

Composite Case Study Method To Build e-Business Transformation Theory

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Abstract

This paper reports on a longitudinal multiple case study of SAP sites carried out between 1999 and 2002 on the use of e-business applications with existing ERP systems. A comprehensive research framework based on structured case studies was developed for this study. This framework used three different models at various stages of research to give a multi-faceted view of each case. The combined application of case methods by Carroll et al. (1998), Klein and Myer (1998), and Eisenhardt (1989) is proposed as an appropriate method for maintaining a balance between research rigour and relevance. This composite case-based method provides a structured, yet flexible and dynamic approach to case study interpretive research. Other researchers are urged to apply similar multi-viewed analysis.

Keywords

Case methods, theory building, multi-viewed analysis, e-business transformation

INTRODUCTION

The paper is built on the belief that Information Systems (IS) research can help practitioners better understand and adapt to emerging situations by providing timely, relevant, and rigorous research (Fernández et al., 2002). Furthermore, it can be argued that synergy between relevance and rigour is possible and that Case Study methods in combination with Grounded Theory (theory building) techniques provides a good composite framework for rigorous and relevant research of emerging phenomena in IS (Moody and Bowles 2000).

This research into e-business implementations with ERP systems (e-ERP) is based on the findings of a longitudinal multiple case study analysis of SAP sites. It resulted in a proposed model of e-business transformation (eBT) developed for ERP enabled organisations. The paper is about the what, why, and how of research. It is concerned with the selection and development of a suitable research method, relative to the research topic. The methodology brings together the antecedents of e-business success using the findings from case analyses against three separate research models: B2B interaction, e-business change, and virtual organising. A single model of e-business transformation (eBT) is proposed that focuses on realising the benefits of B2B interaction, from virtual organising by utilising the facilitators of successful e-business change.

To realise benefit maximisation from integrating an e-business application with an ERP package, it is important to understand from the outset the complementary nature of an e-business and ERP implementation (Hesterbrink 1999). This raises the importance of examining both technological and sociological issues (Suprateek and Lee 2002). In this context, no single research method has the solution for exploring the range of issues about the complex phenomenon of e-ERP. For this research a combination of qualitative methods was used to create a multi-view approach for investigation of the research topic. Other researchers are urged to apply similar multi-viewed analysis (Mingers 2003).

THEORETICAL FRAMEWORK: TRIANGULATION OF RESEARCH MODELS

This section of the paper details the activities designed to explore, describe, and justify theory associated with the research questions derived from the literature. These core questions focus the research to build theory around e-business implementations through ERP (e-ERP). A survey of the relevant literature was used to assemble an appropriate approach to researching an emerging organisation phenomenon, and a pilot study helped ground the initial research model and associated question.

A comprehensive model of e-ERP implementations may be presented simply as the fusion of three interrelated models. Figure 1 illustrates e-ERP as a primitive composite view of the three research models: *Benefits of B2B*, *e-Business Change*, and, *Virtual Organising* where:

- Benefits of B2B are illustrated by a two dimensional model (1) where value returns are directly proportional to the level of integration of e-business activity across a set of B2B models (Carlson, 1995). B2B refers to the class of business-to-business (B2B) models that include business-to-employee (B2E), business to consumer B2C, business-to-supplier (B2B^S) and business-to-corporate customer (B2B^C).
- e-Business Change is illustrated by a flat model (2), in which progress is across eleven interrelated components within three broad dimensions based on relevant research in the areas of “organisational change, strategic management innovation, and information systems evaluation” (Guha et al., 1997, p.121).
- Virtual Organising is illustrated by a three-dimensional model (3) of e-business activity that is “applicable to any company.” Progress is along the three dimensions of “customer interaction, asset configuration, and leveraging knowledge” (Venkatraman & Henderson, 1998, p.34).

