioural factors can positively affect business outcomes generated by better strategic and operational alignment through effective performance management system design, management control, use, managerial and employee behaviour, and performance.

In the case organisation, the combination of performance-driven behaviour and regular use of the performance management process has contributed to the successful implementation of an APMS. This supports the work of Ahn (2001), de Waal (2003; 2004) and Sandt, Schaeffer and Weber(2001). de Waal (2003) argued that a performance management system is regarded as successful if managers use the system on a regular (daily) basis and in the Case's circumstance this occurs every day.

The Case's Accountabilities Framework, together with the ARIS models, supports the behavioural factors identified in the focus group discussion and also the work of de Waal (2003) and the behavioural factors he stated that were important for the successful implementation and use of performance management systems (refer Table 7, Chapter 4). An analysis of how these behavioural factors relate to the Case's Accountabilities Framework and ARIS is listed in Table 9, below.

Table 9. Case's Accountabilities Framework and de Waal (2003) behavioural factors

Aspect	de Waal's (2003) Description	Case's Accountabilities Framework and ARIS
Responsibility structure	A clear parenting style and tasks and responsibilities have been defined and these are applied consistently at all management levels.	The Case's Accountabilities Framework clearly sets up a structure through a responsibility hierarchy. Firstly through corporate and line responsibility and then by the devolving responsibility from COO to process owners and then process managers through to branch managers, area business managers, line managers and employees.
Content	Organisational members use a set of financial and non-financial performance information, which has a strategic focus through the use of CSFs and key performance indicators.	The content of the Case's Accountabilities Framework is determined by the detail in the ARIS process models. Process owners are responsible for setting the structure within corporate strategy and targets, i.e. the content of the performance, and management of data in accordance with the Corporate Data Management Framework. Process Managers are corporately accountable for defining corporate targets and determining what should be reported corporately and divisionally. Branch managers, area business managers and line managers are line accountable for providing information on corporate targets.
Integrity	The performance information is reliable, timely and consistent.	Process managers are responsible for establishing a structure where policies and standards are produced and updated to provide for governance, quality assurance across the organisation and which meet legal and regulatory requirements. Branch managers, area business managers, line managers and employees are line accountable for ensuring data is accurately captured.
Manageability	Management reports and performance management systems are user friendly and more detailed performance information is easily accessible through information and communication technology systems	Clear accountability and responsibility is supported by the framework which allows for the management and monitoring of business processes by the structure of process owners. Process managers are corporately accountable for management of business applications (e.g. CRM) in accordance with the corporate application system architectures model.
Accountability	Organisational members feel responsible for the results of the key performance indicators of both their own responsibility areas and the whole organisation	The framework attempts to place clear accountability for all behavioural aspects of performance within a documented and management approved process. Process Managers are responsible for developing and delivering process capability by ensuring all people can operate effectively within their process or applications for which they have corporate accountability.

Aspect	de Waal's (2003) Description	Case's Accountabilities Framework and ARIS
Management	Senior management is visibly involved and interested in the performance of organisational members and stimulates an improvement culture and proactive behaviour. At the same time it consistently confronts organisational members with lagging results	Process owners are corporately accountable for setting corporate strategy and targets, while process managers have overall strategic leadership and direction for their process. The process owners provide strategic leadership and direction in making decisions for their process and are responsible for identifying areas for improvement of their process, quantifying benefits to be achieved and gaining stakeholder sign-off and commitment to achieve those benefits. Process managers are corporately accountable for developing and delivering process capability by ensuring all people can operate effectively within their process or applications and this includes skill development, education and training and appropriate levels of documentation.
Action orientation	The performance information is integrated in the daily activities of organisational members in such a way that problems are immediately addressed and (corrective or preventive) actions are taken	The Framework states that process owners are corporately accountable for monitoring the performance of their process. Process managers are also responsible for establishing policies and standards which provide for governance, quality assurance across the corporation and which meet legal and regulatory requirements. Branch Managers, Area Business Managers and Line Managers are line accountable for working with Process Managers to maximise corporate outcomes as well as achieving local business outcomes through appropriate allocation of resources while monitoring the effectiveness and efficiency of processes within their area.
Communication	Communication about the results (top-down and bottom-up) takes place at regular intervals as well as the sharing of knowledge and performance information between organisational units	Process managers through the framework are accountable for ensuring appropriate KPI's are defined. They are also responsible for relationship management of outside regulators as appropriate to their process and the measures associated with maintaining regulatory or statutory regulations , e.g. Health and environmental departments. These KPI's are available via the intranet for all to see and enquire upon. The measures themselves were not always available until the APMS was implemented.
Alignment	Other management systems in the organisation such as the human resource management system, are well aligned with performance management, so what is important to the organisation is regularly evaluated and rewarded	Process managers are accountable for management of business applications (e.g. CRM) in accordance with the corporate application system architectures model (ARIS).

de Waal's behavioural factors can be summarised and he grouped them into aspects. These aspects and how they relate to the Case are listed in Table 10, below. de Waal identified over 40 different behavioural factors and grouped

these into the presented aspects below. Aspect descriptions were detailed in Table 9, above.

Table 10. Case performance management alignment analysis (de Waal, 2004)

Type	Aspect	Case Alignment
Structural	Responsibility structure	Illustrated in the structure and operation of the Case's Accountabilities Framework
	Content	The very nature of the APMS controls and defines the important measures for the Case.
	Integrity	The role of the APMS.
	Manageability	APMS is controlled and managed by a set of users, but the overarching structure is managed by Process Owners and Process Managers
Behavioural	Accountability	Characterised by the Case's Accountabilities Framework
	Management	All levels of management use the output from the APMS for both operational and strategic purposes. All measures are compared to previous months and targets and budgets are allocated, where appropriate.
	Action orientation	Operational performance information used but this is to be extended. Strategy and review management supported by the APMS on a periodic basis. This is includes end of shift, end of day, weekly, monthly or whatever the required period is decided appropriate.
	Communication	The Case's Accountabilities Framework is reviewed on an ongoing basis but is formally reviewed and signed off by the CEO at least Annually. Regular monthly reports are available to all automatically at least monthly while performance measures are available to all on demand. By inference the APMS measures are also reviewed through this process.
none	Alignment	Reporting by both functional and organisational unit is possible. The human resource (HR) organisation hierarchy is the basis of these reports and provides constant alignment. The enterprise security layer is role based so personal position based emphasis is placed on keeping this data up to date otherwise people cannot access any corporate system. The HR organisational hierarchy is used for organisation reporting in the APMS.

As stated in Chapter 4, the structural typing of the aspect deals specifically with the content of a measure and the way it is organised. The behavioural aspects deal with the way organisational members use performance management.

de Waal's (2003) behavioural factors are relevant to the successful implementation of an APMS as they are inputs from the human world into the evolutionary cycle at work in the development of theory and practice in the field of performance measurement and control systems (Neely, 2002, cited in de Waal, 2003, p.688). de Waal also states that the issue of the "human element" receives more attention than before in the literature and one quote from Simons (2000) provides additional weight to his argument -

"… performance measurement and control systems cannot be designed without taking into account human behaviour" (p. 688).

Summary of Data Analysis

The Case had many years of exposure to performance measurement and management and achieved a strategic goal to implement an APMS as a key part of their Enterprise Information System suite. Based upon their many attempts, the organisation had a rich and complex communal experience which assisted in the data collection for this phase of the research. This phase of the research has focussed on an organisation that has successfully implemented an APMS and the interviewees were a selection of end users and members of the successful project team. This input focussed on CSFs for APMS implementation. It has been presented in the context of the CSFs identified by the Case interviewees and has been based on their collective human experience. As with the focus group, the Case interviewees have revealed how the factors for success for an APMS implementation interrelate, interact and influence each other; grounded theory has been used to analyse the results, leading to a more accurate and sophisticated understanding of the research domain.

The updated research domain is illustrated in Figure 23 below. The "champion" factor has been substituted with "sponsorship". The de Waal (2003) behavioural factors have also been added to the research domain as they tend to explain influences not described before in either the case study or focus group instance, and they are easily mapped to the data collected.

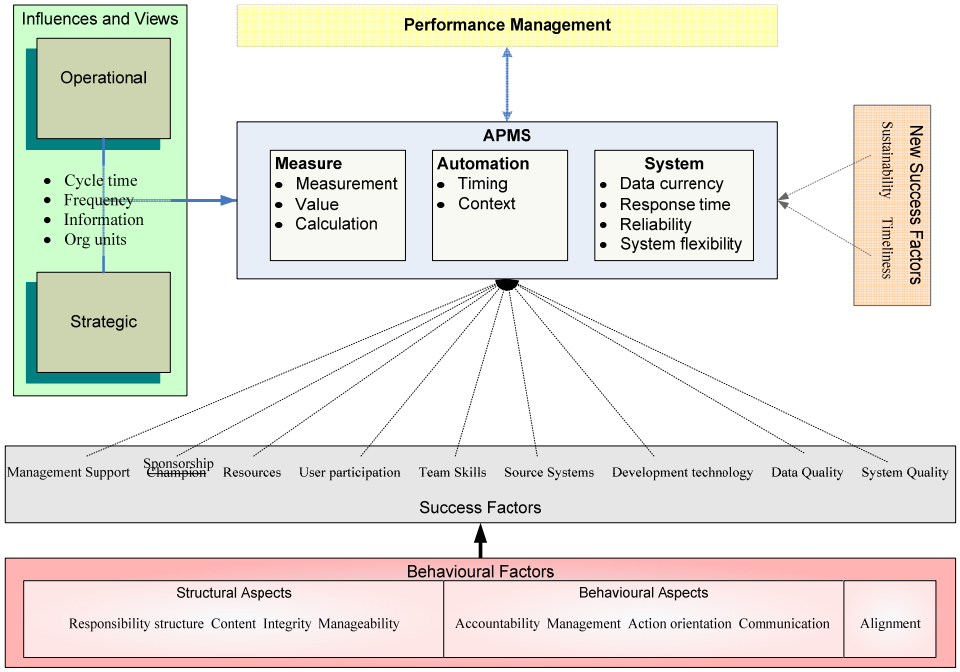

Figure 23. Updated research domain and associated theory with confirmed new factors.

When asked to rate the importance of one success factor over another most interviewees generally responded that it was difficult. When collating the response from all interviewees there was no one obvious answer. Responses included: the actual business process and the change management required; data quality; the failures (i.e. history); management support; benefits expected and those arising from the system; quality of the source systems; the resources and team skills of both the project team and the organisation as a whole; the sustainability of the APMS solution and environment supporting it; the quality of the APMS system itself; the timeliness of the system (i.e. the data is always there when you want it); and the users themselves in the way they engage and interact with the system and the project team, i.e. user participation. No one factor stood out. Based on this response no specific factor was deemed to be more important than any other.

Table 11 below is a summarisation of the factors based on the researcher's view of the collated data obtained during the Case Study.

Table 11. Mapping of Success Factors to Case Study Research

Success Factor	Source	Supported by Case data	Comment
Management Support	(Wixom and Watson, 2001, p.20)	Yes	Case's Accountabilities Framework put a structure in place to enforce management support.
Champion	(Wixom and Watson, 2001, p.20)	No	Not that important. Shared responsibility due to the Case's Accountabilities Framework.
Sponsorship	Focus Group	Yes	Substituted for Champion
Resources	(Wixom and Watson, 2001, p.20)	Yes	Adequate resources, both business and technical. Right resources at the right time.
User participation	(Wixom and Watson, 2001, p.20)	Yes	Total involvement as users did not feel threatened by the APMS and involved themselves in the implementation. There were no obvious threats to the users in the case organisation. As quoted by the IS Manager: *"Huge business engagement. Huge business engagement. Business, yeah but not just business engagement but business involvement or allocation to the project."* Case: DC Ref C#808
Team Skills	(Wixom and Watson, 2001, p.20)	Yes	Good mixture of business, functional as well as strong technical and interpersonal skills within the Project Team
Source Systems	(Wixom and Watson, 2001, p.20)	Yes	Understood the importance of quality data inputs from source systems but this was complimented with the ability for manual data entry in a controlled way. MDE was not the norm or the target state.
Development technology	(Wixom and Watson, 2001, p.20)	Yes	Enterprise Architecture solution was used to construct the APMS but some components, e.g. MDE, needed to be constructed from scratch. The Case interviewees stated that the technology was not mature and commercial off the shelf solutions were not available.

Success Factor	Source	Supported by Case data	Comment
Data Quality	(Wixom and Watson, 2001, p.20)	Yes	Operational and strategic data obtained from APMS and used in daily business processes. The organisation focused on the use of the APMS to improve data quality and used MDE to overcome short term data quality problems. Spreadsheets were replaced by MDE. Quote was spreadsheets are "gathering dust". Spreadsheets not an issue for Case interviewees. Budgets and forecasts were included in most screens and reports and history was always available. Embedded processes through the Case's Accountabilities Framework ensured 360 view of data quality into source systems.
System Quality	(Wixom and Watson, 2001, p.20)	Yes	System quality was considered very good according to those interviewed. System quality included response time, reliability, usability, user control and flexibility. The system was also easily embedded in business processes.
Sustainability	Focus Group	Yes	Confirmed within Case, but also included attributes of usability, timeliness and flexibility.
Timeliness	Focus Group	Yes	Timeliness had two streams: • The first was the reduced time lag from data available in a source system to when it was in the APMS. This was not considered a problem for the Case APMS. • The second was the ability to enter new measures and have them available immediately. Interim processes included the use of MDE to enter both the measures and the data to make it available. Current Case installed COTS packages did not properly cater for MDE and the Case developed this capability within their APMS. Another aspect was the ability to change formulas which for most simple calculations could be done by an authorised end user.
Perceived Net benefits	(Wixom and Watson, 2001, p.20)	Yes	Benefits identified by the Case interviewees included: • Standard definition of measures; • Implementation of the Case's Accountabilities Framework ; • Improved data quality; • Simplification; and • Alignment of business processes.

The de Waal (2003) behavioural factors add depth and insight as they explain influences not described before in the IS literature. They cater

for the human element as performance measurement systems cannot be designed without taking into account human behaviour (Simons, 2000).

Findings

The findings arising from the case study phase of the research project are:

- The Wixom and Watson Success factors for data warehousing were suitable for APMS implementations, except the concept of a champion does not appear relevant in the case organisation. Sponsorship is a more accepted concept as it highlights the interaction and reliance of one manager to another (e.g. functional versus process roles), a community of managers working together using an agreed structure, the Case's Accountabilities Framework. This confirmed the data collected from the focus group. The "champion" factor has been substituted with "sponsorship".

- Two additional factors identified in the focus group data analysis were confirmed by the Case interviewees to be critical for success. The factors added to the model are:

  (vii) Sustainability and

  (viii) Timeliness

  The sustainability and timeliness success factors are co-influenced by data and system quality and perceived benefits.

- de Waal's (2003) behavioural factors have been added as factorial inputs to the model as they explain human influences and are easily mapped in the focus group and case study data.

An updated CSF model for APMS implementations is illustrated in Figure 24, below. This is built upon Model 1, derived from the focus group data analysis model, and the case study data analysis.

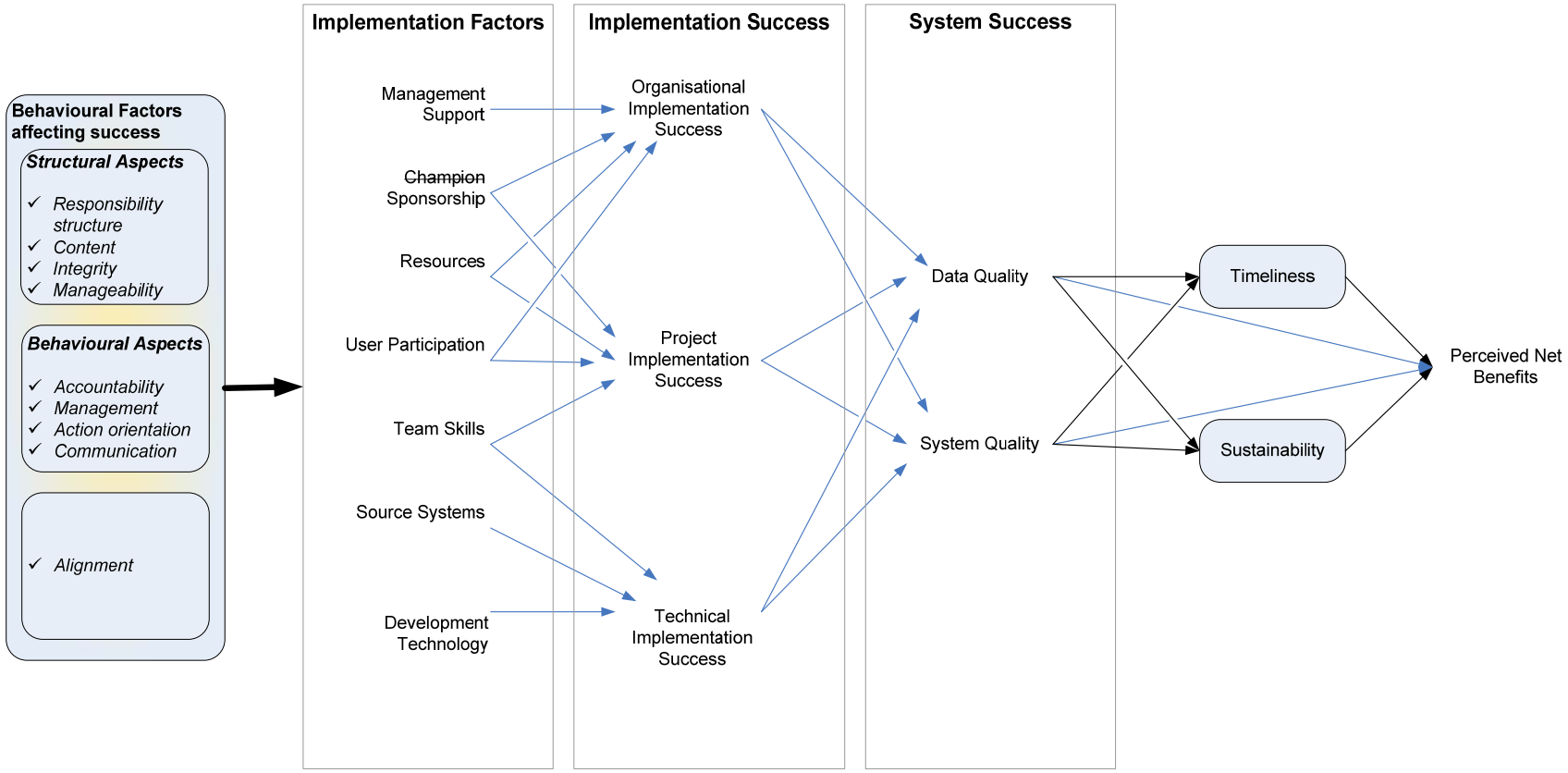

Figure 24. Draft Research Model for APMS Success resulting from Case Study data analysis – Model 2 (derived from Wixom and Watson, 2001, p.20)

Bias and faults during the case study phase

As stated for the focus group data analysis, the personal bias of the researcher may have influenced the way questions were put to the case study interviewees which may have affected the way the discussion was focussed and affected the subsequent analysis and reporting of the data. Hermeneutic theory was employed (as in the focus group) to assist in minimalising this bias. This is discussed further in the next section.

No specific faults were obvious to the researcher during the case data collection and analysis process, although not interviewing any technical team members may have meant that their specific views of the Case's APMS will not be known. As this study has critical realist elements as well as being interpretative through the use of grounded theory method, this qualitative approach does have limitations with respect to the case phase. Although covered in the methodology and focus group chapters, the case study had specific biases and these were:

- The identification and approval processes from the Case did take time and there was delay between the focus group and case study commencement. The subsequent interviews and analysis also took time, as well as the turn around time from interviewees to review and approve their respective transcripts. Data collection for the case study took one month, with a further three months for transcription and review. Work and private commitments for the researcher extended the time for the analysis of the case data which also impacted on the completion of the written report.

- The case study as a data collection method could also have presented a version of the Case organisation that may not represent the actual environment as interviewees may not have been representative of the employee and management population. As with the focus group, open-ended questions were used to allow the interviewees to select the manner in which they wished to respond but this questioning process could also be flawed as the data collected may be affected internally and externally by the impressions, assumptions and biases of the researcher or the person being interviewed (Leenders & Erskine, 1978, p.36).

- During the Case interviews, there may have been times when information has become distorted and it is difficult for the researcher to discover what is correct. For example, the discussion regarding the CFO and his actions although confirmed by a number of people, he never had the opportunity to put his point of view.

- The researcher who was intent on discovering success factors during the case study phase may have been overly zealous and may inadvertently posed questions and directed discussion towards particular response. This may have occurred through the design of the interview structure or through assumptions made prior to or during the analysis phase.

The use of triangulation during the case phase to assist in minimising the biases and faults described above are discussed in the research quality section below.

Research Quality

During this phase of the research, the interviews and experience from the case study were constructive and no follow-up meetings were required to confirm or answer questions arising from the data. The results are therefore considered complete, except for the missing technical team member's data and researcher bias. The lens or view that may have been applied by the technical team members, will remain unknown and this section can only deal with how the researcher ensured research quality during the data collection, the analysis and reporting of the case study findings.

The transcriptions were circulated to the case study interviewees who returned them with a number of corrected transcription and typing errors. The errors reported were mainly to do with specific case organisation acronyms or technical business terms and some typing errors, e.g. some product names were incorrectly transcribed. These items were subsequently changed by the researcher in the reported quotes to ensure ambiguity and to not allow identification of the case organisation or interviewees.

As with the focus group, a record was kept of key events, dates and people, as well as the transcripts of the case study interviews. This allowed the researcher's personal experiences and thoughts at that time to be used when analysing the data and answering questions raised by the associated University supervisors.

Due to its sheer volume of the case data, some aspects may have been overlooked by the researcher although the principles of the hermeneutic circle (Klein & Myers, 1999) were adopted to negate the

limitations with the interpretive approach. Every care was taken to codify all relevant data.

As with the focus group, the individual parts of data were interpreted before allocating a code. This raw code assisted the researcher to revisit the response, where upon refection some where recodified as the original code was not correct. This typically happened after taking into account the context of the quote, i.e. the discussion before and after the quote.

As discussed in Chapter 3 and 4, the quality criteria used during the analysis of the case study data included:

- Contextualisation – was continued through the case study by utilising the previous work (i.e. defining the meaning of APMS and by using the updated models from the focus group (Figure 18, p.174 and Figure 9, p.64) to give both parts of the research a common grounding. This set a common context for each interview. The context of an interview response was also important and constant review of the surrounding discussion was required to ensure the correct meaning of any statement.

- Interaction between the researcher and the subjects - by leveraging off the previous work (i.e. the focus group) this minimised the positivist limitation of ignoring the past and helped refine the model using the case study interviewees as experts. The same process was followed as for the focus group and all case study interviews were recorded, transcribed and verified by the respective case study interviewee to ensure there was no error in what was stated.

- Abstraction and generalisation – as previously used in the focus group data analysis, data was codified. By mapping a raw code to passages of interview discussion, data could be interpreted and compared to theory, general concepts and the focus group data (Chapter 6). This process assisted in confirming existing success factors and led to the identification of new ones.

- Dialogical reasoning – was used to identify possible contradictions between the published theory and actual findings within the case study results. An example was the removal of champion as a factor and the substitution of it with sponsorship, as well as the confirmation of two new success factors. The study is designed to discover success factors by utilising a literature based seed model (Wixom and Watson, 2001) and review by industry expert input (the focus group). This resulted in the first iteration of a working model which was then reviewed against other literature in an effort to explain unexpected data results. This Model 1 was then fed into the case study data collection instrument which resulted in Model 2. This constant comparison of the data allows verification and to support emerging factors. Consequently each

category (or factor) is then tied or empirically grounded in both theory and is supported by real world data.

- Multiple Interpretations - required sensitivity to possible differences in interpretations among the case study interviewees to the questions asked and to the researcher interpretation of the data (transcripts). It is accepted that using another method on the case study data may have yielded different results (Mingers, 2001, p. 255). To overcome this deficiency, the researcher has undertaken to examine the influences that the organisational and work situation has had upon the interviewee responses by seeking out and documenting multiple viewpoints along with the reasons for them (Klein & Myers, 1999, p.77). This has been achieved by including quotes from multiple interviewees throughout this case study research phase and providing interpretations to these quotes where they are not self explanatory.

- Suspicion - Even though the above principles of the hermeneutic circle have encouraged various forms of critical thinking (Klein & Myers, 1999, p.77), it is understood that the case study interviewees have probably put forward distortions as they express their individual biases. What is at stake here is not the truth or untruth of the claims but the fact that when such events occur they give an understanding to the social world from where the interviewees exist or operate. By having a selection of people with different roles from within the Case these biases become apparent and they have either been identified in this report or have been excluded. An example is where the Project Manager was reluctant to speak about the politics between himself and the project sponsor (CFO), although comments he made were verified by another senior manager and confirmed indirectly by the evidence of other interviewees where they stated they did not know who the sponsor (or champion) actually was. “This kind of approach clearly goes beyond understanding the meaning of the data because it points the researcher to ‘read’ the social world behind the words of the actors, a social world that is characterised by power structures, vested interests, and limited resources to meet the goals of various actors who construct and enact this social world” (Klein & Myers, 1999, p.78).

The ongoing iterative approach of building a model by first using the literature, then the focus group and then confirming and refining the results with the case study has reinforced the integrity of the research results. This analysis has been done while reviewing the literature. This approach meets the principal goal of triangulation which is to strengthen the data analysis through enhanced confirmation and completeness.

As stated in the methodology section, while hermeneutic theory was utilised to negate the limitations during the data collection and analysis stages of the research, additional quality criteria were used as an

overarching control of the total research to provide triangulation. This is discussed further in Chapter 7.

This quality approach will continue in the next phase of the research, where the focus group and case study results are compared for differences, culminating in the following final chapter of this report.

Conclusion

"It's about being able to automate from source to board if you like."
Case: MG Ref #316

The case study approach was the data collection mechanism for this phase of the research, through which the output from first the literature review, then the focus group phase, was used as an input for the case study organisation interviews to discuss the CSFs for implementing an APMS.

The case study as a data collection instrument, allowed for evaluation and reflection of the interim model produced from the focus group data analysis and the Wixom and Watson Success model for data warehousing (2001, p.20). The focus group model (Model 1, Figure 18, p.174) contains many factors formulated by DeLone and McLean (2002), and had two new candidate factors added, sustainability and timeliness.

The case study organisation, or the "Case", had a strategic goal to implement an APMS and after previous failed attempts, finally succeeded. Based on this success, a cross section of employees and contractors agreed to participate in one on one interviews to answer predefined questions to share their collective learning and experience.

A number of events and actions occurred within the Case that influenced the APMS success. These were the development of the Case's Accountabilities Framework, improved process maturity, a matured development technology, expert team skills (both technical and functional), learning's from previous attempts, implementation of simplicity (a paradigm shift) and lastly, the right timing. There was also to a lesser extent the concept of sponsorship as opposed to championship.

Two additional success factors of “sustainability” and “timeliness” have been confirmed as new factors while the “champion” factor has been substituted with “sponsorship”.

As in the focus group, human factors became apparent in the codification stage of the case study data analysis. The de Waal (2003) behavioural factors have also been added to the research domain as they tend to explain influences identified but not described in the case study and focus group results. These factors have also been added to the research model (Model 2, Figure 24) resulting in an updated APMS implementation success model.

This chapter introduced the reader to the case study as a data collection mechanism and described the process used. An overview of the Case was provided together with a high level analysis of the interviewees and their roles as well as the history of other events that influenced the successful implementation of the Cases APMS. Reasons for selection of the Case, the interviewees and difficulties encountered were discussed. Ethical considerations and biases were identified that may impact the findings, and quality mechanisms were described to minimise these impacts. The results of the case study data collection were presented as well as an analysis of the results.

The next chapter compares and contrasts the results between the focus group and the case study data. This chapter presents a discussion on possible reasons with respect to the literature and research data collected. It concludes by proposing the final model with respect to the research problem and associated theory.

CHAPTER 6
VARIATIONS BETWEEN FOCUS GROUPS AND CASE STUDY DATA

Introduction

The previous chapter introduced the case data collection mechanism and provided an overview of the history and events that influenced the successful implementation of the Case's APMS. Analysis of the data and difficulties encountered were also discussed with ethical considerations and biases. The results of the case study were reported with "sustainability" and "timeliness" being confirmed as success factors, while the "champion" factor was substituted with "sponsorship". These three factors, as well as the behavioural factors, were added to the research model resulting in an updated APMS implementation CSF model (Model 2). de Waal's (2003) behavioural factors help explain human influences exposed in the case study and focus group data analysis.

This chapter compares and contrasts the results of the focus group and case study, and identifies new areas of influence upon success. Reasons for the inclusion of the results are provided with respect to the literature, research data and the researcher's own professional experience. This is reflected in the proposed final model.

The opportunity is then taken to comment on the how the critical realism lens has assisted in this research.

Comparison of results between Focus Group and Case Study

At the end of the case study data collection, a second revised model was presented. To assist the reader, it is illustrated once again in Figure 25, below.

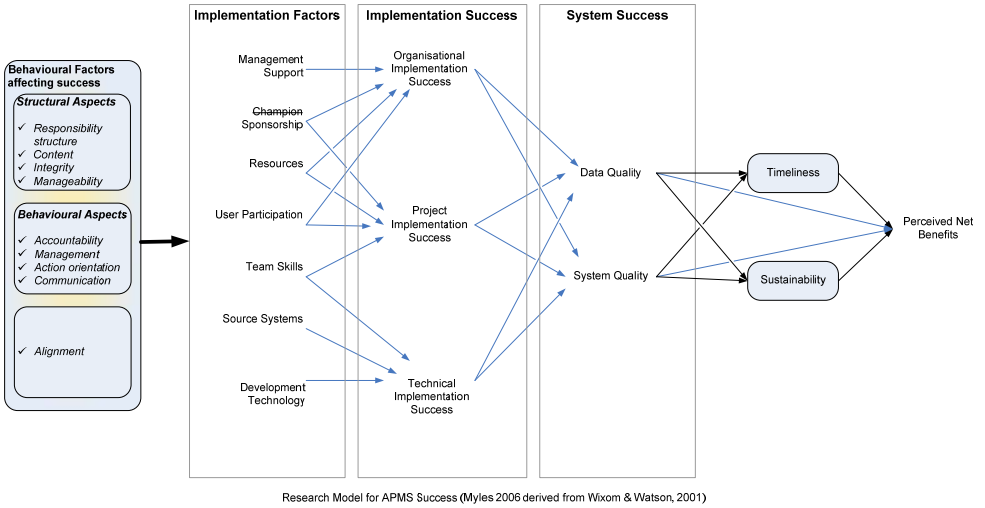

Figure 25. Draft Research Model for APMS Success resulting from Case Study data analysis – Model 2 (derived from Wixom and Watson, 2001, p.20)

Utilising this model as a base, it is important in this phase of the research to compare the results at a high level to ensure all of the influences and data results have been captured. It is also important to identify possible flaws or inaccuracies. To assist in this review, a summary of the results from the focus group and the case study are presented in Table 12 below, and comments are made on the comparison.

Table 12. Summary of results between focus group and the case study

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Management Support	Management support had to come from the top to achieve success. When the term management support was used they preferred sponsorship.	Case's Accountabilities Framework put a structure in place to enforce management support.	Both groups agreed that management support was required although the Case had a specialised structure in place, the Accountabilities Framework which facilitated and supported management with the APMS implementation. The Case's Accountabilities Framework produced a structure that was process driven and was an aspect not raised in the focus group. Sponsorship as a substitute for management support was not present in the case study data. de Waal (2003) structural and behavioural aspects are evident in the management support factor through the responsibility structure, integrity, manageability, accountability, action orientation and communication factors.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Champion	Was an important factor being individually based. The focus group preferred to use the term stakeholder for champion. A weakness identified was when a champion left the organisation or project there was typically no one to replace them and the project would subsequently fail.	Not an important factor as the Case had shared responsibility and allocated accountability due to the Case's Accountabilities Framework.	There was no real evidence in the Case of a link between the sponsor and management support whereas in the focus group they believed there was. The focus group also discussed the relationship between the sponsor and the champion which was not apparent with the Case. A possible reason for the difference was that the Case had a more mature organisation structure with shared responsibility and accountability along process lines. This is discussed further below under the maturity section in this chapter. de Waal (2003) behavioural aspects were evident in champion factor through action orientation, management, accountability and communication. Structural aspects were not evident as "champion" is individual based. If the champion was the CEO maybe this could be argued but it cannot be generalised to all levels of an organisation structure and is not sustainable.	✘

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Sponsorship	Sponsorship as a term was interchanged with management support and champion during the discussion.	Sponsorship term also used as synonym for champion.	Within the focus group a sponsor may be a champion but a champion may not necessarily be within the management structure. The focus group stated that it was possible to rename management support to sponsor although no such data supported this in the case study. A possible reason is that the Case's sponsorship was group based and was implemented through the Accountabilities Framework. de Waal's (2003) structural and behavioural aspects were evident in sponsorship factor through the responsibility structure, integrity, manageability, accountability, action orientation and communication.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Resources	Total commitment was required for the entire project including support and ongoing operational requirements. Need for highly skilled qualified people. Ongoing support and sustainability were raised as major issues that needed to be addressed during the project and not as an afterthought.	Adequate resources, both business and technical were provided at the correct time.	The Case appears to be using minimal resources for ongoing support and administration. This does raise the possibility that the focus group members system and data quality attributes were not as effective as the Case but there was no evidence to support this line of questioning. The Case did have resources that participated in previous attempts (or failures) and this may account for the success, though all being equal, the resources and skills available to both research areas appeared to be similar. de Waal (2003) structural were aspects evident in the resource factor through the allocation of resources. Behavioural aspects were not evident as these are more evident in the team skills or personal attributes of the resources.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
User participation	"Business buy-in" was a term that tended to be used interchangeably when speaking about management support and user participation.	*"Huge business engagement. Huge business engagement. Business, yeah but not just business engagement but business involvement or allocation to the project."* Case: DC Ref C#808	The focus group reported many failures due to the lack of user participation. This did not occur in the Case and may be due to the learning's that occurred with each previous attempt. There were no perceived threats to the users in the Case as experienced by the focus group participants, e.g. in the Case, spreadsheets were not considered a blocker to the APMS implementation; in the focus group people saw the APMS as a personal threat to their role or job or their sense of worth or importance. de Waal (2003) structural and behavioural aspects were evident in the user participation factor through content, integrity, the responsibility structure, accountability, management, action orientation and communication.	✓
Team Skills	"Functional" experts should be part of the team so their functional business skills are available to compliment expert technical resource skills.	Had a good mixture of functional business skills as well as strong technical and interpersonal skills within the Project Team.	The composition of the Case project team replicated what the focus group determined as a factor for success. de Waal (2003) structural and behavioural aspects were evident in the team skills factor. Structurally the Case management are responsible to ensure they have the correct skills while behaviourally the resources must communicate and be accountable for their actions.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Source Systems	Reliable and well maintained data was required from source systems, although local spreadsheet systems were seen as a blocker to the success of an APMS.	The Case understood the importance of quality data inputs from source systems but this needed to be complimented with the ability for manual data entry, although it was agreed this was the exception and not the norm.	Both the focus group and Case agreed on the importance of well maintained reliable source systems but the Case's ability to enter data manually into the APMS overcame the barriers identified by the focus group with this factor. The MDE facilitated flexibility, reliability and sustainability. de Waal (2003) behavioural aspects were not evident in the source system factor but can be matched to the structural and alignment aspects through content, integrity and by the system being a system in its own right, i.e. alignment.	✓
Development technology	No longer embryonic and is maturing readily so early adopter issues not so evident. Getting the right people with the associated skills however was an ongoing issue.	Enterprise Architecture solution used to construct APMS but some components, e.g. MDE, needed to be constructed from scratch.	The Case confirmed the focus group results that the technology was maturing and was not yet a COTS solution. de Waal's (2003) behavioural aspects were not evident in the development technology factor but could be related to the structural and alignment aspects through manageability and system aspects of development technology. This included some form of overarching system environment. The skill shortage problem may not be specifically APMS related but may be an industry or geographic phenomena within the IS discipline.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Data Quality	Data Quality had many different characteristics, so to assist in the analysis the corresponding data characteristics have been separated in the comparison below.		In summary, both the focus group and Case data confirmed that data quality was a critical factor for APMS implementation success, although there were some differences and these are discussed below. Data quality attributes identified by the focus group including measures, auditing and reconciliation, budgeting and forecasting, business processes and timeliness of the data were evident in the case data. The Case displayed a high level of data quality maturity which is discussed in a subsequent section of this chapter. Data quality did not have a direct relationship to de Waals behavioural factors but were indirectly linked through implementation as described by Wixon & Watson (2001).	✓
	Cultural change in the way data is reported	Organisational culture focused on the use of a performance management system to improve	Case results were consistent with the focus group expert data reported.	✓
	MDE not raised.	MDE functionality in APMS	No mention of this as a data or system success factor by focus group as in the purist world of APMS, data extraction, translation, analysis and reporting are all fully automated and no manual manipulation is allowed.	✗
	Data quality issues require formal audits of the data being used in APMS systems as well as methods to formally reconcile the measures reported.		No specific mention by the case organisation on formal audits or reconciliations, although the formal and informal checking embedded within the business processes may account for this omission.	✗

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
	Spreadsheets were seen as a blocker for the introduction of an APMS	Spreadsheets were replaced by MDE and are "gathering dust". Not identified as an issue.	Focus group data indicated that spreadsheets were a potential blocker for success while the Case data indicates that this was not a problem. Aspects of Case maturity may explain users moving away from spreadsheets to the APMS, although system quality for the Cases APMS may also play a part in the acceptance.	✘
	Business process creates quality data.	Embedded processes through the Case's Accountabilities Framework	The focus group requirement of embedded business process data creation was evident in the Case.	✓
	Budgets and forecasts required for reporting against.	Budgets and forecasts were used against every reported measure and tolerances were set within the Case.	The focus group requirement of budget and forecast data was evident in the Case.	✓
	Misalignment between master data sets was seen as an obstacle to the success of an APMS.	Case had similar experience but this was seen as a positive experience because feeder source system data was cleansed and aligned corporately.	The attitude of the management and staff in the Case was positive and enlightening as the focus group reported that this was a continual problem they had encountered and was necessary for data quality success.	✓
	Data quality involved the correct timing of the data. Strategically the data may have some importance but operationally it's relevance may have passed.	Case processes were changed to make operational data reporting the first objective. From there Strategic and Statutory reporting followed. As the time to report data decreased more time was allowed for more analysis of the data.	Case results were consistent with the focus group expert data reported.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
System Quality	System quality also had many different characteristics reported in the data, so to assist in the analysis the corresponding characteristics have been separated in the comparison below.		In summary, both the focus group and Case data agreed that system quality was a critical factor essential for APMS success, although there were minor differences which are discussed below. Data quality attributes identified include response time, usability and user control. The Case displayed a mature system and development environment which is discussed later in this chapter. System quality did not have a direct relationship to de Waals behavioural factors but like data quality, was indirectly linked through implementation as described by Wixon & Watson (2001).	✓
	Response time was considered by the focus group as a primary characteristic of system quality.	Not evident in the case data as response time was never identified as a problem. All reports and queries were extremely fast and available anywhere on the local area network. Reporting and queries were fast enough to enable on-line reporting for the executive committees and monthly board meetings. At these meeting the 'normal' 1 inch report became 10 to 12 pages and items of interest are interactively drilled down into the detail. This was done both against process and organisational lines allowing examination of root causes for success and failure.	Response time was considered an important system quality characteristic.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
	Reliability was raised as a system quality characteristic. The focus group suggested automatic alerts when the system erred or when data was either incorrect or late.	Reliability in the Case was seen as an enabler. Once the APMS proved itself reliable, other uses for the APMS have been examined and its use has already been extended for other purposes.	Reliability was considered an important system quality characteristic.	✓
	Usability of the APMS was a very important characteristic, although being able to cater for "everyone" was considered very difficult to achieve.	The Case reported usability as an important characteristic. It included: ease of use, commentary, simplicity in training, intuitiveness, flexibility, timeliness, ability to update or change data, queries or reports, pleasing screen design, MDE, end user control and lots of features. The ability for it to be administered by non technical staff was also considered necessary.	Case results were consistent with the focus group data, although the case implemented what the focus group determined was required for success, and more.	✓
	User control of the process and data was an important focus group characteristic as "users need to feel they are in control."	The Case interviewees indicated that they had control over the APMS and associated data. User control manifested itself in the ability for users to define how the APMS front-end looked and the ability to customise or personalise it.	The Case displayed a high level of organisational maturity and system awareness by ensuring their users had system control. Not having this control would have resulted in the Case users stating that the system was not usable. User control was considered an important system quality characteristic.	✓
	Flexibility as a characteristic was not explicitly raised by the focus group although they did discuss the need for the APMS to be easily modified while maintaining data integration to allow for organisational change.	Flexibility for the Case included user control over the validation and verification process. The Case had achieved this by end user administration and MDE.	Flexibility was considered an important system quality characteristic.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
	Business processes change over time and the data recorded in one timeframe may not be same as it being recorded in another time frame.	The Case aligned performance measurement to the core business process structures using the Accountabilities Framework. There is a symbiotic relationship between the Case's Accountabilities Framework and business processes as each supported the other and assisted in the alignment of performance measures. The APMS supported ongoing business process change in that it paralleled and reinforced the necessary process structure changes by delivering performance measures along the changed process lines.	Aligning performance measures to business process and ensuring that the APMS is embedded into business process is an important characteristic of success as the APMS must be able to accommodate existing and future processes. Adaptability is an important characteristic of the system quality success factor.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Sustainability	This was a new factor first identified in the focus group data. Ongoing, sustainable support allowing continuous improvement was considered a critical factor for APMS success.	Confirmed within Case, but sustainability also included usability, timeliness and flexibility as characteristics.	Sustainability is a new CSF identified in the focus group data analysis and confirmed by the Case. The Case managed this factor through the governance structure imposed by the Case's Accountabilities Framework. Embedding the APMS in the business process made the Case users not just responsible for the system and the content, but also introduced integrity, manageability, accountability and provided an overall management structure. Sustainability affected the ongoing operations of the APMS. The Case's Accountabilities Framework enabled action orientation for ongoing change and provided a structural mechanism for two way organisation communication. Sustainability was confirmed within both sets of the data collected and has been added to the APMS CSF model.	✓

Success Factor	Focus Group	Case Study	Comment	Accordant with focus group and case
Timeliness	Timeliness is a new CSF that the focus group believed contributed to the relevance of data as it gave it context. Being too old in some circumstances led to a belief that the data was imperfect or not fit for purpose. Specific focus group examples were raised with respect to globalisation and managing different time zones as well as delivering data in a "timely" way. Timeliness was a user defined aspect that affected data quality and organisation methods, i.e. operational versus strategic use.	The case found that COTS packages did not always cater for this scenario and so the Case developed this capability within their APMS One example was MDE and another was rich formatted textual comments.	Technical issues with respect to globalisation and UTC time codes were not relevant to the Case and therefore not discussed as it operated in one time zone. Data quality issues identified by the focus group due to the lag time for data to be available within an APMS were also not relevant to the Case as they did not occur in the successful implementation. The Case had seen this error in previous implementations. Technical, organisational and regulatory change could impact the operations of the Case. The Case's MDE and automation overcame the barriers identified by the focus group as it succeeded in presenting both timely data and allowed the Case to respond quickly to operational change Timeliness is a CSF for APMS implementation success.	✓
Perceived Net benefits	APMS benefits identified by the focus group were different and varying. They were: Information sharing; reliability; SOX compliance; standardisation of business processes.	APMS benefits identified by the Case interviewees were: standard definition of measures; implementation of the Case's Accountabilities Framework; improved data quality; simplification; and alignment of business processes.	The focus group identified possible negative social impacts with the implementation of an APMS but in the Case's instance, they choose to use the system/information for improvement. Intangible benefits identified by the focus group included standardisation of processes, a common set of organisation definitions for measures and "one measure of the truth", which were all realised in the Case.	✓

In summary, all of the above factors were confirmed to be critical factors for APMS implementation success, except the "champion" factor is not supported. Sponsorship was found to be a more acceptable factor and is substituted for "champion". Sponsorship highlights the interaction and reliance of one manager to another, working together towards a common goal. This confirmed the finding of the focus group.