Three Research Models used to Examine e-ERP Success

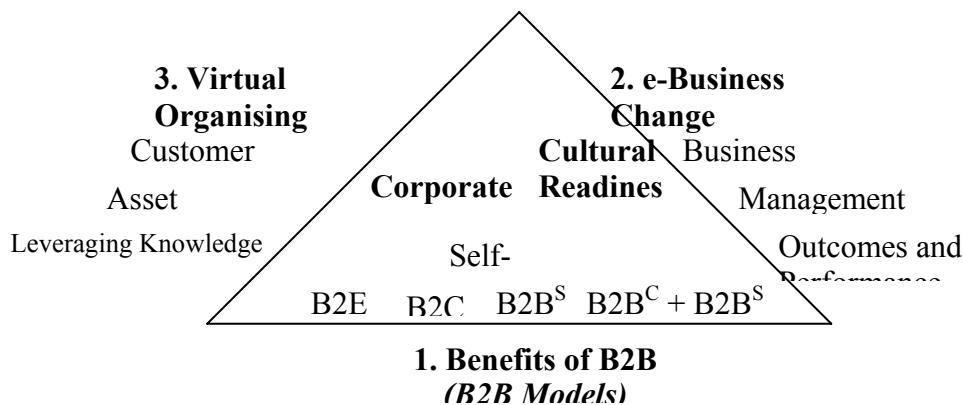


Figure 1: Three Faces of e-ERP Implementation

Each research model represented in Figure 1 reflects a different business focus covering organisational theory, strategy, change management, and work practices. These models were evaluated at different stages of the study through a composite case based method as shown in Figure 2.

A Composite Case-based Research Method

The research questions in association with the three models identified from the literature on the topic were used to develop a composite case-based method. These questions set the main research objectives to test three practitioner “theories-in-use” namely, benefits of e-business implementations derived from virtual organising through e-business change management. These are presented in order of increasing theoretical complexity as:

- Q.1:** How do organisations maximise benefits from e-ERP implementations?
- Q.2:** What factors facilitate and inhibit success of e-ERP implementations?
- Q.3:** Do effective strategies of e-ERP implementations fit the virtual organising model?

Yin (1984) identifies case study types as exploratory, descriptive, and explanatory. Mohr (1985) argues that case studies vary, dependent on the type of research to be performed: theoretical, evaluative, or associational. Edwards (1998) incorporates the three case study types into an overarching framework for theory validation and ultimately creation of new theory.

Edwards (1998) describes a conceptual framework for understanding the phases of case-based research. “Case-based strategies in research are widely used in case study methodology as well as in a number of qualitative methodologies, including grounded theory development, phenomenological research method, and psychotherapy process research” (p.61).

The critics of qualitative methods are many, and hail mainly from the physical sciences (Gable, 1994). More objective criticism has come from the social sciences. Kerlinger (1986, p.348) identifies three major weaknesses of case study research in IS:

- The inability to manipulate independent variables, not relevant in this study.
- The risk of improper interpretation – most relevant.

- The lack of power to randomise – relevant but manageable.

Further, Lee (1987) identifies four corresponding problems with case study research as a lack of controllability, deductibility, replication, and generalisability. The latter two limitations stem largely from the lack of power to randomise. Lee defends the case study method by suggesting these are not insurmountable and can be overcome by quality of design. Inspired by Carol et al. (1998) a range of research methods are designed into a composite structured method (case-based) to overcome these limitations. The use of case studies appears the most appropriate research method with additional help from conceptual study, action research and grounded theory building techniques.

THREE PHASES OF THE RESEARCH METHOD

A pilot case study of nine Australian SAP sites helped ground the theory of the study. This was followed by a three-stage study of eleven international cases within a diverse industry context. A final conceptual framework was developed in terms of e-business transformation (eBT) (Table 2). The concept of eBT is defined as realising the benefits from virtual organising within complex B2B interactions by utilising the facilitators of successful e-business change.