Two additional factors were also confirmed to be critical for success. These are sustainability and timeliness. Sustainability and timeliness as CSFs have relationships with data and system quality and perceived benefits, and affect ongoing operational success.

de Waal's (2003) behavioural factors are critical to the success of APMS as they impact on the implementation factors identified by Wixom and Watson (2001).

Results Review

A review of the results indicates three new areas of influence to be included in the research model. These are:

- Behavioural factors;
- Operating success; and
- Accountability framework.

Please note: While the term *"Case's Accountabilities Framework"* was discussed in detail in the case study chapter, this is the term that is used by the case study organisation to describe their framework. To distinguish between the Case's existing framework and to abstract the concept into theory, the term *"accountability framework"* has been used with respect to the APMS CSF model. This is considered to be more generic, albeit confusing in the context of this thesis, no other term was deemed appropriate.

Behaviour factors

de Waals (2003) behavioural aspects were identified in both sets of data, i.e. the focus group and case. This is not new and early research theorised that behavioural or human factors affected IS success. Ives and Olsen (1984) provided a review of literature on computer based success from 1967 to 1983. In their model, both cognitive and motivational factors were identified arising from user involvement. Cognitive and motivational factors are delineated by the red dotted rectangle in their model in Figure 26, below.

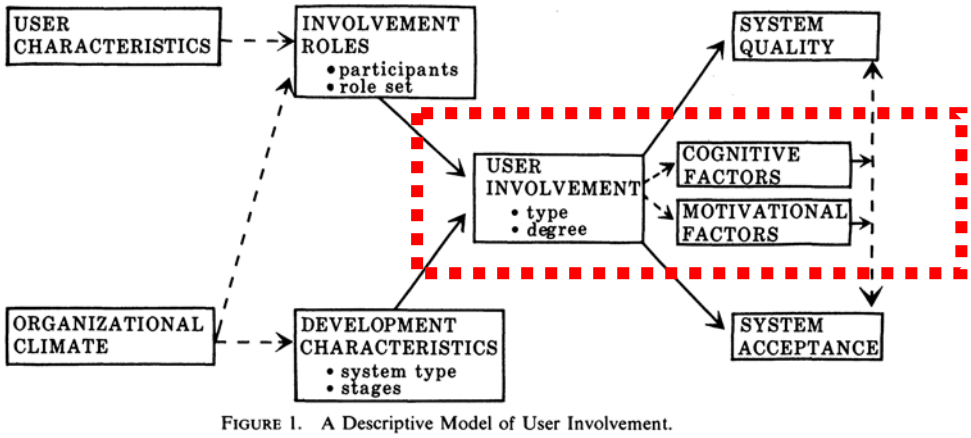

FIGURE 1. A Descriptive Model of User Involvement.

Figure 26. User involvement and MIS success (Ives & Olson, 1984, p.588).

Supporting the human behavioural factors is research from (1990) on MRP system implementation (or infusion). Cooper and Zmud suggest that looking at political and learning models may be more useful than rational decision models (p 123). They argued that success had a human influence, be it as an individual or as a group. This helps support the addition to the model of de Waal's (2003) behavioural human factors.

Although Olsen (1984) and Cooper & Zmud (1990) are both old references, no other literature could be found that describes the relationship between CSFs and behavioural aspects until de Waals (2003) work, i.e. behavioural structures impact information system success. One possible explanation is that the DeLone and Mclean seminal 1992 work and subsequent follow up 2002 literature, is based upon standard preconceived approaches within the previous timeframes.

DeLone and McLean' 1992 paper is based upon 180 empirical studies between 1981 and 1987 and the 2002 'revisit' was based on a further 150 articles that referred to, and made use of, this original IS Success Model. As stated by DeLone and McLean (2002), *"the role of information systems has changed and progressed during the last decade. Similarly, academic inquiry into the measurement of IS effectiveness has progressed over the same period."* (p. 238).

It could be argued that the DeLone and McLean work is based upon academic theory of the time, and as both IS and the measurements have changed since this time the dependent variables sought by DeLone and McLean in 1992 and 2002 are not as relevant as they were when they were originally published. As all the empirical research is based on data from 1981-87, both studies have the same timeframe and influence. In 1981-87, information systems of the time were batch, mainframe, CRT monitor based and the earlier applications would have been less interwoven with people's daily work and were specifically tailored for a small number of "experts". Therefore, the scope of CSFs has changed since that time. This is not to say the DeLone and McLean CSF models are no longer relevant, but they appear to be too simplistic for the current IS world.

DeLone and McLean's work was a starting point for this research and as a base was valuable. It provides a consistent framework within which to examine other research and relevant facts discovered. It provided a building block or basis for including new factors, e.g. operating success through timeliness and sustainability (discussed in next section).

By using critical realism, preconceived beliefs have been challenged and through the data, expert users of APMS applications have also revisited what characteristics make up success factors. For example, the DeLone and McLean attribute '*reliability*' was a characteristic of the CSF '*data quality*', while the data for APMS success indicates that users attribute '*reliability*' to the CSF '*system quality*'. In the same way, using critical realism, the research approach has identified structures that affect behaviour which themselves affect system success.

As discussed in Chapter 3 (p. 85), the DeLone and McLean model is too simplistic, and it is difficult to agree with the notion that organisational impacts are solely predetermined by individual factors. The extension of DeLone and McLean's original model, developed by Wixom and Watson (2001) to model data warehousing success, provided further depth to the analysis, as it helped to identify the various levels of analysis needed and associated impacts at each level. The increasing richness of this model (and the subsequent APMS CSF model) suggests a more subtle and differentiated interaction between its elements and reduces the dependence upon a few "critical" success factors.

Using the comparative analysis performed in Table 12 above, the data relationships between de Waal's (2003) behavioural factors and Wixom and Watson (2001) implementation factors have been mapped. This is illustrated in Figure 27 below.

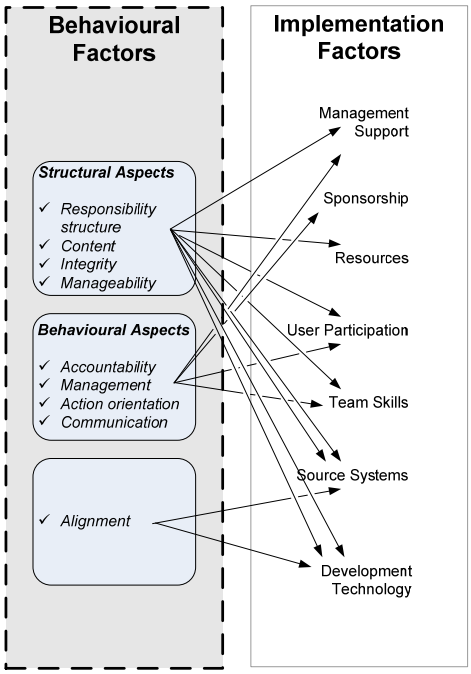

Figure 27. Mapping of de Waal's (2003) behavioural factors to Wixom and Watson (2001) implementation factors.

The discovery of de Waals (2003) behavioural factors alignment to the implementation factors, adds a richness to the results while confirming that performance can be considered an outcome of both organisational and human activities, and assists with the claim that there is a link between performance measurement systems, human nature and business outcomes (de Waal, 2003, p.688).

Operating Success

Two new CSFs were identified in this area of the research. They were sustainability and timeliness. An analysis of the summarised data from Table 12 above indicates that both factors affect operating success.

Operating success can be assisted by embedding a process to ensure that operating process is repeatable and consistent in its outputs. The interviewees stated that quality is referred to as not the best, but the most consistent, e.g. McDonalds burgers are not the best but are based on a reliable, repeatable process. Given this repeatability and consistency, a buyer understands what they are buying, as they are very consistent from one store to another. Operational processes therefore constitute the "doing of business" (Davenport, 1993, cited in Mooney et al., 1996, p.71). Operating success is consequently not new and has been attributed to sustainable competitive gain (Kettinger et al., 1994, p.36).

Operating success depends upon reliably repeating an operation to achieve a consistent outcome. Reliable, efficient operations cannot be taken for granted and must be explicitly strived for. The ability to change and adapt processes, and therefore performance measures within the APMS when required means that the APMS can evolve with the business. “Things that cannot adapt, die.” Being able to react to change, means ongoing relevance to the business and leads to greater sustainability.

Another way of explaining operational success is in software terms. Sustainability is the ability of software to be maintained and improved, and to function in probable future operating environments (i.e. new versions of Windows, new hardware developments). The aim is to meet the needs of the present without compromising the capability of the future (Brundtland, 1987, p.24). The effective ongoing operation of a software application environment is critical to its performance and integrity. Having successfully implemented an application, many organisations lack the skill and experience to ensure appropriate performance and security are maintained. Organisational and process structures need to be established to ensure that the applications are sustained. Experience in planning, establishing, and supporting the application is vital. Basic maintenance and support issues

include responsibility for implementation, security, and the day-to-day support of the system. Once the application environment has been established, vendors can provide experienced administrators to ensure that performance and security of the infrastructure are maintained.

Ongoing operating success also leads to benefits. The Wixom and Watson (as well as the DeLone & Mclean) success model indicated that through system and data quality success, perceived net benefits may flow. The researcher believes there would be few applications where at the end of the post implementation support phase, which usually occurs some 30 to 90 days after go-live, that benefits would be realised. Benefits typically take time and require careful management to be realised (Buchanan, 2007). A system that is operated in a reliable and timely way will not realise benefits. There will be additional costs and possible business impacts that will conceal or negate the benefits expected.

It is therefore argued that operating success is required before benefits can be realised, but these benefits are still dependent on system and data quality. This is illustrated in Figure 28 below.

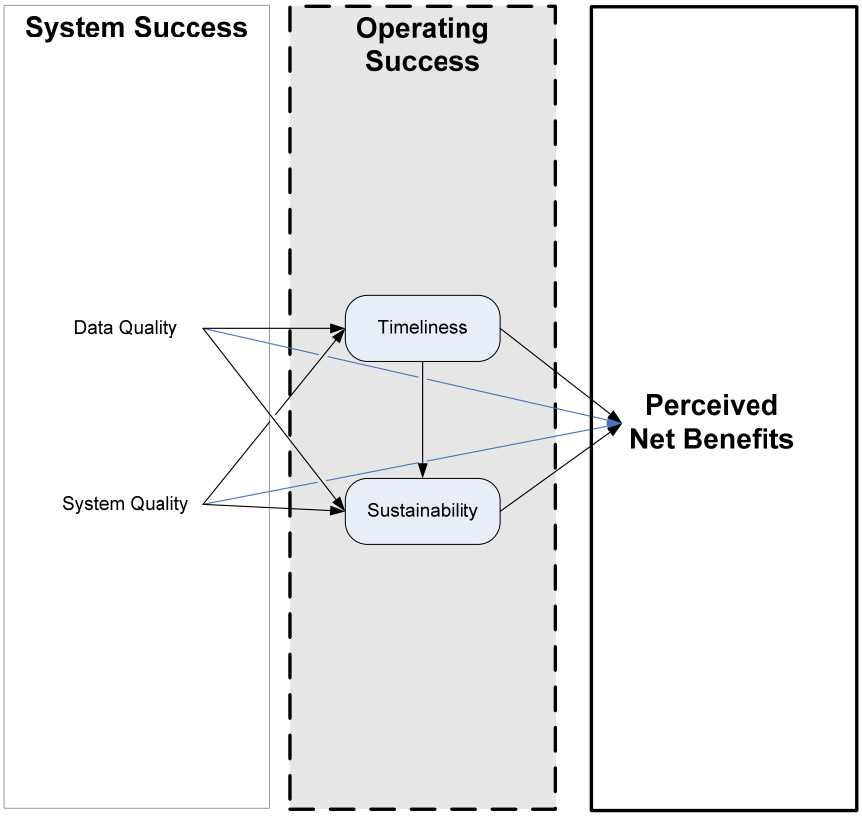

Figure 28. Operating success.

At this point of the research, operating success factors have been identified and included in the model, although it is an area for further research. This is discussed in Chapter 7, further research areas (p310).

Accountability Framework

While an accountability framework was discussed in detail in the case study chapter, it is important to first discuss the maturity of an organisation, business processes and how maturity relates to the research data.

Maturity

As discussed in the case study data analysis, there were historical events that influenced and assisted the success of the APMS in the Case. One of these is process maturity. “Maturity” as a concept in IS literature has mainly focussed on the Carnegie Mellon Software Engineering Institute (SEI) Capability Maturity Model for Software (CMM and SW-CMM) (Paulk, Curtis, Chrissis, & Weber, 1993a). This has been subsequently replaced with the Capability Maturity Model Integration (CMMI) (Herndon et al., 1993). Considering the SEI model and the process maturity encountered in the Case, conclusions can be drawn about the level of maturity for the focus group and case study data, and a comparison of the two can be made.

Adapting the underlying SEI model to areas other that software process development is not new. Lockamy and McCormack (2004) took the original SEI maturity model and used it to examine the relationship between supply chain management process maturity and performance, resulting in a supply chain maturity model. Other examples of using the SEI model to describe maturity include knowledge management (Gallager & Hazlett, 2004; Klimko, 2001; Kochikar, 2000; Kruger & Snyman, 2005), product development (Fraser, Moultrie, & Gregory, 2002) and project management (Maqsood & Javed, 2007).

Table 13 summarises five levels of maturity (using the SEI model classifications). The table describes the characteristics and these have been mapped to the focus group and case study data.

Table 13. Maturity Level compared to focus and case data results

Level	Characteristics	Focus Group	Case Study
Level 1 Static or Ad Hoc.	Unstructured and ill-defined processes. Process measures not in place. Organisational structures based upon traditional functions, not horizontal processes. Individual heroics and 'working around the system' are what make things happen.	Majority of the focus group reported that most organisations were individually led with "heroes". There were limited defined structures for budgets and forecasts for organisation levels and process measures were ill defined. Monitoring for most areas was done through spreadsheets and most of the user base saw little or no value in the APMS.	No evidence present in current implementation of APMS, although some anecdotal evidence in past attempts. Case is more mature.
Level 2 Functional Excellence or Defined.	Basic processes are defined and documented. Changes to processes go through a formal procedure. Jobs and organisational structures include a process aspect but remain basically traditional. Representatives from functions meet regularly to coordinate process activities (though only as representatives of their traditional functions)	One or two global organisations (e.g. global oil & gas company) were discussed by the focus group to have had defined processes linked to maintenance measures, i.e. Solomon indicators. These in the main though did not link to other strategic measures or plans.	No evidence present in current implementation of APMS, although some anecdotal evidence in past attempts. Case is more mature.
Level 3 Horizontal Integration or Linked.	The breakthrough level. Managers employ process management with strategic intent. Broad process jobs, measures and structures are put in place outside of traditional functions. Cooperation between intra-company functions, vendors and customers takes the form of teams that share common process measures and goals.	Although discussed in part by the focus group, no evidence was presented to support the linking between activities. Most of the comments from the focus group were actually requirements, i.e. what was needed to make it a success, not what was actually happening	Case's Accountabilities Framework supports this level of maturity. They have defined processes linked to measures that feed operational and strategic outcomes and goals. Their people (employees and contractors) understand the processes through the Accountabilities Framework.

Level	Characteristics	Focus Group	Case Study
Level 4 External Collaboration or Integrated.	The company and external entities take cooperation to the process level. Organisational structures and jobs are based on process. Traditional functions begin to disappear altogether. Process measures and management systems are deeply embedded in the organisation. Advanced process management practices take shape.	No evidence was presented by the focus group to support this level, although it was determined to be a requirement for ongoing success.	Case's Accountabilities Framework does display this level of maturity and the Cases use of the APMS for regulatory reporting has just commenced. External contractors did use the system and fed measures back into the system, but as outsourced employees. This was however limited to only the maintenance area. The Case is moving to this level of maturity but is not there yet.
Level 5 Multi firm collaboration or Extended.	Competition is based upon multi-firm networks. Collaboration between legal entities is routine to the point where advanced process practices allow the transfer of responsibility without legal ownership. Trust and mutual dependency are the glue holding the extended network together. A horizontal, customer-focused, collaborative culture, sharing all measures, is firmly in place.	No focus group data to support this level of maturity	No case study data to support this level of maturity, although they do have a longer term strategy for moving their business to a virtual organisation (i.e. utilising other vendors and business specialist skills). The APMS system was available to external organisation users, although this was limited (e.g. Board members).

Utilising the work performed by Lockamy and McCormack (2004), IBM came up with a mechanism of rating supply chain maturity (Butner, 2005). Within each level of maturity an organisation is rated against nine key dimensions (strategy, process, monitoring, customer liaison, people, systems, culture, organisation as well as product and service). These dimensions are critical human and organisational structures and are easily mapped to the success factors in the research findings. The researcher has taken these dimensions and mapped them based on his understanding of the data provided. While it could be argued that the dimensions could be replaced by the proposed CSFs, no data or evidence was collected to explain the degrees of difference between the generalised focus group organisations and the specific one off Case. It is important to rate the focus group and Case against something accepted in the business and academic community that allows a maturity comparison between groups. For this reason the supply chain dimensions were used; n.b. Butner's model has now been generalised and IBM are reporting these results for Australia/New Zealand and mainline China as the original research was based only on the United States. Further details can be found at http://www-03.ibm.com Search "Follow the Leaders".

The mapping illustrates the differences between the underlying subject areas and is illustrated in Figure 29 below.

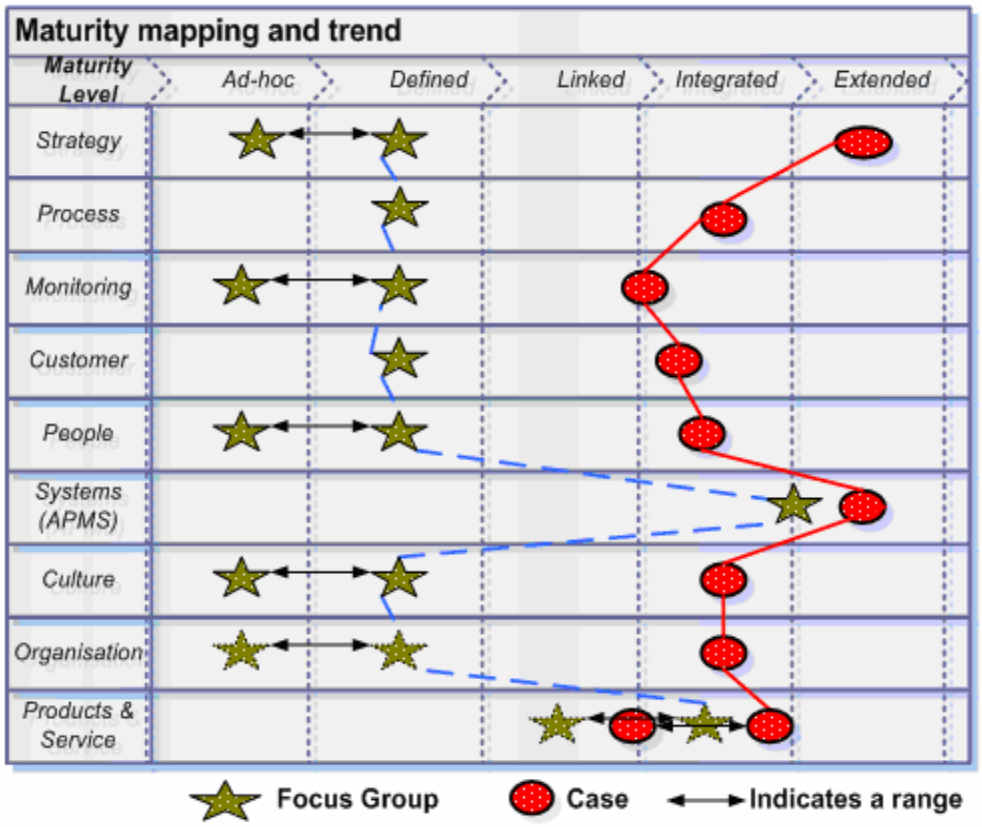

Figure 29. Maturity mapping interpretation for focus group and case study data.

It is suggested that the low rate of success presented by the focus group is caused by the gap between system maturity level and the overall maturity level. Other causes have also contributed. The mapping of the focus group with the Case clearly illustrates the difference in maturity. The tight grouping of the Case for most aspects of maturity indicates why the Case has successfully implemented the system; they are within a congruent maturity plain. The focus group on the other hand, illustrates a wide degree of separation between the system and other maturity aspects. It is suggested that unless all of the maturity factors are within a similar maturity level, the organisation (and people) will drag the non-aligned aspect(s) back to the same approximate plain. This area requires further research.

Business Process

Process maturity proposes that a business process is cyclic and is assessed by the amount to which the process is explicitly defined, managed, measured, and controlled. It implies growth in process capability, richness, and consistency across the entire organisation (Dorfman & Thayer, 1997, cited in Lockamy III & McCormack, 2004, p.273). As an organisation increases its process maturity, institutionalisation takes place via policies,

standards and organisational structures (Hammer, 1996, cited in Lockamy III & McCormack, 2004, p.273).

Business processes can also be intermediate processes, that taken together comprise the execution of an organisation's strategy and is typically where IS business value can be measured (Mooney et al., 1996, p. 74). In this context, this is another identified difference between the case study and focus group data which highlights the ownership of the intermediate processes. The Case's Accountabilities Framework clearly puts all business process, even intermediate processes, within the control and management of the Case's business process owners and managers, whereas the focus group spoke only about sponsorship, management support and champions. In the focus group, responsibility for these intermediate processes moved from the business owners to IS. IS then had all the accountability but no responsibility and therefore was more likely to fail.

Clearly defined processes within the Case's Accountabilities Framework, are described and illustrated in the ARIS modelling tool. The ARIS process models support: clearly agreed responsibility structures; well defined content; group manageability; individual accountability; action orientation; and well understood communication mechanisms. This reinforced the performance measurement and management framework implemented through the Cases APMS.

Defined and well understood business process was necessary for the creation of the Case's Accountabilities Framework; this has a mutual beneficial relationship with the APMS.

Accountability Framework and Success Factors

A significant discovery in this research was the accountability framework itself and the symbiotic affect it had with the Case's APMS. The accountability framework has directly influenced the success of the Case's APMS and is a major structure affecting this success.

de Waal's (2003) behavioural factors are supported by the accountability framework through making available structural and

organisational aspects while also supporting the behavioural aspects of the people in the Case.

The accountability framework provided for implementation factors through a structure for management support, sponsorship and user participation while establishing structures for maintaining source system data and providing a mechanism for technical and business resources. This led to implementation success at the Case by providing a well defined and agreed structure for organisational and project success. The accountability framework also supported technical success by empowering the IS Manager to be responsible for all IS and technology processes.

All of these components led to system success. Through the defining of ongoing process owner and manager responsibilities via the accountability framework for data associated with a business process, there was data and system quality success.

The accountability framework also contributes to operating success by providing a robust and sustainable structural environment that is continually reviewed by all senior managers, communicated to all employees and freely available via the intranet. This has led to benefits being realised. More benefits are expected in the future as the APMS and the organisation matures to the next level.

The accountability framework relationships are illustrated in Figure 30 below.

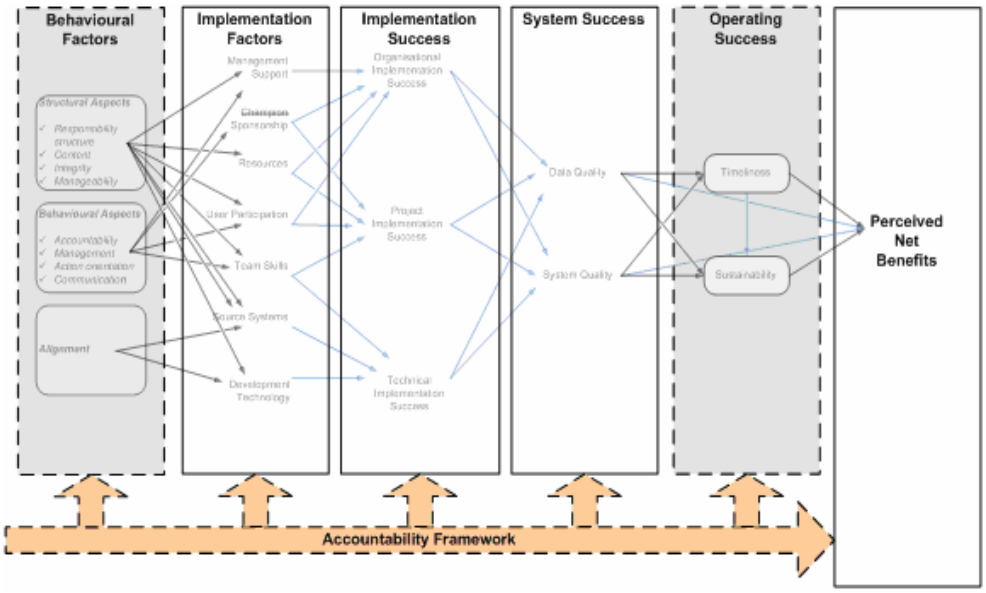

Figure 30. Accountability framework relationship to factors.

Resulting Model

Taking into account the new factors and results a new updated model is proposed.

The additions and modifications to the research model exposed in this chapter are:

- The mapping of de Waal (2003) behaviour factors to Wixom and Watson's (2001) implementation factors (Figure 27);
- The alignment of timeliness and sustainability into a group called operating success which leads to perceived net benefits (Figure 28); and
- The inclusion of the accountability framework into the APMS CSF model (Figure 30).

This final model is illustrated in Figure 31 below. Additions and modifications are shaded in grey.

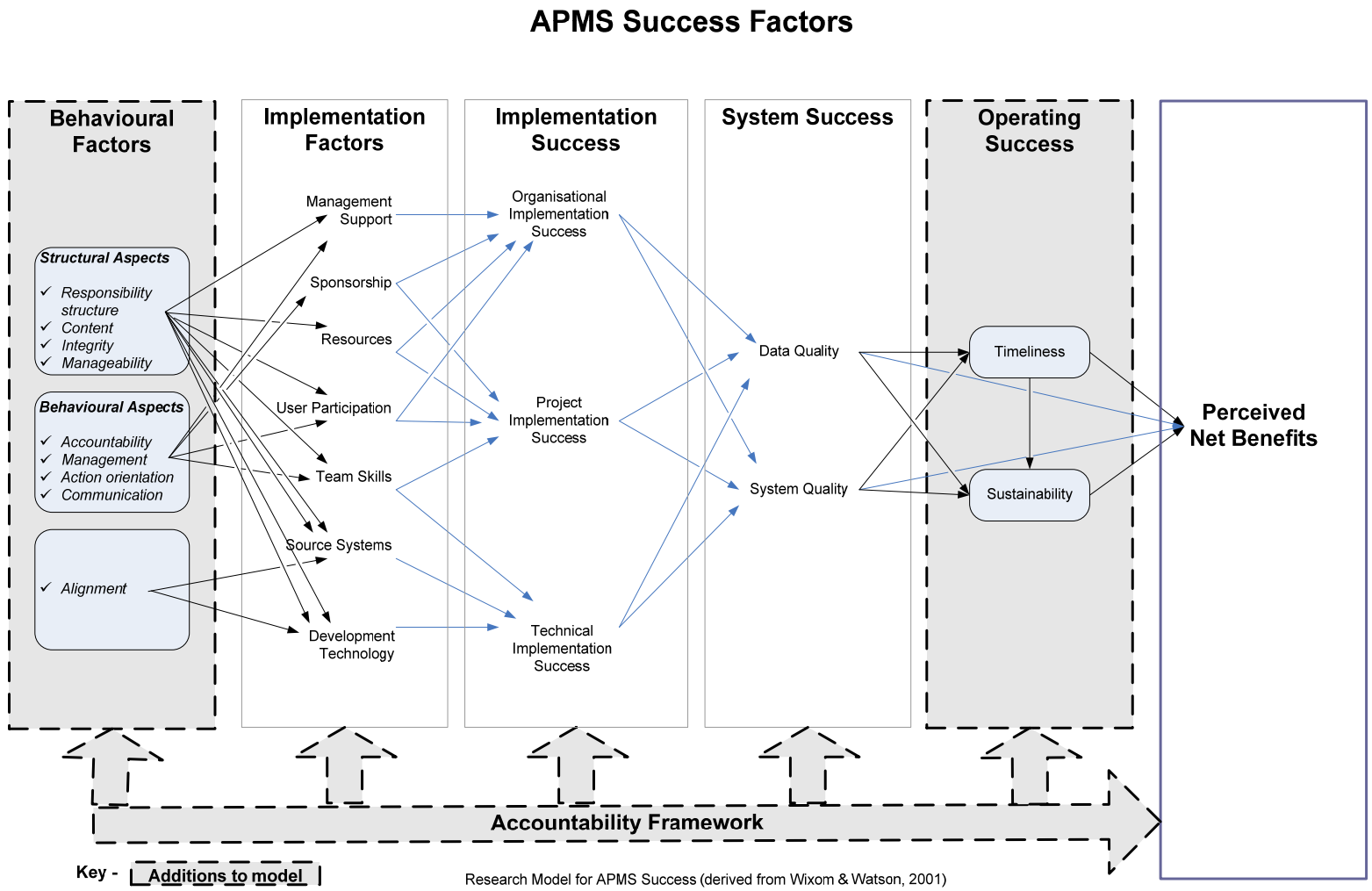

Figure 31. APMS CSF Model.

The Research Problem, the Results and Critical Realism

The research question for this body of research is:

"What are the critical success factors for successful implementation of an Automated Performance Measurement system (APMS)?"

The results have led to a proposed model of CSFs for implementing an APMS. The research seeks to understand the issues involved in implementing such performance measurement systems, and adopted critical realism as a basic underlying philosophical grounding for the research.

The focus group meetings with previous APMS project participants confirmed the importance of many of the factors identified in the various models and identified potential new factors. In the case study, the organisation had previously tried to implement automated performance management on a number of occasions with little success. The final attempt was successful, and the system is being used to report and analyse business measures. Other uses are being investigated. One of the key aspects identified in their latest attempt is the successful APMS must have a degree of sustainability that other IS systems may not need to have (this was discussed on page 275). According to Backström et al. (2002), a sustainable work system can be described as a work system that consciously strives towards simultaneous development at different levels: individual, group/firm, and region/society.

The notion of timeliness also emerges as a characteristic of operating success. It addresses how quickly, when, or by what date an enhancement or change can be applied to affect the APMS. The ability to react to a new measure within a reporting cycle is very important. Governments, external regulators and other 'dues ex machina' bodies do not necessarily wait for a business to be ready to report a particular measure. Sometimes these measures are driven internally due to a need to correct or enhance a particular business process.

From this study it has become evident that external structures and the constraints and mandates they impose severely affect APMS

implementations. Such a conclusion is consistent with the critical realist view, in that it reveals the evident, analytical duality in the way that agents are both constrained and enabled by preexisting internal and external structures that they transform and reinforce through their ongoing actions.

The Case's Accountabilities Framework, introduced in the case study, assisted in the identification and support of business processes in the organisation by universally empowering the process managers, while communicating to all users the people responsible and accountable for the process and associated measures. This devolvement allows for each specific process manager to cope individually with change in that process chain, while engaging the whole organisation. It promotes collective learning and self organisation. The APMS in the case study presented people with a common vision of performance measures, while sharing interpretation of the results from the lowest points in the organisation structure through the executive to the board.

At the conclusion of the focus group, unknown factors were discovered that were human in nature. These factors affecting behaviour became evident in the constructs used by the focus group and the Case interviewees, and are important to an APMS because like all systems, an APMS exists within a social context. Both the focus group and the Case discussed organisational structures and mechanisms for managing and utilising an APMS, but the behavioural factors indicate social and psychological aspects that affect success.

People are complex social beings who can and will modify their behaviour over time. At an individual level, critical realism suggests that, whatever a person actually did during any particular period of time, they could have done something else, if they had wished to. (Pinkstone, 2003, p.152). Critical realism takes seriously the notion of free will, notwithstanding the constraints of the physical and social structures within which we find ourselves. As with the Case, people change their behaviour over time because they learn from experience, qualitative circumstances change, or because they are just persuaded by others to do so. This research has uncovered structures that influence behaviour which is conducive to

success, and must therefore be seen as belonging to the set of CSFs for APMS implementation. This is equally true of social groups or society at large. (Pinkstone, 2003, p.152).

Throughout the study, critical realism provided a foundational platform for developing the research. The following realist elements (described in Chapter 3, p. 80) were important in the study development.

The realist focus on context and setting

In the context of the APMS research it became evident that contextual issues were paramount in explaining the success and failure of the implementations. With the focus group interviews and individual case follow-up, the fundamental discussion was always around the particular circumstances of the implementation, e.g. the people involved, the organisation structure and the technology version at the time. This emphasis on context impacted the underlying research focus. The critical realist focus on retroductive, propositional type questioning, led to a contextual basis for the study seeking to answer "Under what conditions might APMS implementation prove successful?" rather than "What are the (predictive) CSFs for an APMS implementation?" de Waal's (2003) behavioural factors assist by identifying this context for each APMS implementation, as individual or group behaviour will change based on the environment and context of the time.

Realist emphasis on explanation and ex-post evaluation

For this research the focus group and case examples were of previously implemented systems and the focus was on confirming or denying a postulated model. The model developed from the focus group interviews was further refined by examining an actual case study, so each examination was based on lived experience from APMS implementations. Through continual review and explanation through the data, a final model was reached, although it is only relevant to this research study and within those confined structures.

The realist need for an "analytical dualism"

As discussed in Chapter 3, any research study founded on critical realism needs to reflect the duality of structure and agency. This duality in the research was undertaken by looking at both individuals (the micro) and then the organisational (the macro). This occurred in both the focus group and case study data collection methods. Through these data groups, structural relations were examined to identify resources and ideas that resulted in changes based on the historicity of APMS implementation and pre-existing social practices. This led to the discovery, examination and use of de Waal's behavioural factors as a prelude to implementation and the accountability framework influences the behaviour and structural aspects present. The data also led to the identification of the Case' Accountabilities Framework and the effect that this major structure had towards success by impacting both the micro and macro views.

This research utilised the Wixom and Watson (2001) model to produce a final research model (Figure 31, p.285) that reinforces a fine and differentiated interaction between its elements and reduces the dependence upon a few "critical" success factors. This model (Figure 8, p.60), an extension of the simpler DeLone and Mclean model, helped to identify the various levels of analysis needed and associated impacts at each level.

An emphasis on the social nature of IS/IT implementations

As stated previously, the implementation and operation of an APMS can be highly political and sensitive, and the final communication of performance figures is inherently social. The communication may lead to public disclosure of underperforming departments which may lead to the possibility of sanctions and to a broader organisational community act to censure and / or control the underperforming party (Pawson et al., 2005, p.22).

During the analysis of the focus group data a number of unknown factors became visible and these appeared to be social in nature. Through this social lens the factors were mapped to de Waal (2003) behavioural factors and were reaffirmed within the case study.

The identification and review of the Case's Accountability Framework highlighted new divisions of labour, requirements for cooperation and a transcendence of current work processes. This framework was particularly useful to the Case in assisting with an unimpeded flow of information and the removal of the perceived threat to those whose authority is based upon the existence of boundaries and fiefdoms. These social structures assisted in the evaluation and discovery of the success factors.

The ontological depth of critical realism

The research framework included macro phenomena, like structural and institutional phenomena, as well as micro phenomena, like behaviour and interaction. It looked at context, setting, the situated activity (or dynamics) while acknowledging influences from the researcher. This is in accord with Carlsson (2003, p.13, cited in Dobson et al., 2007, p.148).

As stated previously in Chapter 2, critical realism encompasses the distinction between the world and our experience of it but also suggests a stratified ontology. This ontological depth comes from first, the empirical or experience and was evidenced by the focus group real world knowledge and shared experience; the second, the actual, was evidenced by the focus group participant's experiences as well as the failures and successes of the case. The third, the transcendental, non-actual or deep, was evidenced by the structures most clearly represented by the Case's Accountabilities Framework but was also evident in the structures, mechanisms and powers associated with sponsors, user participation, managers and employees.

The events of each implementation were not the primary focus but the deep structures and mechanisms that made up the APMS implementation environments were the primary focus of this research. These structures were only observable through the effect of failure or success of the focus group participants or case study interviewee's collective experience.

This research although comprehensive is an initial investigation in APMS CSFs and can be improved. It may also not be relevant to other organisations, i.e. generalisable, and should be seen as a point where the

knowledge can be expended upon and improved. This is in accord with Stones (1996, cited in Dobson et al., 2007, p.140).

Conclusion

This chapter compared and contrasted the results between the focus group and the case study with respect to the literature and research data collected. The analysis was presented based upon the researcher's beliefs and experience, resulting in the final APMS CSF model.

The next and final chapter, puts forward the conclusion and possible implications of the research. It also discusses implications for both established theory and for APMS practitioners. Limitations of this research are presented and areas of possible further research are tabled.

CHAPTER 7
CONCLUSIONS and IMPLICATIONS

Introduction

The previous chapter compared and contrasted the results between the focus group and the case study and discussed possible reasons for the similarities and differences with respect to the available literature and research data collected. The analysis presented was based upon the researcher's beliefs and experience, well known concepts and established ideas, resulting in the final revision of the APMS CSF model. Critical realism elements were discussed and examples from the research data presented to support the proposal as to why critical realism was selected as the underlying philosophical grounding for the research.

This is the final chapter and puts forward the conclusion and possible implications of the research. It also discusses the contribution to established theory and APMS practitioners. Limitations of this research are also presented and areas of possible further research are listed and discussed.

Conclusions and implications

APMS implementation is highly complex - socially and technologically. In a sense, such systems are the pinnacle of enterprise IS, relying upon the technological success of base systems, the adequacy of their own technology, and the organisational coherence and commitment of a wide range of effected stakeholders.

As stated in Chapter 1, the definition of a successful implementation is:

> "Implementation success for an automated performance measurement system is an automated performance measurement system delivered with agreed-upon requirements and being used in the organisation."

The important word is “success”. The literature and focus group data indicates that success is rare for APMS implementations, although the data obtained from the case study indicates that success is possible, given the right factors. There is a real world solution that does exist, although it may not be easily repeatable, as different organisations will have different cultural and structural aspects that may influence the final outcome.

The focus group meetings, with previous APMS project participants, confirmed the importance of many of the factors identified in the various existing and proposed models, while the evolving models assisted in identifying possible new factors. The case organisation had previously tried to implement automated performance management on at least three occasions with very little success. The final attempt was successful and the system is being used to report meaningful data. The Case assisted with this research, confirming the existence of additional factors and structures which assisted with APMS success, i.e. the Accountability Framework.

Through this research, additions and modifications were made to the original seed model (Wixom and Watson Data Warehousing Success Model (2001, p.20)) resulting in a proposed CSF model for APMS implementation.

In Chapter 1, claims were made as to what this research would contribute. To recap, this was to:

1. Propose a model of CSFs for implementing an APMS that may be of some use to companies interested in implementing an APMS; and

2. Examine the relationship in the literature between the operational management and IS disciplines for success factors in implementing performance measurement systems.

The Researcher believes that both of these components have been achieved and two additional contributions have become apparent through the research. These are:

3. Making a case for the use of critical realism in IS research; and

4. The realisation that performance management is a broad and confusing term hence performance measurement is a more suitable term in this study.

These are described further below.

1. Model of critical success factors for implementing an APMS

The research question for this research was:

> *"What are the critical success factors for successful implementation of an Automated Performance Measurement system (APMS)?"*

The success factors were identified and refined through the literature review, focus group and case study data.

Having uncovered possible factors from two literature disciplines, operational management and IS success, and taking into account other discoveries from the focus group participants and case study interviewees, new factors were grouped and the results included in an updated model. The additions and modifications to the original seed model are best summarised from those listed in Chapter 6.

- *The mapping of de Waal (2003) behaviour factors to Wixom and Watson's (2001) implementation factors.* The structural and behavioural aspects of de Waal's (2003) factors are evident in most of the Wixom and Watson implementation factors as they confirm that performance can be considered an outcome of both organisational and human activity and assists with the claim that there is a link between performance measurement systems, human nature and business outcomes (de Waal, 2003, p.688). These factors may be an important contribution to APMS success as they may also influence IS system success in general. This is a possible area for further research and is discussed later in this chapter under the contributions to theory section.

- *The alignment of timeliness and sustainability into a grouping called operating success.* Operating success is experience in repeating an operation reliably to achieve a consistent outcome, but reliability by itself cannot always be depended on. Reliable, sustained, efficient action is what is required to maintain operating success within the required timeframes. These actions have been attributed to sustainable competitive gain (Kettinger et al., 1994, p.36). Sustainability in IS is the ability of software to be maintained and improved to function in probable future operating environments. IS sustainability aims at meeting the needs of the present without compromising the capability of the future. The effective, ongoing operation of a software application environment is critical to the performance and integrity of the application, and for its ability to realise perceived net benefits.

- *The inclusion of an accountability framework*. A significant discovery has been the accountability framework and the positive symbiotic affect it had with the Case's APMS implementation. An accountability framework provides well defined agreed structures for organisational and APMS project success by providing support for management, sponsors, and users. By defining ongoing process owner and manager responsibilities for data associated with a business process, it enables data and system quality success while ensuring a robust sustainable, structural environment that is continually reviewed by all senior managers and is formally communicated to all. Most importantly, points of accountability are defined, assigned and are well understood.

The final research model is illustrated in Figure 32, below. This model was the primary objective of this research into the discovery of APMS CSFs as there are few academic studies on performance measurement systems. This is probably the first on APMS.

A valuable contribution from this research is the extension of the IS implementation literature through the investigation of APMS implementation factors. Both IS and affected business managers will benefit from this research as it validates current understandings and develops new ideas for APMS implementation and its ongoing operation.