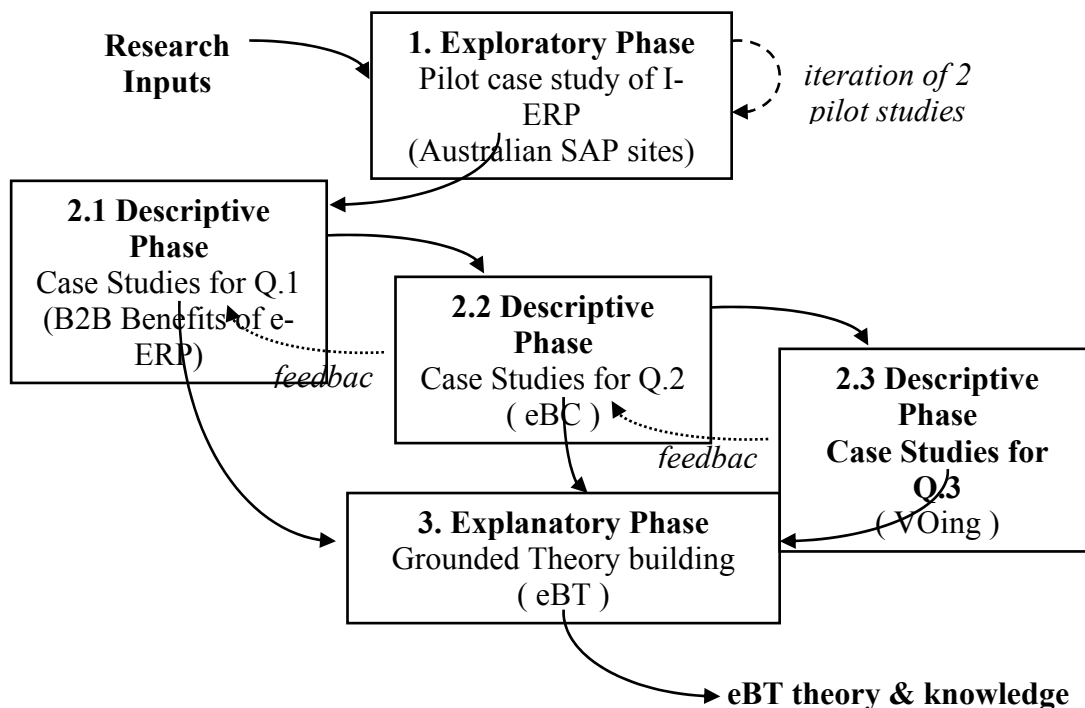


Figure 2: Composite Case-based Research Method

Figure 2 diagrams the three types of case-based research methods: exploratory, descriptive, and explanatory. Importantly, it shows the interrelationships between them:

- Exploratory Phase 1 – pilot study
Carroll et al. (1998, p.66) provide “structured-case studies” for use in the pilot study to build initial conceptual foundations, with the focus on rigour and relevance. The elements of the structured-case studies method are embedded within a research cycle with multiple inputs for two iterations to establish.
- Descriptive Phase 2 – main study uses three views of multiple case studies
Eisenhardt (1989, p.533) provides eight research activities as the “basics” of case work (Table 1) for theory testing of the three research models (Figure 1), using multiple case studies.
- Explanatory Phase 3 – holistic study
In theory, Klein and Myers (1998) offer the key principle for interpretive field research the “Hermeneutic circle” as the interdependent meaning of the parts to understand the whole they form. In practice, Strauss and Corbin (1990) provide grounded analysis techniques for creating new theory of eBT.

This triangulation of methods was applied across three views of e-ERP. Finally, synthesise the findings of three research models of the main phase of this longitudinal multi-case study, carried out between September 1999 and June 2001. A sample of eleven cases were used to test the hypothesis; the strategies and performance criteria of eBT - applicable to all ERP enabled organisations when adopting e-business.