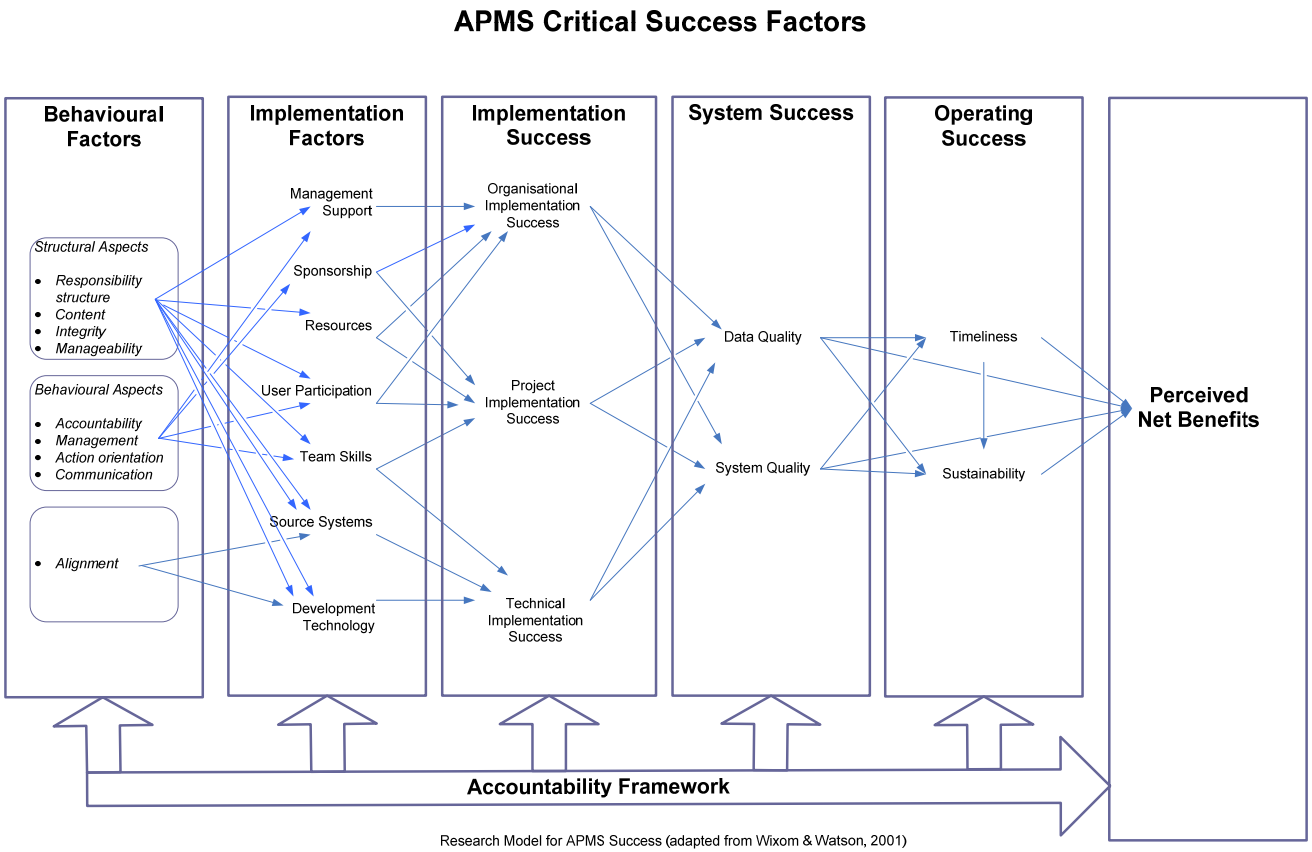

Figure 32. APMS CSF final research model.

2. Relationship in the literature between the operational management and IS success

To establish a relationship between operational management and IS success, a model was produced by mapping common success factors documented in the relevant literature. As literature was reviewed and success factors identified, they were mapped to the existing factors from the DeLone and McLean (1992; 2002) and Wixom and Watson (2001) models. Where the same factor name was identified, multiple source indicators were mapped. A resulting model (Figure 9 p.64) establishes the literature relationships between the IS discipline with that of the operational management discipline. The contributions of this mapping are two fold. First, the model demonstrates the relationships between the different disciplines while the second contribution was the model provided a domain and source of reference for this and future APMS research.

3. Making a case for a realist approach

Throughout this research the underlying epistemology has been that of critical realism. Using the work of Lee (2002), who has argued that grounded theory supports critical realism in economics, the following argument is put forward to substantiate the critical realist approach followed in this research. It utilises the same argument in Lee's paper (p. 794).

Critical realism is becoming influential in a range of disciplines but there have been few practical examples of its use in IS research (Dobson et al., 2007, p.139). The data reflects real, observed patterns of behaviour and belief structures recorded through interview. The participants verified the transcripts and confirmed their statements. The factors too are real, as they are embedded in history by Wixom and Watson (2001), and emulated from the established work of DeLone and McLean (1992; 2002). Since the data lie in time and history, each factor can be identified to a particular historical setting.

The constant comparison of the data allows verification and to support emerging factors. Each factor identified then becomes established and is traceable to other pieces of data collected, or multi-sources. Although

not significant in their own right, they become significant by their collective presence. The factors that have emerged therefore are from the data and the patterns and structures observed by the researcher. Through the researcher's immersion in the data and the researcher's own considerable experience, underlying "deep structures" of timeliness and sustainability have been discovered, which have a causal impact upon success. The collective data is therefore denser and more realistic. A grounded theory category, in this research - success factors, has not ignored the complexity of reality but, rather, it has embraced it (Lee, 2002, p.794).

Applying grounded theory to the results has been very successful. It created an abundant quantity and yielded a great richness of information. The examples given by the focus group participants contained more varied data than could be expected from an individual or multiple set of interviews. Having everyone in the one venue, discussing the questions and supporting and querying each others answers, was efficient and fruitful.

As stated in Chapter 6, realist researchers need to be able to account for the underlying ontological richness they implicitly assume and reflect the belief that any knowledge gains are typically provisional, fallible, incomplete and extendable. Realist methodologies and writings, thus, must reflect a continual commitment to caution, scepticism and reflexivity.

Contributions from utilising critical realism for this research has resulted in one paper being published and a conference proceeding. These are listed below. This research has helped contribute one more example of the use of critical realism in IS research.

- Dobson, P. J., Myles, J., & Jackson, P. (2007). Making the Case for Critical Realism: Examining the Implementation of Automated Performance Management Systems. Information Resources Management Journal, 20(2), 138-152.

- Myles, J., Dobson, P. J., & Jackson, P. (2007). Examining the Implementation of APMS - A Critical Realist Perspective. Proceedings of the Australia and New Zealand Systems Conference 2007 (in press). Auckland, New Zealand. 2 – 5 December.

4. Performance Management is a confusing term

The concept of providing the right measures to the right people at the right time is aiming to add to the ideal of an information democracy; therefore a measurement information supply chain paradigm is evolving. The realisation during this research that performance management is a broad and confusing term is a minor contribution. Performance measurement as a term ranges in meaning from human resource management, to managing the performance of an internet site. Gartner, a commercial research company, try and cover all these bases by even including spreadsheets and full text searching, thereby rendering the term so broad as to be of little use.

A summary of the Gartner Group's application types as well as other application types identified in the technology industry and academic literature, are described Table 2 in Chapter 2, to help both academic and industry understand what applications are available and whether they are APMS or not.

Implications for theory

The implications for theory from this research are four fold. The first is that there is now a proposed CSF model for APMS success. The second is the linkage of de Waals (2003) behavioural factors to IS success; the third is that the Wixom and Watson (2001) success factors may not be just limited to data warehousing but through this research they have been expanded to include APMS implementations. The fourth and final implication to theory is the accountability framework and its possible impact on IS success. These are discussed further below.

Critical success factor model for APMS success

No model currently exists for APMS implementation success. This research adds this to the body of knowledge for performance management and performance measurement. The findings suggest that most of the traditional factors from the implementation literature, e.g. management support, resources, user participation, affect the success of an APMS, as do behavioural factors. The research also indicates that implementation success models cannot be used to investigate APMS implementations without some

modification. For example, other factors were needed to explain ongoing operating success, i.e. timeliness and sustainability, and the behavioural factors were added that affected the established implementation factors from Wixom and Watson's data warehousing model. This is consistent with the Wixom and Watson findings (2001, p.37).

Linkage of de Waals (2003) behavioural factors to IS success

The impact of de Waal's behavioural aspects on IS success are also important as early research indicated that behavioural and human factors affect IS success and need to be taken into account during an implementation project (Cooper & Zmud, 1990; Ives & Olson, 1984). Some later critical research introduced behaviour as a term to explain the reason or thoughts behind the "intention to use" a system or technology through the technology acceptance models (Legris, Ingham, & Collerette, 2003, p.197). Little research has occurred in the front-end process that drive IS success, i.e. before start-up, although Hevner et al, (2004, p.80) did introduce behavioural science into an environment group that contains people, organisation and technology as business needs. Hevner et al, lacks the depth and detail apparent in the de Waal model and is not considered appropriate. de Waal's factors though, are positioned to enable a determination of structural and behavioural maturity before any attempt is made to introduce an APMS (let alone any other system). de Waal's behavioural success factors therefore have the ability to influence most (if not all) theory on IS success.

The mapping of de Waal's behavioural factors to Wixom and Watson's implementation factors, adds a richness to the results while confirming de Waal's claim that performance can be considered an outcome of both organisational and human activities and assists with the claim that there is a link between performance measurement systems, human nature and business outcomes (de Waal, 2003, p.688). de Waals behavioural factors are also supported by the accountability framework by making available structural organisational aspects while also supporting the behavioural aspects required for success.

Wixom and Watson (2001) success factors may not be just limited to data warehousing

Wixom and Watson's (2001) data warehousing success model was used as a seed model and was expanded upon to facilitate the discovery of CSFs for APMS. The validation of this model, through this research, indicates that it may be possible to use the Wixom and Watson model for other applications or technology success. The increasing richness of the Wixom and Watson model suggests a more subtle and differentiated interaction between its elements, and reduces the dependence upon a few "critical" success factors, as proposed by DeLone & McLean's IS model (2002). It is proposed that the Wixom and Watson model may be a better model for IS success theory instead of the more universally accepted DeLone and McLean model (2002). The DeLone and McLean model appears to lack depth as it is too simplistic as discussed in Chapter 6. This is an area for further research.

Accountability framework and its possible impact on IS success

There is existing theory with respect to IS success in IT governance (Weill & Ross, 2004), various industry papers from Gartner, and some business processes tools (e.g. Moods transformation toolset (Hall & Harmon, 2007, P. 263)) that deal with accountability and IS success. These studies and papers are not specifically related to IS implementation success but IT governance. While it could be argued that proper IT governance supports IS success, the IT governance theory presented to date does not appear to support the structures, roles and responsibilities introduced by the accountability framework in this research. Apart from this research, little or no other research appears to have been undertaken on the accountability framework and its effect on IS success. Specifying and allocating the decision making process through an accountability framework, encourages desirable behaviour in the use of IS and therefore impacts IS success theory.

Implications for practitioners

Through the results of this research, two major implications emerge for practitioners responsible for APMS implementations. Firstly, APMS applications are risky, and secondly, there is a high degree of planning and

organisational maturity required to be in place before embarking on an APMS implementation. These implications are discussed further below.

APMS implementations are risky

APMS implementations are high risk as evidenced by the lack of success within the focus group participant organisations for which they worked, and is a major consideration for businesses intending to implement these systems. The risks are two fold. The first is the system aspects (technology) and the second is based on personnel and organisational behaviour (the people).

Technology Immature

The technology that supports an APMS is not mature and in many cases the COTS offerings fall short of the total business requirement. The technical factors investigated during the course of the research indicate that even in a successful implementation, some form of bespoke application development is required. The utopian aim of just using “an out of the box” (COTS) product seems unlikely in the near future and practitioners should be aware.

Performance can be greatly enhanced if there is timely (often real-time) reporting, instant feedback, quick decisions and immediate actions (Paranjape et al., 2006). This need for real-time data is often called the Operational Gap (Azvine et al., 2005). Without real-time data, timely analysis of operational business process performance is not possible and therefore real-time process automation cannot occur. Azvine, et al., argue that self correcting processes are the answer in achieving full process automation and this gap is not well supported by product vendors.

The people

The automated aspect of an APMS has implications for the managers of employees and contractors within an organisation that intends to implement an APMS. The autonomy of the manager or an employee is at risk as an APMS allows any authorised user to by-pass the manager’s intervention and therefore has potential impacts on the smooth running of a business. The performance management aspect of an APMS has

implications derived from surveillance and control and the concomitant power structures (Dobson et al., 2007, p. 148). To combat the negative aspects of this potential intervention, an agreed code of conduct, protocols, standard and/or guideline can be introduced for all management and employees to adhere to.

High degree of planning required

> *"No, no, I'm just thinking that if you started a brand new business would you stick something like the APM system in it?"* *Case: Researcher Ref #1931*
>
> *"Absolutely, straight up."* *Case: LT Ref #1932*
>
> *"And did you have to go through that lifecycle or not?"* *Case: Researcher Ref #1933*
>
> *"No, because the APM system would do it for you. I mean basically once you've actually worked out, say you do have a genius manager that actually knows truly what the reasons are for his business, just go straight into it."* *Case: LT Ref #1934*
>
> *"So it will work?"* *Case: Researcher Ref #1935*
>
> *"Yes. Mind you, it depends on how big you're going to develop it and how big the business is. If you're only a tiny business I suspect you'd develop possibly far too much."* *Case: LT Ref #1936*

This discussion between the researcher and a Case interviewee indicates that it makes sense to implement an APMS at the commencement of a business, but the reality is that this is unlikely and if the researcher did, the researcher would try and implement too much, and possibly fail. APMS implementations require extensive planning and an understanding of what is required; doing this in a new business may not be wise, as all processes, measures and issues are not always known.

The problems highlighted by the focus group that affect APMS implementation planning are three fold. The first problem is that of *strategic versus operational intent*. Unfortunately, strategic intent often fails to translate into the measurement and information collection capabilities needed to enhance operational performance (Fawcett et al., 1997, p.420). It

is important for practitioners that they understand the strategic direction of the organisation but they must define the operational measures to monitor and enhance operational performance. It is important to identify the key operational metrics that should be monitored in real time to provide the feedback necessary to determine the success (or otherwise) of strategic initiatives (Bitterer et al., 2006, p.13). Understanding these key operational metrics will assist with the right process foundation for an APMS receiving real-time data.

If business strategy measures are of a higher priority for an organisation than operational measures, the organisation should embark on implementing a standard decision support system based on mature data warehousing technologies where timeliness and sustainability success factors are not as important. If the need is for operational measures to drive and enhance the business, these measures need to be process focussed, clearly understood, defined and communicated before commencing an APMS implementation.

The results from the APMS case study indicate that forecasts and budgets need to be operationally focussed. Utilising an accountability framework helps define and support both operational and project structures that empowers process owners and managers to define, manage and communicate both process information and the measures. The accountability framework also facilitates process improvement and appears to increase organisational maturity.

The second planning aspect is *effective communication*. At the commencement of an APMS project there will most likely be cynicism and this requires communication and change management activities to mitigate and deal with behavioural, organisational and process change management issues. Business executives and middle managers will typically use an APMS to determine broadly adopted and consistently applied measures of value to make informed decisions, but each level of management will have different priorities. This disconnection between their individual or department measurements may explain some of the cynicism that prevails with many employees and mid level managers that consistently adopt new

management initiatives, programmes or systems, like an APMS (Fawcett et al., 1997, p.420). These management initiatives are designed to enhance competitiveness, but Fawcett, Smith & Cooper (1997) state that employees and managers pay much more attention to what is measured than they do to the latest slogans and competitive directions that are espoused by top management (p. 420). Keeping the organisation focussed on operational measures will help in the implementation of such management initiatives.

The accountability framework and de Waals behavioural factors also support the four mechanisms which appear to contribute to the success of measurement managed companies, i.e. closer agreement among management on strategy; greater clarity of communication; focus and alignment efforts; and organisational culture (Gates, 2000, p.49).

The final contribution to practitioners is *to utilise the APMS CSF model* which may assist practitioners in their APMS implementation planning, but there are some limitations.

Limitations

There are a number of limitations of this research. Limitations were discussed in the focus group and the case study chapters with respect to each of the data collection processes. A summary of the limitations are:

- The focus group and case study could have presented a version of the world that is not real as focus group participants and case study interviewees could have put forward their own views or beliefs.

- During the case interviews, there may have been times when information was distorted or may have been based on hearsay. The researcher has assumed that unless there was conflicting data the information provided is correct.

- The researcher may also have been “looking” for the answer, which might have resulted from the design of the interview structure for both data collection mechanisms. This personal bias may have occurred due to the researchers involvement in other projects of this nature. The same limitation may have occurred during the comparative review of the data.

- Realist review has a number of limitations and although the researcher has tried hard to incorporate a critical realist aspect into this research and believes this has been accomplished, it probably can be improved. These limitations were discussed in the Methodology Chapter 3 on page 113.

The ongoing, iterative approach in this research of first building a model from the literature, using the data collected from the focus group, confirming and refining the results once again using the case study data collector, reinforces the integrity of the research results. This was done while continually reviewing the literature to explain new, emerging and changing success factors. This approach meets the principal goal of triangulation which is to strengthen the data analysis through enhanced confirmation and completeness.

The use of triangulation during the research was used to assist in minimising the biases and faults described above and in Chapters 4 and 5. While hermeneutic theory was utilised to negate the limitations during the data collection and analysis stages of the research, additional quality criteria was used as an overarching control of the total research to provide triangulation. Triangulation strengthened the merit of research findings by the use of multiple theoretical frameworks and sources of data. In summary, the quality criteria used during the data collection and analysis phases of this research were:

- Construct validity was enhanced by establishing clearly specified operational procedures during the conceptual categories development stage and through the use of multiple sources of evidence that increased the construct validity of the research. This was in accordance with Pandit (1996, p.2) and Yin (1994, p.13), respectively. The use of the focus group and multiple interviewees from the Case introduced data from multiple people with different roles and their responses were compared for similarities and differences.

- Internal validity established causal relationships. An example was in the case study, each interviewee was presented and asked the same questions. Another example is where the same base seed models were distributed as per the methodology described in Chapter 3 so as to check for the internal validity of individual responses to these models and provide a common point of reference.

- External validity established the domain to which the study's findings can be generalised (Pandit 1996, p.2). As already stated in Chapter 3, a known limitation is that the specific research subjects are local to Perth, Australia, and may not be generalisable to other samples, contexts and locations. The results are available to anyone who wishes to read, understand and use them as they see fit, but they are not considered generalisable.

- Reliability can be demonstrated in that the process of the research study can be repeated with the same results (Pandit 1996, p.2). No such guarantee can be given that the exact results will be reproducible as the research involves people working in a changing environment, although in the same environment with the same people, it may lead to a 'near' result.

Ethics

No ethical issues were raised in both the capturing of data from the focus group or case study during the gathering, analysis and reporting stages of this research.

Further research

This research appears to be the first investigation into APMS implementations. The factors derived in this study may not be generalisable and further research is required to validate the results across a greater range of APMS projects.

APMS are new and the approach and processes described in this research are available to anyone who wishes to read, understand and use it as they see fit. More research into APMS would be beneficial which may confirm or adapt the developed model.

During the research other possible opportunities were entertained and in some cases actually examined, although upon further investigation they were considered not to be within scope but are possible endeavours for further research. These areas are:

- Expansion of Wixom and Watson's (2001) success model to include all IS success factors;
- Benefits derived from APMS implementation;
- Business maturity for APMS related organisations;
- Real-time analytics and its future impact;
- Spreadsheets and their impact on APMS; and
- Operating success factors.

These are described briefly below, except for the extension of Wixom and Watson's data warehouse success model (2001) as this was covered in the implications for theory section earlier in this chapter (p.301).

Benefits derived from APMS implementation

As APMS are relatively new and many of the integration technologies are embryonic, no studies currently exist detailing the benefits that may be or have been obtained from such installations and subsequent operations. A study into these benefits may assist in exploiting future APMS systems.

There will be difficulties with such a study, as those organisations that do operate them successfully typically have the APMS deeply embedded within their business processes and are tightly integrated into the enterprise architecture. These systems are also strategically very important as they provide a competitive edge. In these situations, organisations using them are guarded about their use, let alone being willing to tell researchers the benefits gained.

Business maturity for APMS related organisations

Although covered in Chapter 6, the maturity model example used was based on the researcher's interpretation of what the maturity levels equate to for the organisations implementing an APMS and is possibly inaccurate.

There is a need for the creation of a maturity model to assist in the determination of an organisations maturity and of the development phases an organisation must go through before they are mature enough to effectively implement an APMS. This is an area for greater research into building and developing the concept of APMS organisational maturity and would be beneficial to both academics and practitioners alike.

Detailing the features of an APMS

As described in Chapter 2, no clear agreed explanation exists of what an automated performance measurement system is. Bitterer at al. (2006), Gartner researchers, call APMS, corporate performance

management systems and in this classification they include data warehousing, business intelligence through to spreadsheets. No feature list currently exists for an APMS which leads to confusion as to what an APMS is. Research in this area that documents these features will lead to clarification and uniformity of this term.

Table 2, in Chapter 2 details a list of possible applications that could be used as a starting point to try and determine what an APMS consists of, and hence describe a working example.

Real-time Analytics and its future impact

During the literature review in Chapter 2, real-time analytics was discussed to help explain some of the problems with real-time data extraction and reporting. This discussion was based around action time and data and analysis latency which affect data and system quality success factors. Research in the area of real-time reporting and data analysis and its impacts on business operations was found to be minimal and this is an area of increasing interest, as evidenced by APMS. This is an interesting area of further research.

Spreadsheets and their impact on APMS

"The usefulness, flexibility and convenience of spreadsheets are undeniable, but enterprises must nonetheless regard the use of these applications to manage internal key performance indicators, or to create legally relevant statements or reports, as a high-risk business practice" (Heiser & Buytendijk, 2005, p.2). Extensive literature was uncovered on spreadsheets but the ongoing structural, organisational and behavioural aspects of spreadsheets with respect to organisational maturity and sustainability was not found. This is an area for further research.

Spreadsheets will continue to be a source of serious 'compliance risk' and it is unfortunate that many BI and APMS components typically use spreadsheets as the front-end where data is manipulated and the spreadsheets become defacto business applications. IS organisations are usually unaware of the extent to which sophisticated and complex spreadsheets are being used within the organisation; spreadsheets will

continue to be the basis for many ad hoc applications especially within the performance measurement area (Heiser & Buytendijk, 2005, p.2).

Operating Success Factors

A finding of the research was the grouping of two CSFs, timeliness and sustainability, into a grouping named '*operating success'*. During the analysis and review of the literature there appeared to be an apparent lack of information on this topic. This is therefore another potential area of greater research into building and developing the concept of operating success.

Conclusion

In this research, performance measurement has been shown to differ widely across organisations. A theory is required which has greater scope for explaining and predicting implementation outcomes. Therefore, the first step was to review literature to establish a base. This resulted in definitions and theories from operational and strategic management, as well as IS/IT to assist in defining what an APMS may be.

A focus group of experienced practitioners and case study interviewees gave an insight into the world of automated performance measurement. Organisational and system comparisons were derived from differences in the capacity and experience of the organisations the participants represented, to accumulate, deploy, renew, and reconfigure resources in response to systems and processes to meet their goal of successfully implementing an APMS.

Success factors were confirmed, modified and new factors discovered and abstracted from the data through: research participants; their collective knowledge and experiences; social structures that are embedded in an organisation's business and managerial processes; communications; and culture.

Operations management as a discipline was investigated with respect to performance measurement and management and was compared to IS success research to establish similarities and relationships between these

disciplines. Differences between strategic and operational goals were discussed and the potential impact on APMS was examined.

Existing research frameworks were used to help structure the research problem and to offer guidance for practice, but like any framework with ambition to guide action and solve the problem at hand, had to be confronted with regard to human behaviour and the properties and structures of their environment. To examine the problem and the impact on this framework, the data extracted from the focus group and case study was classified and compared to existing literature to look for trends and to discover new factors. This grounding was ongoing, as there was many iterations of draft CSF models for APMS implementation.

Through this examination and discovery process, behavioural and new CSFs were identified and tied to existing theory. An accountability framework which existed in the data and relationships was drawn into the maturing model. The identification of *sustainability* and *timeliness* of process and data as specific factors resulted in "operating success" being defined as a new term. This allows the achievement of perceived net benefits by removing uncertainty through the introduction of a sustainable reliable timely process. Operating success was then related to the accountability framework.

A final CSF model for APMS was proposed, incorporating the data from the focus groups and case study, resulting in the conclusion to this research. This research has limitations and further areas of possible research were also identified.

Research into performance measurement is not new but the automation of the entire process is and this research has hopefully contributed to both theory and future practice.

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APPENDIX ONE:

SAMPLE COMPLETED DATA SHEET - FOCUS GROUP

Seq	Question	Time-stamp	Who	Discussion	Codification	
					Primary	Raw
1	1. How does the organisational structure affect success?	0:00	R	Ready to roll, ok, so alright, um, do you want to talk about just how does the organisation structure affect the success. Does it have anything to do with the success in your work? In your organisations or any you have worked in?		
2			JB	Alright um, I mean certainly from an organisational structure there's a system of going into the needs, and that it really has a strong champion in the organisation., it has a project steering group and a well funded project so it really needs to have that support within the organisation.	Champion	Champion
3			R	What about, What about after the after the …after the project is finished		
4			JB	Yep. I think. I mean certainly on an ongoing basis they need to put into an organisation um a support group to, to certainly look after it. Make sure that the data remains consistent. Ah …then obviously be subject to continuous improvement. Um perhaps enhancement and handle project changes. The vital change in a business context changing would be to keep updating the measures so you meet that type of professional organisational structure behind it.	??	Ongoing Support
5			JR	Yes from my experience. you have to be especially from a global sense, need a structure in place that allows buy-in at a zonal level. Obviously the vice president might be the highest, and he might be the key driver and the owner but if you can't get buy-in at a zonal level, . and have the structure in place to align your goals and, your all trying to achieve the same, objectives. For instance, at Shell we had a US Zonal manager for Plant maintenance who was really pushing what he wanted. . He was sick of using all these other systems, he wanted to standardise across the whole twenty four refineries so they had buy-in. They had a committee that drove standard in systems and then they got in buy –in at a refinery level. All the	??	Business buy in

Seq	Question	Time-stamp	Who	Discussion	Codification	
					Primary	Raw
				mangers had to buy-in and then they then had representatives from each area within plant maintenance. There was reliability maintenance, equipment integrity, turnaround and safety. Rather than one area, i.e. The USA or Europeans driving it, they tried ,to push it out to all the industry that had buy-in across all the zones, and because they had buy-in levels they sat around a table and went through to standardised processes which then drove the KPI's.. That helped rather than saying these are your KPI's. So I think that's important that you get buy-in across all levels, but it has to be driven, top down. The Vice President was the one who obviously took ownership initially.….		
8			R	OK		
9			JM	Yeah well that's as far as the organisational structure goes. Um. What your talking about was a very forward where a lot of divisions against control at the same level so there all bickering with each, retail for example. But then if you get a get more of a vertical org structure, where it gets driven not out through a number of different channels and they all fall out with an agreement with you. At Iluka for example upstairs is the executive team like the CFO and all that and as soon as they say this is the way its gonna go there's no,.. there's not a lot of dilution between there and that,... there's' the ones on the ground that has to have to push it, so that works, …. when you get defined and that.	Champion	Sponsor
10		4:51	JR	So it's like the bottoms up They have measures even at an operators level which then aggregate and feed up to the supervisor, which feed up to the refinery manager. The plant maintenance costs for instance, the operator or shift supervisor might only be interested in his plant, the refinery manager is interested in not just one plant, he's interested in total costs of .. preventative versus pro active, plant maintenance. The Vice President looks at it at a refinery level, he doesn't care about at the lower more detail levels.	Measure	barrier to success
11			JM	Can I ask you a question? About organisational - is it the person or is it the organisation? Like you said "top down there's not much discussion" cause you've got a very vertical organisation. Um is that is that because it's the person that's driving that because he's a powerful person and can see. Where as .. in your organisation you said Geoff, was that more to do with the person himself because he was a strong Character?	Champion	Champion

Seq	Question	Time-stamp	Who	Discussion	Codification	
					Primary	Raw
12		5:40	JR	He was a very strong character and I suppose he believed in it and not only that … the data he was getting and the information he was getting was once again the timeliness of it took so long and it wasn't accurate and he didn't believe in it. …	??	timeliness
41	2. Were there any technical issues with the application that affected the success of the system?		R	Number two. Were there any technical issues with the application that affected the success and take up of the system?		
42			JB	Probably one of the major technical things in terms of the performance management system is the speed of reporting. There is a world of difference between waiting thirty seconds for your numbers or your graph or your trends versus five to ten seconds. People seem to switch off after that. If you don't get the performance right then they switch off very quickly from using the system.	System Quality	Response time
43			JB	I think the other technical barrier is something as simple as logons and passwords. People can't just click on a manual option on a web page or the internet and can't just go straight into their KPI's or performance indicators and they …. it's actually a real barrier to get there. Especially for a performance measurement system in the sense AH….that if it does take time AH….to get credible base data in place and people very quickly forget passwords and logons and things like that.	System Quality	Single sign-on
44			R	What about you John?		
45			JM	Presentation is a major factor.		
46		15:04	JM	Like there is a perception that the new millennium and new information age and all that, the expectations are massively high were as when we try to push it out with the presentation of BW we are getting a bit of high level resistance because of the dash - They are really big on the dashboard and the speedo and all that kind of stuff. So we are undergoing a bit of a period where we are looking at other products to use as a front end to the Business Warehouse. Just for the presentation. Um	Use	User Interface
67	3. How did information quality affect the	19:00	R	That moves on to Question Three – Good timing. So question three is "How did the information quality affect the introduction and acceptance of the system?		
68			R	We just talked about standard business content the quality of information.		

Seq	Question	Time-stamp	Who	Discussion	Codification	
					Primary	Raw
	introduction and acceptance of the system?			What did you mean?		
69			JM	We had a major emphasis on information quality, that was the number one priority before we even looked at reports. So we were very conscious that as soon as confidence was lost in reports you could potentially loose the whole thing … so because we also went live with BW and R3 at the same time ….. that was a major.	Data Quality	Quality Data
70			JR	What about when we had LIS and we had to refresh the cubes using LIS and we found out that they hadn't actually updated LIS for ten months. So your quality of data was, even though you thought it was right , was actually incorrect. So that s the type of thing . that were the aligning , it's not just where you think your sourcing the data it's actually how that data is sourced where it's getting its information from.	System Quality	Quality Data
71		21:00	R	So how does that affect the system acceptance?		
72			JR	In that case . So they decided not to use it or it's two options you either have to refresh it and keep managing it but they found the data there was not sufficient it was in the procurement area. And they found that they … would have to write an ABAP program to extract the data and then put it into BW. So they had to find another way.		
73			JB	So a really important factor was the extent of testing - user acceptance testing, was done because I know with BHP Iron Ore Maintenance area they pulled people into doing a whole lot of user acceptance testing and that is pretty key to getting the data to a quality that is I guess is acceptable. I kept moving on in terms of wanting greater detail and changes to the rules of KPI's unless you get the get the functional experts in to do the testing and you get to stage where they are satisfied the data's right nobody's going to use the KPI's Reports.	User participation	Testing
74		22:15	JM	Also going forward you really need reconciliation processes. So periodically it gets reconciled. You only have it processed and reconciled back to. …	Data Quality	Reconciliation

APPENDIX TWO:

CODIFICATIONS USED IN THE FOCUS GROUP DATA SHEET

Table 14. Codifications used in the focus group Data Sheet Analysis

Raw Codification	??	Barrier	Champion	CSF	Data Quality	Development Technology	General	Management Support	Measure	Perceived Net benefits	Source Systems	Success	Summary	System Quality	Team Skills	User participation	(blank)	Grand Total
Accountability								1										1
Audits					1													1
barrier to success		3		2					1		1					1		8
Budget Vs Actual					1													1
Business buy in	1		1				1	1				1				6		11
Business processes	1				4					1								6
Champion	1		3															4
Complexity		1																1
Conclusion													1					1
Continuous improvement	1																	1
credibility					2											1		3
Data Quality					2			1			1							4
Governance	1																	1
Immaturity		3																3
Infrastructure														1				1
Inhibitor – existing systems		1																1
Key User				1														1
Legacy systems											1							1
measure					3				3	1								7
Meta data	1																	1
Ongoing Support	1																	1
Quality Data					1									1				2
Reconciliation					3													3

Raw Codification	??	Barrier	Champion	CSF	Data Quality	Development Technology	General	Management Support	Measure	Perceived Net benefits	Source Systems	Success	Summary	System Quality	Team Skills	User participation	(blank)	Grand Total
Resources															3			3
Response time														1				1
Responsibility																	1	1
Single sign-on														1				1
Sponsor		1	2															3
Spreadsheet					2						4							6
Success														1				1
sustainable	6																	6
Technical						2								1				3
Technical success						3												3
Testing																1		1
timeliness	6										1							7
top down								1										1
Usability														3				3
User Control														2				2
User Interface														1				1
(blank)																	312	312
Grand Total	19	9	6	3	19	5	1	4	4	2	8	1	1	12	3	9	313	419

APPENDIX THREE:

SAMPLE COMPLETED DATA SHEET – CASE STUDY

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
1	1. What is your role with respect to the APM system and for what purpose do you use the system?	R		What you do and we can probably move on from there.			
2		AD		I am Manager of Business Analysis Area which is part of the Financial Management Branch which is part of the Finance Division of a large utility.			
3		R		OK. What was your role in relation to the APM system?			
4		AD		My role was involvement, early on we had a separate project team early on, and my involvement was getting involved in workshops as a participant in workshops and providing a lot of input and liaising and working pretty closely with the APM system team without being actually part of the team at the time. What has happened now is that team has almost dissolved and the APM system product has been handed over to my group and we run with that. We are doing all the maintenance and bulk of the rest of the development work to implement it across the rest of the business as well.			
5		R		Ok So from a Business Performance Management point of view what does that actually mean in relation to A large utility and in relation to what your area does? Is it all Performance Reporting or what is it?			
6		AD		Yeah We look after – are you asking about what we look after or just the APM system?			
7		R		What the APM system in relation to your role will do.			
8		AD		In my role I look after the Treasury Area, I look after all internal performance reporting and some external performance reporting not the statuary Financial Statements but the type of non financial reporting associated with our Operating Licence			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				so to the external regulator and reports to the minister as well– I look after that. The APM system really covers the bulk of our work which is the internal reporting. So it replaces all the reporting processes and systems we had in the past – it completely replaces them It is one system that will be used by every business unit across the organisation every level possible.			
9	2. What are the critical success factors for the APM system?	AD		I think number one is getting the business on board and the cultural change associated with that. I think one of the things with this organisation is that there is a fair bit of, in a way, resistance to change because there is a lot of different business areas that in the past have always operated as in size they a have done their own thing with reporting. Even with Customer Services Division which handles all the regions there was no or very little standardisation of reporting across the regions. There have been attempts before to implement standardised reporting but there has been resistance from the regions because all the managers being business managers thought that the reports they had were the best. Each wanted to keep the reports he had and thought everyone should change to be the same as me. So I think breaking down those barriers and getting them on side is probably the most important thing. A lot of that stemmed from getting support at a high level as well getting a General Manager onboard first setting them to start pushing the message that this was coming in there is a lot of benefits in it for everyone and it's going to happen whether you like it or not.- but really pushing the benefits. But at the end of the day just pushing the message that it is going to happen. So rather than resist it have a look get behind it and in there and see what the benefits are.		Management Support	Sponsorship
10		R		OK How did they actually get the Business onboard what was the cultural change or change process how it that actually happen? And why was it different to any other time?			
11		AD		I think that the difference this time was the approach. In that it		Management	Process driven

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				came from top down That helped as well. The first hurdle was getting General management onboard. They seemed to warm to it reasonably quickly although that was at the conceptual stage. So they were all a bit concerned that from a conceptual point of view it all looks great but what exactly does it me to us. What impact is it to me. So in any system that you are standardising you are coming up with a best fit so it is likely that there will be some degree of compromise as well. So if everyone is doing their own style of reporting and you are trying to come up with the best fit its going to have to be some compromise. We think that there was very little compromise and the business tends to agree with us now. There are some things that were done differently		Support	
12		R		Like what?			
13		AD		Well just the level of information in the reports we found that some report s were 100 pages which is just ridiculous. So the view we took was well the reports got to be appropriate for the suitable for the audience. It's got have strategic measures in it, Key performance indicators all the other information type data in there we will pull that out if it's not absolutely necessary. It can be looked after by some other in the organisation. Management doesn't need that noise /distraction in their reporting. They need the key measures the key performance indicators to focus on and we will take care of all the rest of it		Data Quality	Amount reported
14		R		OK			
15		AD		I guess part of the culture of the organisations is detail. Everyone's been so engrossed in detail in the past it was a bit of a challenge to get manager's to warm to the idea of getting less of it. Letting go is Ok. .It was going to work there was no harm done.	Yes	Data Quality	Amount reported
16		R		Who was the person who did that – pushed the General Manger to get acceptance. Who was that person?			
17		AD		It was the Project Team – it was really the Manager – which is MG he would be the spear head. I guess it happened at a lot of			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				levels. You had the Project Manager going to General Managers presenting to them at various meetings. But it also had at all levels of the organisation members of the APM system team and people like my group who were working closely with it, just spreading the message as well. So we had it coming from the top at a formal level and with all our other contacts at a lower level we were having more sort of informal discussions helping people understand what the APM system was and what meant. How it was going to impact on them and its benefits as well.			
18		R		Who was the Champion for the Project?			
19		AD		Who was the Sponsor? The sponsor was as far as I know was the CFO a	Yes	Champion	Sponsorship
20		R		So it was CFO			
21		AD		Yes CFO			
22		R		Did he have much involvement I know he's not here any more? At that point in time did he have much involvement in the process and it change and the sell process that went on.			
23		AD		He did. He didn't have a lot of hands on involvement but he did what he needed to do in his role. In other words he pushed the message at the right level	Yes	Sponsorship	Sponsorship
24		R		OK			
25		AD		With his pitch he pushed the General Managers he pushed that message and he pushed the CEO as well.			
26		R	7:48:00 AM	Good			
27	3. How does the organisation structure affect this system?	R		Moving on to question three? That's talking about the organisation. How did the organisation's structure affect the system because it's reporting at all levels with in the system - did that have any effect on the system at all and if so what was it?			
28		AD		When you talk about organisational structure we had our certain geographical hierarchy but also our divisional also our process hierarchy and in the last year or so the business has			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				shifted more towards managing along process lines.			
29		R		Is that the accountabilities framework?	Yes		
30		AD		Yes the Accountabilities framework exactly In the past the reporting wasn't aligned with that. It was all aligned with Divisions – CSD, Finance and Communications Business Services. It was all aligned to divisional structure rather the processes. I guess at a time that we are trying to move towards the accountability model this project was really important in that it changed reporting to try and reinforce that message because until the APM system started delivering those reports along process lines the message was out there that OK accountabilities framework was in but without the reporting line to it, it didn't have a great deal of acceptance. There was one message coming from one side of the business but from the reporting side it was the old way still. Ultimately people were relying on reports to judge their performance so they thought well we're not being judged along process lines then.	Yes	Business Process	Accountabilities framework
31		R		A question forming in my mind is. When did the accountabilities framework .. process managers are not a new concept at Product Corp they've been there for a long, long time.			
32		AD		Yep			
33		R		When the accountabilities framework, when did that take over the performance measures, Was that instigated by the APM system team or was that prior to it or what timeframe.			
34		AD		It was the same time It was the same time			
35		R		So one drove the other or did the APM system drive that?			
36		AD		I think the intention when the accountability model came in was that there always would be reporting on process lines but because we knew the APM system project was coming up instead of changing immediately the APM system will take care of that.		Champion	Accountabilities framework
37		R		So the APM system became the vehicle for that			
38		AD		Yeah it became a vehicle for that. exactly			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
39		R	10:51:00 AM	BRP gave it some more practical substance because I know that the process managers have been there for along time but the individual reporting prior to the APM system has always been around the organisational structure And that's why the question is about organisational structure. I'm trying to understand the matrix that occurred and I'm very interested in how the accountabilities framework, that matrix organisation came in place. the APM system seems to, this what I understand, seems to have reinforced that measure and reinforced that matrix organisation			
40		AD		It's made it real. Tangible really			
41		R		Alright and so that's the first time you've actually seen it			
42		AD		It's taken a concept of an accountability model and made it into a tangible, a report that where you can actually measure along those accountabilities.		Champion	Accountabilities framework
43		R		Do you think what sort of benefits do you think you're going to get out of that process?			
44		AD		It's a much smarter way of managing Business. Like you said the concept of process managers has been around for a while but there's been no real way of managing performance along those processes. We just weren't set up for that.		Champion	Accountabilities framework
45		R		OK			
46		AD		So It's really important from that point of view. It really has reinforced that shift to the accountability or process.			
47		R		The simplicity that you talked about before in the critical factor. You know a lot of them were 100 pages or whatever. How did that also go along the process line or have an impact in that area. I'm trying not to lead the question I'm trying to understand			
48		AD		Sure.			
49		R		You went from a 100 page report to how many pages is it now?	Yes	History	Amount reported
50		AD		Atypical area that would have got one of those depending upon how many KPI's are in it – probably about 8 or 10 pages		Data Quality	Amount reported

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
51		R		OK so it's 10% or less than what it use to be			
52		AD		Yeah exactly			
53		R		And it's more process driven now			
54		AD		It is more process driven but It's also - you don't necessarily have 10% of what you had before t- a lot of it's how it's presented as well So with the scorecard format we've got there is still a fair lot of information contained in the old reports retained but it's presented in a much more concise and consistent manner, so it means you can present a lot of information in a way that it's easy on the eyes and it draws your attention in to where the area of focus is. What you should be focusing on. So where the issues are.		Data Quality	Design
55		R	0.611111111	So is it management by exception now?			
56		AD		It's purely management by exception now.		Data Quality	Organisational structure
57	1. What technical issues have there been with the system?	R		OK I'm not trying to put words in your mouth I'm trying to understand the time because what that drives down into is - Was there any technical issues that came out of the system. During that implementation I understand that there was bugs and defects and all that sort of stuff technically the APM system as it was delivered in the first rollout			
58		AD		Where it is now there might have been some weeks.			
59		R		But is it predominately the same and is it working well? extra well? still the same?			
60	4. What technical issues have there been with the system?	AD		Yeah it's predominately still the same. Apart from a little bit of fine tuning and some further refinement of a couple of KPI's as well. Then yeah not much has changed.			
434		MG	[20:10].	We had a lot of strong discussion to actually build that project, that report into, into the Status Quo *[20:10]*.			
435		R		So what happened there?			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
436		MG		Errm.			
437		R		I think it's relevant.			
438		MG		Can we cover it later?			
439		R		What happened in the end?			
440		MG	[20:47]	We talk about the scope, the sponsor of the project being the CFO, okay he was a barrier at that point there, and, and we were saying, look this is where, this is where it's at and, and I had to tread wearily on that one but certainly I, we kept on pushing and pushing and pushing and I was also having discussions with the COO and the other General managers so I was building a bit of a groundswell and then we went back. He finally, he finally agreed to have that in cope for them for them.	Yes	Champion	Organisational Structure
441		R		So one of the deliverables was that from the top of the pyramid right down to the bottom to a branch manager that was reporting.			
442		MG		Yes. And in terms, and one of the critical things in actually getting him to change his thinking was that, the original board reporter, the executive report contained a lot of information, you know it's a seventy page report and what we were saying, and what I was saying to him, is we're about changing the organisation, we're trying to change the culture and here we're saying, you managed your accountabilities we want you to empower your staff who are accountable and responsible for these periods and pieces of information. Now we're trying to say them, to them, focus on the key performance indicators and you're gonna get a, like a flash report which is very high level information what's good and what's not, not so good. Yet on the other hand you want this detailed report which is seventy pages. And I said, the success of this project is very much in jeopardy if you want to continue to have this detailed information going up to the board but you want managers over here to just have very streamlined report, traffic lights, just. Now it's not going to work because they will feel exposed that		Perceived Net benefits	Flexibility