Structured-Case Research Method

The first art of the methodology suggested for this research is called ‘structured-case’ research method (Carroll et al., 1998). It offers a structure that guides the IS researcher in undertaking case study to build theory. Structured-case uses a range of mechanisms from action research and case study method. These were synthesised into a structured yet flexible method for performing rigorous research.

Structured-case assists the researcher to undertake case study research through the use of conceptual framework (CF) and a research cycle that provides for building knowledge and theory.

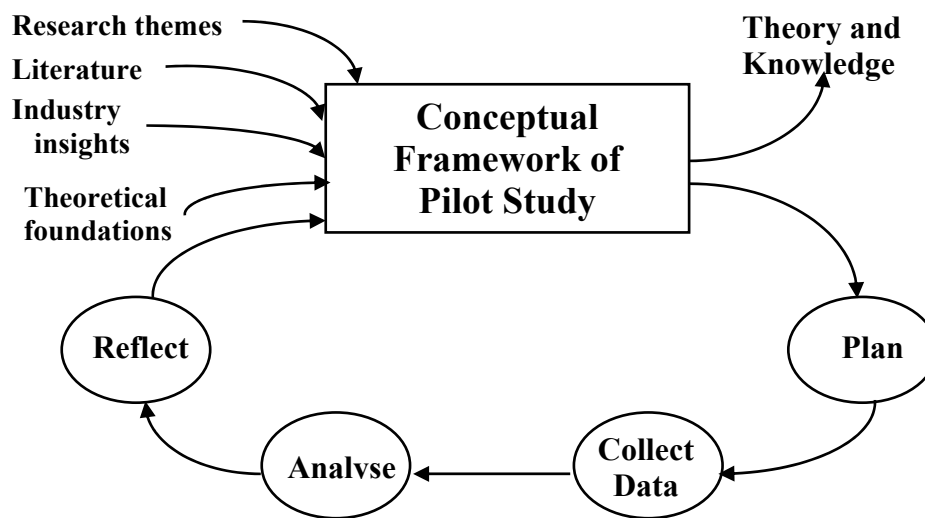


Figure 3: Structured-Case Research Method (source: Carroll et al., 1998, p.65)

Figure 3 illustrates the main activities of the method, and the procedural structure within the research cycle, as well as the inputs and output. In building theory from case studies, the conceptual framework (CF) is the theoretical construct that gives boundaries to the research and determines what is to be examined in the next cycle. At the beginning of each cycle a CF is constructed by considering the following inputs: research themes, literature review, industry insights, and theoretical foundations that acts as a filter to the vast range of observations.

The research cycle involves the set of activities used to test and refine the CF. This cycle is adapted by Carroll et al. (1998) from Susman and Evered (1987) who provided an earlier action research model. In practice, at least two research cycles may be performed to achieve the research closure. During each cycle, a set of activities: planning, interviewing, analysing, and reflecting are performed to validate the final CF.

Building Theory from Cases

The use of case studies appears the most appropriate research method with additional help from conceptual study, action research and grounded theory building techniques. The implications of choosing case studies can be seen in the steps detailed in Table 1. This set of activities form the backbone of the overall research method.

Table 1: Eight Basic Steps of Case Research (Eisenhardt, 1989)

Step	Activity	Reason
1. Getting Started	Definition of research question Possibly a priori of constructs Neither theory nor hypotheses	Focuses efforts Provides better grounding of construct measures Retains theoretical flexibility
2. Selecting Cases	Specifation of population	Constrains extraneous variation and sharpens external validity.