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				senior management has got more information than them. And it's not gonna work because at the end of the day, if they've got more information they're gonna be asking questions potentially where these managers won't have that information and they're gonna be a little bit exposed. And that was one of the areas of, effectively that was one of the things that we used to say well hang on.			
443		R	[22:33]	So who, who, who really became the unofficial sponsor and champion then? It wasn't. You were working at a level to make it happen *[22:33]* to make it happen but you, you did that, you mention the CEO and the other general managers and core management support, you were the champion making that happen. Without that management support from the other general managers and the CEO it wouldn't have happened would it?			
444		MG		It would of in the fullness of time. It was because I guess I, I meant, I think I'd be handed the de-facto champion of it, I had the CFO there as a sponsor there, but he was hedging his bets, in politics.	Yes	Champion	Change management
445		R		Yes and the fact that.			
446		MG		He was hedging his bets, yeah, it was a corporate project and I had a number of corporate projects that I was going, this was one of them, at that point in time it was all care and no, I'm supporting you but at the end of the day.			
447		R		It's your head on the block.			
448		MG		Yep, it was my head on the block and, and effectively, collectively when, that's why I spent a lot of time going back to these General managers, COO, to get them to agree, so keep them aligned with the concept and yes, yes, yes, yes, and then eventually once we got them to agree to it, you know, that we. Look really we're trying to get them to change the way that they were operating also within the next level down. Yeah, do you, do you need to spend a lot of time getting involved in this detail, and I say yes I do, because the COO has got that		Management Support	Organisational Structure

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				information, I said yeah, well if he didn't have the information do you think you really need it *[24:06]*, no you know I'll trust my people to do that so. So, once we said to the COO and he agreed with it then people started to relax a little bit more. And it was quite interesting because I talked about a lot of communication and awareness and keeping involved, the COO, that's where I was stopping, so the CEO, he wasn't really getting involved in it, until.			
449		R		Okay. Towards the end of the project?			
450		MG		When you were starting to see things, so.			
451		R		I agree, I've gotta move on. What are the success factors?			
452		MG		Success factors, good planning. Look at other systems.		History	Implementation Approach
453		R		Okay.			
454		MG		So don't try and reinvent the wheel but try and examine other systems, bring in people that have had experience in other systems so in terms of an advisory capacity or consultant capacity.	Yes	Team Skills	Team Skills
455		R	[25:10]	That was BF? Did he do a good job? *[25:10]*			
456		MG		Yeah very good job.			
457		R		I want to talk to him alright.			
458		MG		Yeah, hopefully you will. And certainly utilise his experience to challenge things, so he was challenging, continually challenging, asking questions.			
459		R		Okay. That's good. Anything else? What about the systems and the data quality?			
460		MG		Data quality, we identified that as couple of other things, good plans, good systems in place in terms of measuring, so we had, you know, risk registers, issues registers. Data quality was identified as a risk. We made a decision very early on in terms of the accountabilities; we weren't going to be responsible for data quality, because we would, the way we were going to be take information from other systems was, well there out there *[25:59]*. There are managers responsible for those systems so		Data Quality	Organisational structure

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				therefore, there's rubbish in those systems, we'll take the rubbish and we'll report it, and we knew that was coming and it was going to be a risk for our project but effectively the responsibility was going to go back to that manager, that data custodian.			
461		R		Did you push it back?			
462		MG		Pushed it back.		Data Quality	User participation
463		R		Working well?			
464		MG		It's working well, we have got some data quality issues that are still coming but it's really.		Data Quality	Issue
465		R		They're visible now though?			
466		MG		They're visible now.			
467		R	[26:33].	Whereas before people manipulated them out [26:33].			
468		MG		That's right and that's one of the good things about this system is that we're trying to cut out that intervention as much as possible. If this is what's in the system that's what we're going to be reporting and, and people are actually, before they were getting in there and manipulating figures and reporting what they wanted to report, so they're actually sanitising the information.		History	Sanitising
469		R	[26:57].	Sanitising. *[26:57]*.			
470		MG		Going up to the corporate reports and, and that used to happen at the corporate management report. You know if the CFO didn't want something reported in such a way that you'd go through and, and make a change.		Data Quality	Spreadsheets
471		R	[27:12]	So they could do that because they were spreadsheets and able to be changed?.			
472		MG		Yeah, it was all manual based. Now what we have done, and we acknowledge that some things need to change, you know, just because you had an artificial month end, you needed to have an opportunity to make some adjustments, so on some of the key systems what we have done is said, at month end *[27:33]* you'll do all this processing, but we'll leave a small		Data Quality	Spreadsheets

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				window there that if any adjustments need to be done to, to the information being reported, you actually go through and make the adjustments in the source systems.			
814		DC		I'm not sure, I mean whether we needed the phase, I think we needed to ensure into warehousing, that's why people look back, I think MRE1 which saying those sort of data marts getting going and needing some immediate requirements, I don't think that was the wrong thing to do.		History	Leap of Faith
815		R		No, no I think they were all perfect, yeah.			
816		DC		Were we prepared to make that leap into you know, real performance and more integrated corporate warehousing and associated stuff, obviously we weren't, it needed a big tip and perhaps, I mean it certainly helped from our point of view I guess, we were a lot more cautious about it and how we structured it. One of the things that's underlying that whole BWIP stuff again, that sort of was going on as a bit of contention stuff, there was some discussions I had with Corp exec and warehousing was actually splitting the business projects from the warehousing which was something, I mean previous APM attempts we kind of said you know, you got to meet all these business outcomes and you've got to build a corporate sustainable warehouse and blah, blah, blah so it's a pretty big ask on a project manager. Whereas we started off with AH on the APM system and saying it's your responsibility, and to extend, CFO's responsibility to meet the business requirements, it's my responsibility or BSD about information managements our resource so I mean building, whether it's silos or integrated or what tools we use, that's kind of our business so I think you've got those things.		Sustainability	Sustainability
817		R		That's interesting commentary.			
818		DC		So we didn't go into it trying to do too much, I think that's one of the things we learned and might have been something that you know, I'm just trying to think now, sort of off the top of		History	Champion Didn't Buy In

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				my head but the, it might have been something that influenced CFO as well because he could see that he wasn't you know, going to wear all that, indeed that was part of it I suppose, clearer accountability so he was kind of going so that would be a steering committee, are you guys going to be able to deliver this, are you going to be able to support it, not his problem, my problem, that's Ok, that's fair so it was probably a bit, that was a little bit clearer this time round and that was from learning's with previous APM attempts where I think we, I mean that was the learning's, one of the learning's but we just tried to, I think it was too ambitious, the APM system was probably ambitious but achievable.			
830		EM		Well you know, I was thinking about this, well I actually wrote down quite a few, I'll go over them but looking back to say previous APM attempts (2) which towards the end of previous APM attempts (2) what it was trying to do was effectively what the APM system did, right, previous APM attempts (2) was originally quite different to what it ended up at so there was issues there about the scope, the sponsorship, the team involved, I'll say this up front, me as Project Manager was wrong for that, I shouldn't have been in there because I was out of my depth and so on. However when the APM system came along it seemed to get all those things right, certainly over time, maybe not performatively, it took a long time to get up and going, remember many meetings with, let me see this was in the BIP days, if you remember back in October 2003 whenever, when all this started to come out that the executive really wanted this and BF was part of the Ernst and Young team then who were, who was working on that. So I remember long and endless meetings about how we should do this and we were telling them oh no previous APM attempts (2) was you know, bigger than Ben Hur, you got to, you know, said oh no, what we've got to do is but I think what they did was they	Yes	History	Team Skills

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				then sat down and took most of that on board and then they over time developed the right scope, they got the right scope sponsorship, they got the right business involvement and they then carried that through very, I should say with a lot of focus, they didn't let themselves get distracted, they had a strong business representation, strong technical side, project side as well. Now if you like, I'm going to say sponsorship for example, I mean right from the start, very key sponsorship from, well from executive, much to say from corporate executive as a whole you say you had general sponsorship, a good sponsorship there, very specifically from one GM who was very, very keen on it, he.			
1146		GB		Generally portal is pretty good. Yeah, portal is pretty good. I suppose there are little bit of times that they could speed up a bit.		System Quality	Reliability
1147		R		In the APM system or just.			
1148		GB	[19:24}	In the APM system, in the APM system itself, that I think the speed has starting to little bit deteriorate I think. *[19:24}*			
1149		R		The other one is that, is it easy response, does it respond to change quickly? Like is it easy to add a new KPI and do whatever you like? Do you do that yourself?			
1150		GB		No, the reason being is we, because I'm a pack controller, and the management, the corporate reporting people took on board the administrative role, so there was only 2, so they can virtually liaise with what things have been done.		System Quality	Usability
1151		R		You can let them know and they get it done pretty quick?			
1152		GB		Yes. As soon as I say change this, they just go online, change it, bang it's there within a couple of minutes.	Yes	System Quality	Usability
1153		R		Alright, so it's pretty quick.			
1154		GB		Yes it's self managed. The one thing that like about the APM system is that it's self, once everything is set up for maintaining, removing, indicators, having indicators, you know, expanding those little bits there, within the framework,			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				it's like self managed. You don't need another take out.			
1155		R		Does that add to the sustainability of the system? Because being sustainable means ease of use, because when you get new people in, new managers, and you probably haven't had any yet, but how long did it take you to do training on this?			
1156		GB		No, we get new people, like this morning, I did a briefing, a presentation of the APM system to our branch meetings. So I just took them through, it was more like my branch manager wanted to be sure, our branch members what this new reporting's capable of, so I just took them through the, a bit of a story just so, a bit of a demo on the system, and I can virtually show a person, not even train a person, show a person in 10 minutes what the APM system's about and leave them alone. That's how intuitive.		Sustainability	Sustainability
1157		R		And does that make it more sustainable, because sustainability means reactive to change, be able to keep it going. You talked about the 2 admin people and all that sort of stuff. Is it a sustainable system, is it going to grow?			
1160		GB		Like I said, there's going to be doubling with the KPI's, right, and the user, add another 30, about another 40% of users onto it, hoping that the platform of this system can handle that additional load.		Sustainability	Reactiveness to change
1539		JC		Well that's why the change in sustainability are important, but if you only want them to use it you know for a year or something, well then it's.		Sustainability	Usability
1540		R		It's embedded in the business?			
1541		JC		That's why I'm saying in terms of the time.			
1542		R		Yeah, whatever you define the time that the system is valid, whatever that is.			
1543		JC	[40:24].	But, but to me the system can only be valid if it's continually changing and actually adopting business process *[40:24]*.	Yes	Sustainability	Reactiveness to change
2014		LT		That's right, and I don't believe it is. And I think that		Data Quality	MDE

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				ultimately at least one day of revision is essential, because you have manual intervention in everything that an organisation or business does, there is a risk that will involve some sort of error or some sort of complication. Therefore that one day sometimes is required to correct and it's not.			
2015		R		I've worked on SCADA systems in the past where you have automated systems and the tank is considered full all week because the floats suck at the top of the mast.			
2016		LT		Yeah, that's right but there you go.			
2017		R		And until someone goes out there and actually checks it, the float drops and they go, oh no, it's only a third full and they go my god now all the panic starts. I worked with something like that before. That's the reason I asked you because the nirvana in there, your sort of a hybrid, you're in the middle and maybe that's the reason for the success.			
2018		LT		Yes, certainly the success is. That I don't know, I don't even know we'll actually reduce the timeframe over which we can practically.			
2019		R		How many days do you do it now?			
2020		LT		Eight days at the moment. Which is, bear in mind that the structure sort of drives that a little bit, the fact that you actually have branch regions who need to actually look and their results, divisions who need to look at their results and business to the board exec needs to review that.			
2021		R	[47:26]	To review?			
2022		LT		Pretty much. You do need that sort of flow. Whether we've got too much time, I suspect at this stage not whilst we're in the infancy of the APM system but I think it does have room for movement in the future but how much I'm not sure. And things like MDE reduce that to being close to.	No	Source Systems	MDE
2023		R		What's MDE?			
2024		LT	[47:53]	Manual Data Entry?			
2025		R		Okay.			
2026		LT		Reduce that, because that takes a significant piece of time.			

Seq	Question	Who	Timing	Discussion	Used	Primary Codification	Raw Codification
				Now what you're doing is still doing the old style. Instead of automatically extracting from the source system you're actually manually getting the information from a source system, which adds an extra day or so to your process.			
2027		R		And have a look.			
2028		LT		Yes.			
2029		R		Okay. Are there any other questions or comments?			
2030		LT		No.			
2031		R		We covered everything didn't we?			
2032		LT		Yeah, we did.			
2033		R		Thank you very much for your time, I appreciate it.			
2034		LT	[48:28]	That's alright. *[48:28]*			

APPENDIX FOUR:

CODIFICATIONS USED IN THE CASE STUDY DATA SHEET

Table 15. Codifications used in the case study data sheet analysis.

Raw Codification	Accountabilities framework	Business Process	Business Process Change	Champion	Data Quality	Development Technology	Management Support	Measure	Perceived Net benefits	Reactiveness to Change	Resources	Source Systems	Sponsorship	Success	Sustainability	System Quality	Team Skills	timeliness	User participation	Grand Total
Acceptance														3						3
Accountabilities framework		1	3	8			1		1					3	1				1	19
Amount reported					3															3
Benefit				2	1				2							1	1		1	8
Business Process					1				3							2				6
Champion				4																4
Change management			4	1			2													7
Communication																			2	2
Cultural Change		2	1					1					1				3			8
data quality					6				2			5								13
Design					1							1				9				11
Development						2	1	1											1	5
Enhancement						2		2						2		1				7
Flexibility			1						1	1					2	3				8
Future												1				3				4
Implementation			1											1		4				6
Issue					1												1			2
MDE					3							3		1						7
Measures			1		5			6	5			2		1						20
Most important factor			1		1															2
Operational																			2	2

Raw Codification	Accountabilities framework	Business Process	Business Process Change	Champion	Data Quality	Development Technology	Management Support	Measure	Perceived Net benefits	Reactiveness to Change	Resources	Source Systems	Sponsorship	Success	Sustainability	System Quality	Team Skills	timeliness	User participation	Grand Total
Organisational structure				1	3		6	1	1					1					2	15
Outsource																	1			1
Process		1	1												1					3
Process driven			1				1											1		3
reactiveness to change															5			5		10
Reason			1				1							4	1	2			2	11
Reliability																4				4
Resources											4									4
skills																	3			3
Source Systems					1												1			2
Sponsorship				4			4						1				1			10
Spreadsheets					5															5
Stakeholders				1			1													2
Sustainability															11					11
System Output									1					3						4
Team Skills				1													9			10
Technical	1					1														2
Technology						2			1							4				7
Threat		2																		2
Timeliness															1	3		4	1	9
Usability															1	26				27
User participation	1				1				1					1					4	8
Grand Total	2	6	15	22	32	7	17	11	18	1	4	12	2	20	23	62	20	10	16	300

APPENDIX FIVE: EXAMPLES OF ARIS MODELS

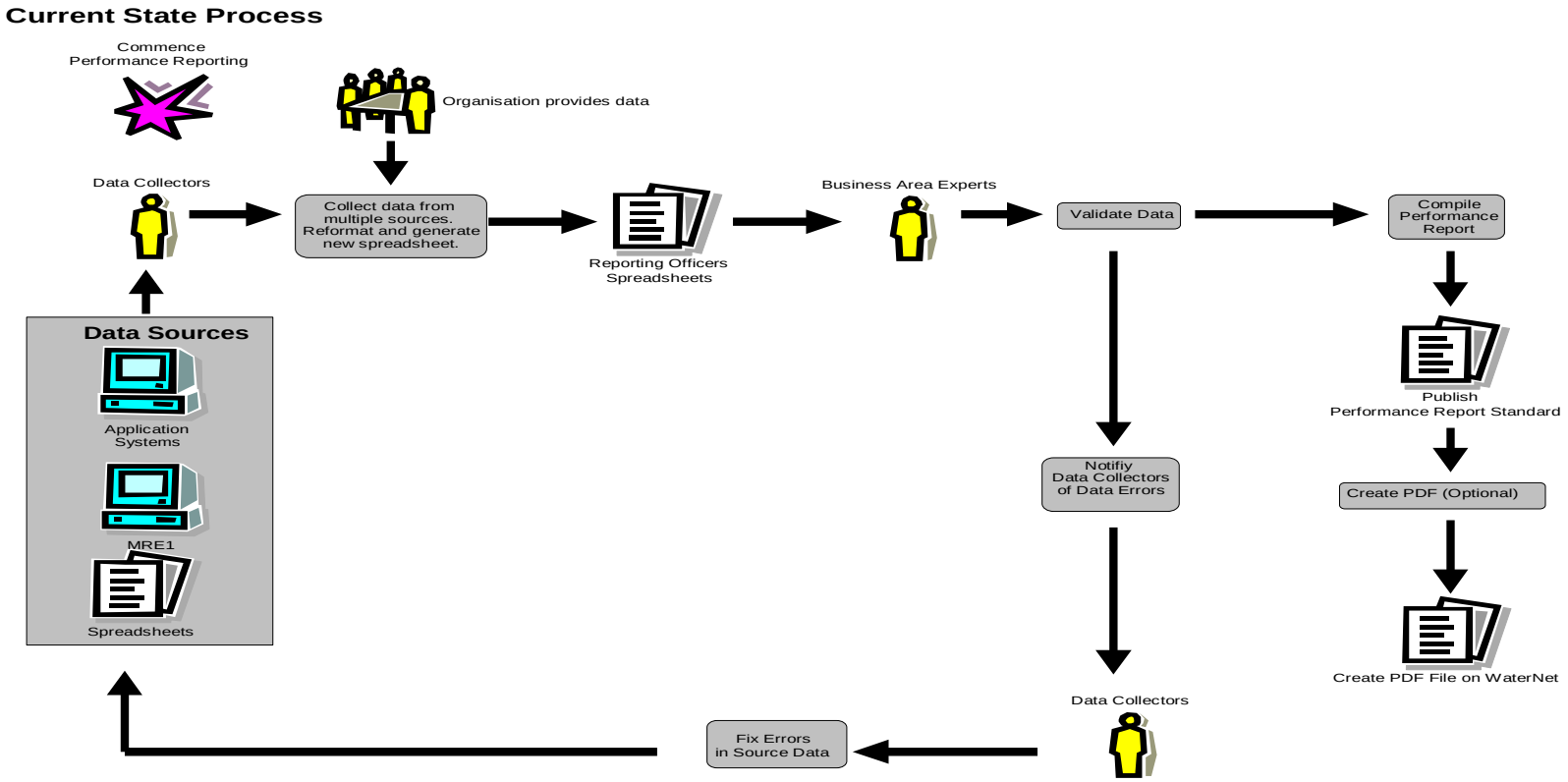

Figure 33. ARIS example: Process model - another representation

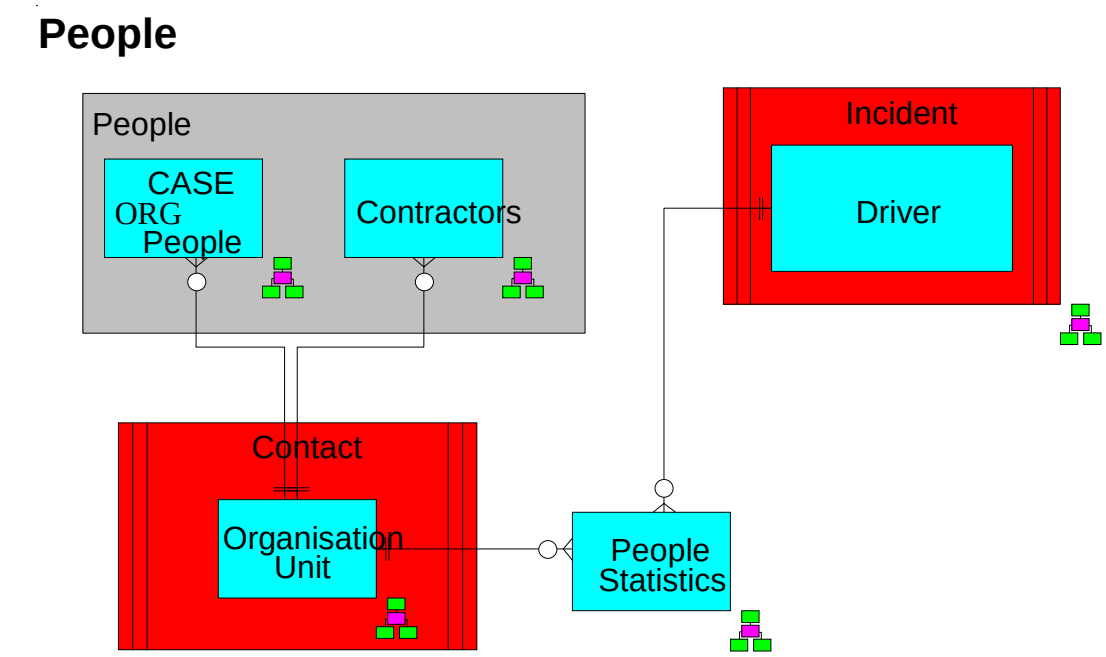

Figure 34. ARIS example: Data model simple

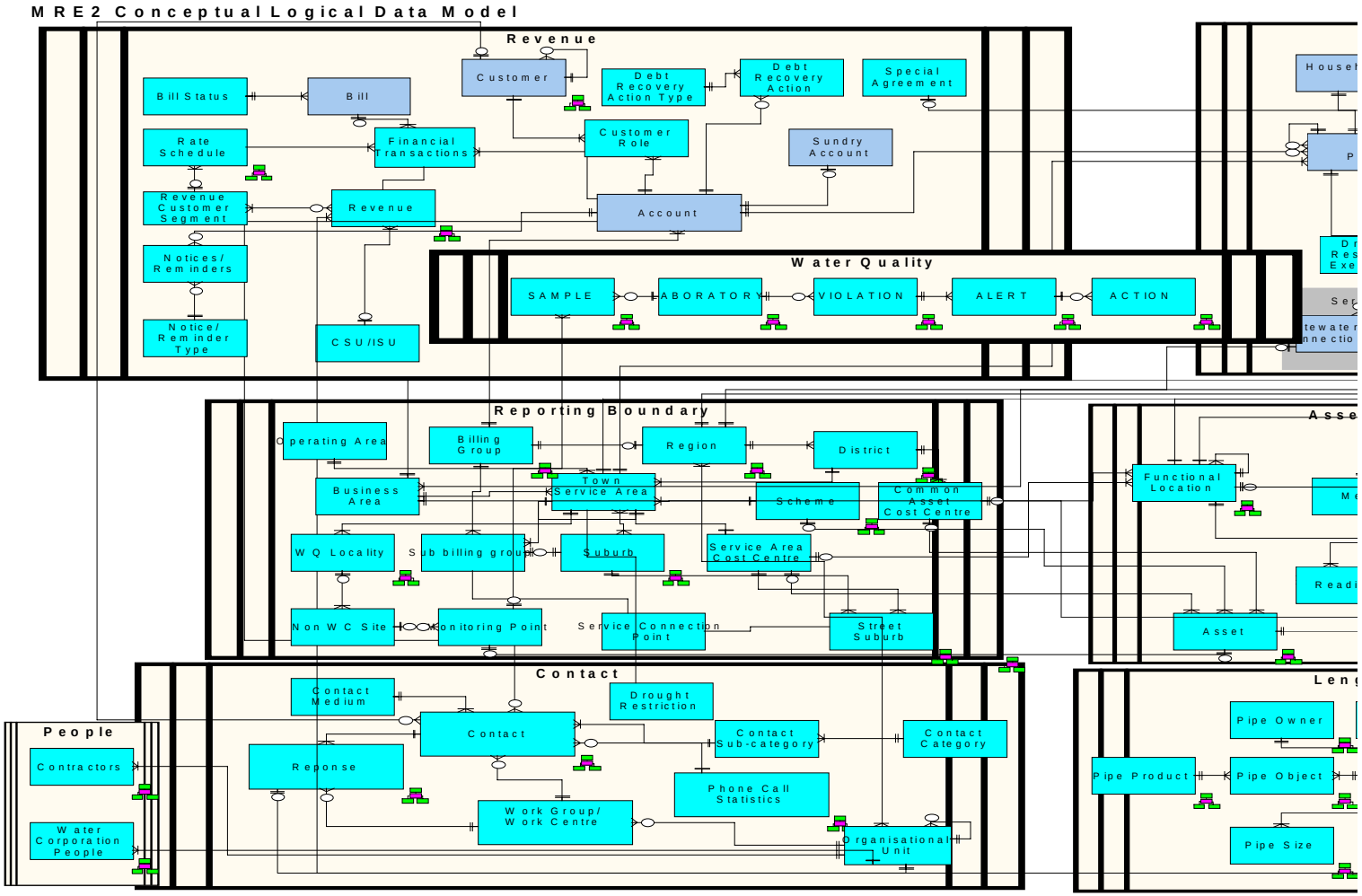

Figure 35. ARIS example - Data model complex

Report Relationship

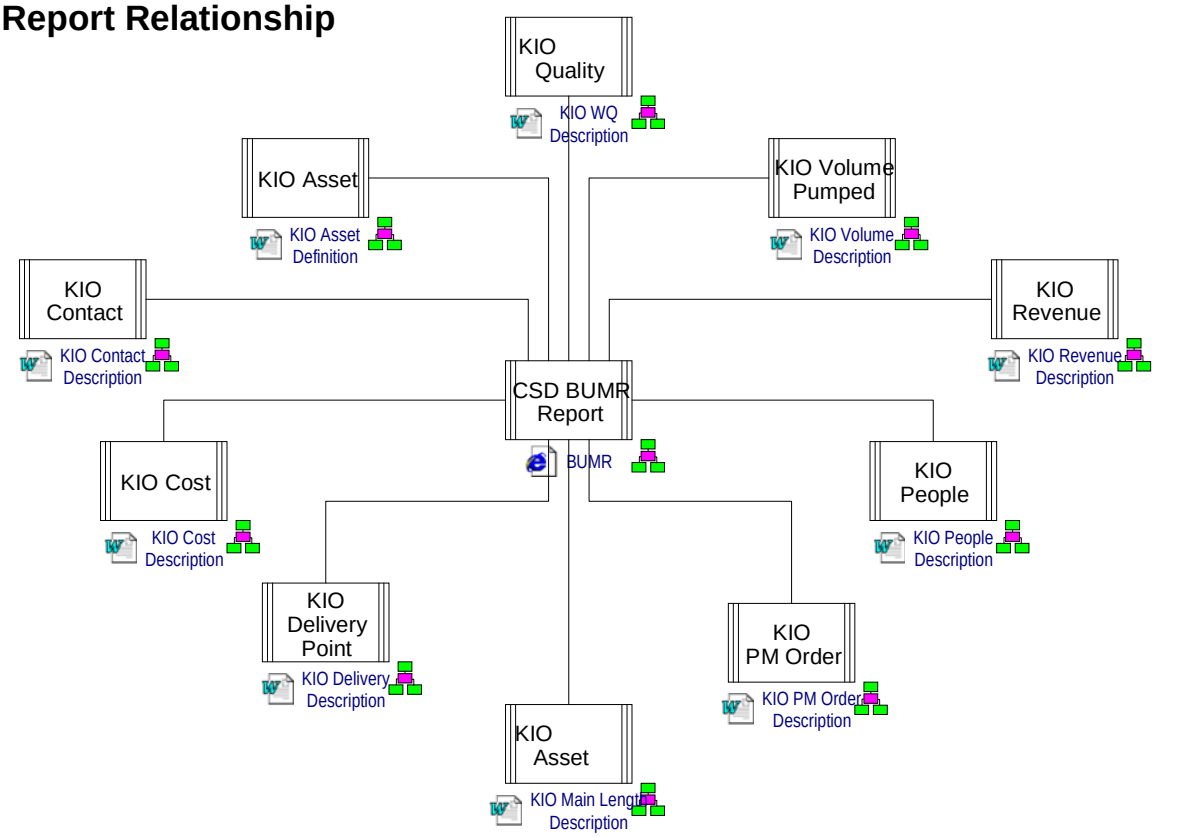

Figure 36. ARIS Object relationship model (Note the embedded word document icon)

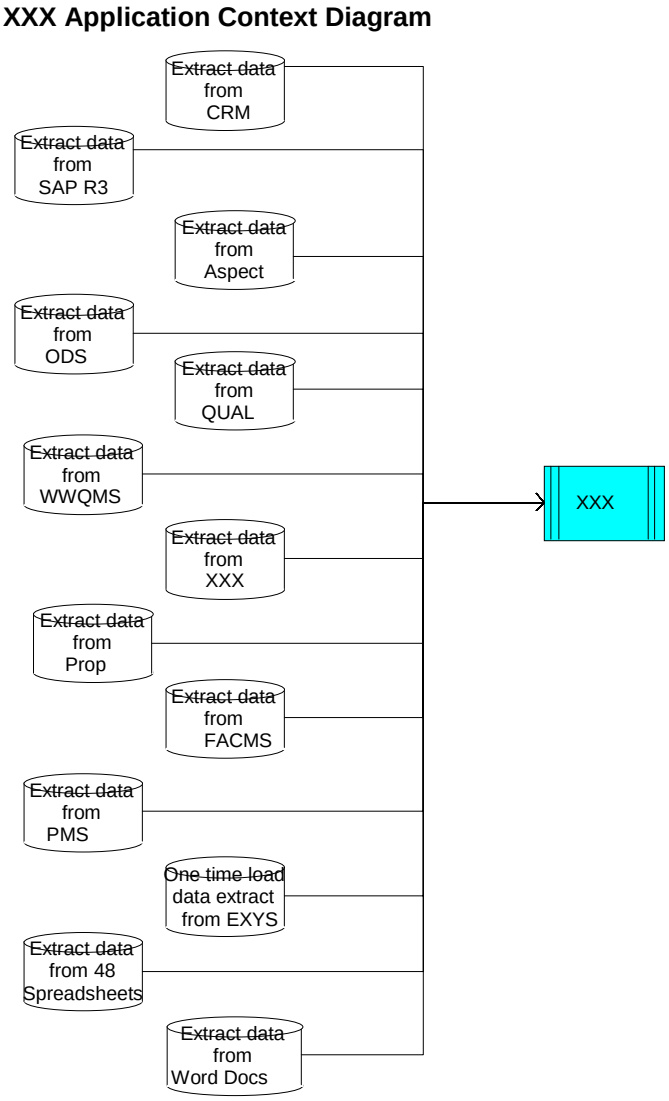

Figure 37. ARIS example - Application complex

ATTACHMENT ONE:
FOCUS GROUP CONSENT FORMS AND INFORMATION LETTERS

Focus Group Consent Form

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Focus Group Information Letter

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Proposal proper\Ethic

Faculty of Business and Law,
Management Information Systems
For further information:
Supervisor: Dr Paul Jackson
Tel: (08) 9273 8405
Fax: (08) 9273 8754
Email: p.jackson@ecu.edu.au

Researcher: John Myles
Tel: (08) 9307 3003
Fax: (08) 9307 4567
Email: jmyles@ecu.edu.au

FOCUS GROUP CONSENT FORM

Discovering Critical Success Factors for an Automated Performance Measurement System

I, …… *(please print)* have read the information on the research project "*Discovering Critical Success Factors for an Automated Performance Measurement System"* which is to be conducted by John Myles from Edith Cowan University and all queries have been answered to my satisfaction.

I consent to:

- Participate in a focus group that will take approximately two hours.
- Attend the focus group discussion which will be held at *Celtic Club* on *13 Dec 2005* commencing at *16:30.*
- The audio-taping of my contribution to the focus group discussions.
- Review the transcript of the focus group discussion to edit or erase part or all of my contribution.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I understand that all information collected will remain confidential to the researchers. All information gathered from the focus group will be stored securely and once the information has been analysed the audio tapes and transcripts will be destroyed. My identity will not be revealed without consent to anyone other than the investigator/s conducting the project. Further, I have had the opportunity to have my questions answered to my satisfaction.

Print Name:……

Signature: ……..

Date ……

***This project has been approved by the University's Human Research Ethics Committee, on* 17 November 2005, Ethics Number 05-213.**
"If you have any concerns or complaints about the research project and wish to talk to an independent person, you may contact:
Research Ethics Officer
Human Research Ethics Officer
Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

Faculty of Business and Law,
Management Information Systems
For further information:
Supervisor: Dr Paul Jackson
Tel: (08) 9273 8405
Fax: (08) 9273 8754
Email: p.jackson@ecu.edu.au

Information Letter for Focus Group Participants

Discovering Critical Success Factors for an Automated Performance Measurement System

Dear Potential Participant,

My name is John Myles and I am a student in the School of Management Information Systems at Edith Cowan University where I am undertaking a Doctorate of Business Administration (Information Systems). As part of my studies, I am conducting a research project entitled "Discovering Critical Success Factors for an Automated Performance Measurement System". You are invited to take part in this research project which is aiming to describe the nature of Automated Performance Measurement Systems and to identify and explain criteria to support successful implementation of the supporting technologies.

The proposed research intends to leverage off the existing information systems success models by interviewing industry experts to refine the success criteria defined and produce an updated success criteria model for automated performance measurement system. At present academic literature indicates that over 70% of these system implementations fail. Identification of the success criteria for this type of system implementation would be of benefit to people and organisations intending to implement these types of systems.

This is the first stage of the Project where it is intended to conduct a focus group comprising of various industry experts to define success criteria. Following this focus group, a set of revised success criteria will be defined and tested as to their significance in a case study organisation.

You have been selected because you either were nominated by another party or are known to be actively involved in implementing automated performance measurement systems.

If you agree to participate, you will be asked to:

- Sign the Focus Group Consent Document and return it to the researcher
- Participate in a group forum to be held at *Celtic Club* on *13 Dec 2005*, *16:30.* This will involve answering questions relating to projects you have participated in and the environment where these business initiatives have been undertaken to implement an automated performance measurement system.
- Discuss your views on the reasons for the success or failure of such initiatives

It is not expected that this process should take more than two hours. If it looks like it will take more than the allocated time, the group will be asked if they wish to reconvene at a time acceptable to all to finalise the discussion. Refreshments will be served at the conclusion of such meetings at no cost to yourself.

Subsequent contact after the focus group meetings may be required where ambiguus or conflicting information is obtained to that provided by you. You may choose to participate, or not, in these subsequent meetings.

No payment or reimbursement is available from participating in this research and no direct benefits are expected to be forthcoming to you as an individual. A copy of the published research results may be made available to you electronically if you desire.

Please read this Information Statement and be sure you understand its contents before you consent to participate.

Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you in any way. If you do decide to participate, you may withdraw from the project at any time without giving a reason and without penalty. The withdrawal may also include the withdrawal of information or material provided by you that has already been collected.

The results of the study may be included in the resulting thesis and may be used in other reports, at conferences and in publications.

The intention is to electronically record the group proceedings and any subsequent interviews or discussions to enable the correct collection of the information. If this is not favoured by yourself, please advise me as soon as possible as in this circumstance notes will be taken. If one participant objects to the electronic recording, notes will be taken for the meeting.

All information collected will be treated as confidential and will be stored securely. Once the information has been analysed, the audio tapes and transcripts will be destroyed. Individual participants will not be identified in any reports or presentations arising from the project, unless specific consent for this has been obtained.

If you have any concerns or would like to know the outcomes of this project, please contact my supervisor Dr Paul Jackson at the above address.

Thank you for considering this invitation,

John Myles
(Researcher)
jmyles@ecu.edu.au
Mob: 041 99 55 282

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Email: research.ethics@ecu.edu.au

ATTACHMENT TWO:
CASE STUDY CONSENT FORMS AND INFORMATION LETTERS

Interview Consent Form

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Proposal proper\Ethic

Case Study Information Letter

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Proposal proper\Ethic

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Researcher: John Myles
Tel: (08) 9307 3003
Fax: (08) 9307 4567
Email: jmyles@ecu.edu.au

INTERVIEW CONSENT FORM

Discovering Critical Success Factors for an Automated Performance Measurement System

I, …… *(please print)* have read the information on the research project "*Discovering Critical Success Factors for an Automated Performance Measurement System: A Case Study Approach"* which is to be conducted by John Myles from Edith Cowan University and all queries have been answered to my satisfaction.

I consent to:

- Participate in an interview that will take approximately one hour.
- The audio-taping of my contribution.
- Review the transcript of the interview to edit or erase part or all of my contribution.

I agree to voluntarily participate in this research and give my consent freely. I understand that the project will be conducted in accordance with the Information Sheet, a copy of which I have retained.

I understand I can withdraw from the project at any time, without penalty, and do not have to give any reason for withdrawing.

I understand that all information collected will remain confidential to the researcher. All information gathered from this interview will be stored securely and once the information has been analysed the audio tapes and transcripts will be destroyed. My identity will not be revealed without consent to anyone other than the investigator/s conducting the project. Further, I have had the opportunity to have my questions answered to my satisfaction.

Print Name:……

Signature: ……..

Date ……

***This project has been approved by the University's Human Research Ethics Committee, on*17 November 2005, Ethics Number 05-213.**
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For further information:
Supervisor: Dr Paul Jackson
Tel: (08) 9273 8405
Fax: (08) 9273 8754
Email: p.jackson@ecu.edu.au

Information Letter for Case Study Interview Participants

Discovering Critical Success Factors for an Automated Performance Measurement System: A Case Study Approach"

Dear Potential Participant,

My name is John Myles and I am a student in the School of Management Information Systems at Edith Cowan University where I am undertaking a Doctorate of Business Administration (Information Systems). As part of my studies, I am conducting a research project entitled "Discovering Critical Success Factors for an Automated Performance Measurement System: A Case Study Approach". You are invited to take part in this research project which is aiming to describe the nature of Automated Performance Measurement Systems and to identify and explain criteria to support successful implementation of the supporting technologies.

The proposed research intends to leverage off the existing information systems success models by interviewing industry experts to refine the success criteria defined and produce an updated success criteria model for automated performance measurement system. At present academic literature indicates that over 70% of these system implementations fail. Identification of the success criteria for this type of system implementation would be of benefit to people and organisations intending to implement these types of systems.

The Project has already conducted a focus group of various industry experts to define success criteria. Following this focus group, a set of revised success criteria have been defined and are now being investigated as to their significance in a case study organisation. *"Case Organisation"* senior management have agreed to participate in this study on the basis the organisation remains confidential and at no time the results of the study identify the organisation.

You have been selected because you either were nominated by "*Case Organisation"* senior management or have been involved directly or indirectly in a similar type project(s) at *"CaseOrganisation".*

If you agree to participate, you will be asked to:

- answer questions relating to these projects and business initiatives that have been undertaken to implement an automated performance measurement system.
- Discuss your views on the reasons for the success or failure of such initiatives
- sign the Interview Consent Document and return it to the researcher

It is not expected that this process should take more than one hour. If it looks like it will take more than an hour, the interview can be broken into segments and held at times convenient for you.

No payment or reimbursement is available from participating in this research and no direct benefits are expected to be forthcoming to you as an individual. A copy of the published research results may be made available to you electronically if you desire.

Please read this Information Statement and be sure you understand its contents before you consent to participate.

Participation in this research is entirely your choice. Only those people who give their informed consent will be included in the project. Whether or not you decide to participate, your decision will not disadvantage you in any way. If you do decide to participate, you may withdraw from the project at any time without giving a reason and without penalty. The withdrawal may also include the withdrawal of information or material provided by you that has already been collected.

The results of the study may be included in the resulting thesis and may be used in other reports, at conferences and in publications.

The intention is to electronically record interviews to enable the correct collection of the information, if this is not favoured please advise me as it is possible to participate in the project without being recorded. In this circumstance notes will be taken.

All information collected will be treated as confidential and will be stored securely. Once the information has been analysed, the audio tapes and transcripts will be destroyed. Individual participants will not be identified in any reports or presentations arising from the project, unless specific consent for this has been obtained.

If you have any concerns or would like to know the outcomes of this project, please contact my supervisor Dr Paul Jackson at the above address.

Thank you for considering this invitation,

John Myles
(Researcher)
jmyles@ecu.edu.au
Mob: 041 99 55 282

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JOONDALUP WA 6027
Phone: (08) 6304 2170
Email: research.ethics@ecu.edu.au

ATTACHMENT THREE:

ETHICS APPROVAL

file:///U|/Thesis/Thesis%20Document/Ethics%20Approval.htm

From: Research Ethics [research.ethics@ecu.edu.au]
Sent: Tuesday, 15 November 2005 11:23 AM
To: John Myles
Cc: Paul JACKSON
Subject: 05-213 MYLES
Hi John

05-213 MYLES
Discovering Critical Success Factors for Implementing an Automated Performance Measurement System: a Case Study Approach

Thank you for your application for ethics approval. The application has been reviewed by members of the Human Research Ethics Committee and they were happy to approve the application. I will send you an email shortly confirming the details. The Committee also had the following comments:

In the research proposal on page 27, Section 10 Ethics, there is a reference to letters and consent forms for the focus groups and case study participants for the University of Newcastle in addition to ECU but there appears to be no other mention relating to Newcastle. The researcher is advised to contact the University of Newcastle and review their requirements for ethics approval. If ethics approval from this University is required, please send a copy of the approval letter for our records.

Regards
Kim

Kim Gifkins
Research Ethics Officer
Edith Cowan University
100 Joondalup Drive
JOONDALUP WA 6027
Phone: (08) 6304 2170
Fax: (08) 6304 2661
Email: research.ethics@ecu.edu.au

ATTACHMENT FOUR:

ETHICS CLOSEOUT

From: John Myles [john.myles@sujo.com.au]
Sent: Wednesday, 13 September 2006 8:57 PM
To: 'Noviani SETYADI'
Subject: RE: Ethics Approval - 05-213 MYLES

Hi Noviani,
I spoke t Kim this afternoon and we agreed I had finished. No more interviews are required. The analysis is me writing and analysing the data collected. It has been circulated to the participants, verified (for those that responded) and then de-identified.
I have already started writing 2 chapters of my thesis and hope to finish the draft early next year.
Hope this is acceptable and no extension is therefore required.
Cheers,
JM

From: Noviani SETYADI [mailto:n.setyadi@ecu.edu.au]
Sent: Wednesday, September 13, 2006 11:07 AM
To: john.myles@sujo.com.au
Subject: Ethics Approval - 05-213 MYLES

Dear John,

We've received your ethics report form which indicates that you've completed your project. However, we also noticed that the analysis of the data is still to be undertaken. It is important to note that ethics approval is needed for data analysis. Therefore, we recommend for you to extend your ethics approval. Let us know how long should we extend the ethics approval and we'll extend it for you. Once it's done, we'll send you a letter confirming the extension.

If you have any question, please feel free to contact either Kim Gifkins on 6304 2170 or myself (Novia Setyadi) on 6304 2492.

Kind Regards,

Novia Setyadi

Novia Setyadi
Ethics Administrative Officer
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