	Theoretical not random sampling	Focuses efforts on theoretically useful cases, ie those that replicate or extend theory by filling conceptual categories
3. Crafting Instruments and Protocols	Multiple data collection methods Qualitative and quantitative data combined Multiple investigators	Strengthens grounding of theory by triangulation of evidence Synergistic view of evidence Fosters divergent perspectives and strengthens grounding
4. Entering the Field	Overlap data collection and analysis including field notes Flexible and opportunistic data collection methods	Speeds analyses and reveals helpful adjustments to data collection Allows investigators to take advantage of emergent themes and unique case features
5. Analysing Data	Within-case analysis Cross-case pattern search using divergent techniques	Gains familiarity with data and preliminary theory generation Forces investigators to look beyond initial impressions and sees evidence through multiple lenses
6. Shaping Hypothesis	Iterative tabulation of evidence for each construct Replication, not sampling, logic across cases Search evidence for 'why' behind relationships	Sharpens construct definition, validity, measurability Confirms, extends, and sharpens theory Builds internal validity
7. Enfolding literature	Comparison with conflicting literature Comparison with similar literature	Builds internal validity, raises theoretical level, and sharpens construct definitions Sharpens generalisability, improves construct definitions, and raises theoretical level
8. Reaching Closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

* Source; Eisenhardt, (1989, p. 533)

The case-based research method caters for the overlap between theory creation and validation or building and testing (Eisenhardt, 1989). Also, it allows for “unfreeze thinking” on the part of the researcher (p.546). Eisenhardt warns the inexperienced researcher against “slipage of completion” at each step of the method (p.547).

Conceptual Studies

The research attempts to provide knowledge and extend our understanding of e-business solutions by the target organisations - initially in Western Australia. The specific or generic objective is to develop a CF of e-business adoption by SAP-based organisations. This is described by Neuman (1991, p.30) as “a system of interconnected ideas that condense and organise knowledge.”

The CF is the theoretical construct that bounds the research and determines what is to be examined in the next cycle. At the beginning of each cycle a CF is constructed by considering the following inputs;

- research themes – scopes the area in which the research questions are refined,
- literature review – visits the literature to confirm/disconfirm the findings,

- insights – accesses expert knowledge in ERP from SAP consultants and practitioners, such as SAP/IT consultants as would be mentors,
- theoretical foundations – acts as a filter to the vast range of observations.

Modelling the Conceptual Foundations

The conceptual foundations of this research may be better understood and more simply communicated by the use of models. Amalgamated into a holistic business model based on actual case studies interviews. Such models may incorporate a valid e-business strategy that is achievable and sustainable in the real world.

In this study, modelling is used systematically to clarify and explicitly state the conceptual foundations at each stage of the study of e-ERP implementations.

“We humans have developed an exceptionally powerful technique for dealing with complexity. We abstract from it. Unable to master the entirety of a complex object, we choose to ignore its inessential details, dealing instead with the generalised, ideal model of the object.” (Shaw, 1981, cited in Steele, 1999, p.864).

The representation of abstractions through models is an over-arching theme in functionalist information systems development (Steele, 1999). A model is an abstraction or simplification of some part of the present proposed information system (Avison and Fitzgerald, 1995). A good model captures the crucial elements of a problem and the relationships between them (Rumbaugh et al., 1991). In order to express all the subtleties of complex systems it is necessary to use multiple views (models), with each view representing a subset of the aspects of interest (Booch 1994, p.172), such as the complex phenomena of e-ERP.

LONGITUDINAL STUDY ON E-ERP

As the research was viewed as foundational, eleven cases were chosen across a wide range of industries. They were viewed simply as pioneers of e-ERP technologies, on a continuum of e-business adoption from pioneers, innovators, early adopters, to followers. This longitudinal study identified different stages of progression along the eBT journey. Through this study the complexity of eBT was examined through the development of three research models:

- Benefits model with B2B Interaction
- e-Business Change model
- Virtual Organising model

The research method is used to finally synthesise these case findings into a single comprehensive ‘3x3’ matrix as the core of a new theory or model of e-Business Transformation.

The early adopters of e-business applications show a trend towards realising benefits from e-procurement and self-service applications, for customers and employees. To maximise the benefits from these types of applications, employee involvement is essential. Combined, these applications offer use of many functions and shared services across operational and administrative groups. All this relies heavily on employee self-service and leads towards new work roles.

B2B Benefits Model

The overall findings from the set of e-business cases demonstrate that three stages of the business interaction model (B2E, B2C and B2B^S with B2B^C) provide a framework for studying e-business benefits. These three stages typically progress through three levels of benefits: **self-service, quality of work life and care, and empowerment**. While this research found an important role for ERP in support of e-business, the message from these case studies is that the business model should drive an e-business implementation, not the technology (Fan et al, 2000).

The following conclusions address the first research questions used to investigate the benefits of B2B activity:

Combined, B2B applications offer use of many functions or “shared services” across operational and administrative groups. All this relies heavily on employee self-service and leads towards new work roles. To maximise the benefits from these B2B applications, employee acceptance is essential. With e-ERP technologies the integration of e-business applications across ERP systems provides an essential technology for optimising the overall B2B value chain. The case of B2B “e-Commerce integration” represents the exemplar case of the empowerment of employees with increasing B2B interaction. The stages of sophistication of the e-business B2B models collectively demonstrate that greater benefits flow from increased level of B2B e-business interaction.

The real savings from integration of B2B - back-end and front-end integration requires a dual approach;

- inside-out optimisation of business processes witnessed by early adopters,
- outside-in optimisation of business processes will be driven by customer and supplier relationship management.

e-Business Change Model

The following conclusions address the research questions used to investigate the antecedents of e-Business Change:

A successful project was found to have facilitators in all components of the eBC management framework, including the change environment and management practice. Further there is the implication that the least successful e-business projects will have inhibitors in several dimensions, especially in the area of cultural readiness and change management.

As all cases were proactive by definition, the researcher believes that eBC management does not have to be *proactive* to be successful but by the way the organisation *reacts* to the stimuli.

When organisations undertake e-business initiatives, they need to recognise that they will only accomplish their objectives through people. Therefore placing importance on improving the quality of work-life becomes a critical issue. If effectively managed, employees should ultimately be more productive in their work tasks and better able to serve customers, suppliers, and business partners.

These are complex issues that require leadership, appropriate problem solving skills, lots of hard work and executive commitment and a culture that embraces the ideals of the learning organisation. Further, managing the transformation process through several stages of e-business process change is critical for success. Relationships building.

Virtual Organising Model

The following conclusions address the research questions used to investigate the theory embedded in the three dimensions of virtual organising (VOing):

VOing model represents a generic, comprehensive, and long-term plan that should assist ERP-based organisations, in developing e-business strategies. No one dimension adequately captures the potential opportunities of VOing.

VOing should be focused on business models, not industry based. It will vary in terms of the business focus of the organisation, customer focused, or product focused.

The tendency of enterprises is not to develop at all stages of VOing. Progress along all dimensions, although rarely practiced, is essential to VOing.

Although limited to discrete snapshots of each organisation's progress they can be completely mapped by the VOing model. Further it serves the purpose of demonstrating the generic components of virtual change.

eBT Model

The final conceptual framework is described in terms of e-business transformation. The concept of eBT is defined as realising the benefits from virtual organising within complex B2B interactions by utilising the facilitators of successful e-business change. To develop a precisely defined theory of eBT, we begin by identifying the basic research themes, displayed as a model in Table 2.

The research identifies that antecedents of e-business transformation with ERP as *value propositions* are realised through *integration* and *differentiation of technologies* used to support new *business models* to deliver *products and services* online. The associated management practice evolves through efficiency from self-service, effectiveness from care, and empowerment towards and value enhancement from extensive relationship building with multiple alliances.

An eBT model was developed that identifies the stages of e-business growth and development as a comprehensive plan that should assist managers of ERP-based organisations in migrating their company towards a successful e-business organisation. The model offers a foundational perspective of strategies, tactics and performance objectives for e-ERP implementations. The strength of the theory lies in the synthesis of multiple case analyses using three different lenses over three separate time periods. The triangulation of the three research frameworks provides a method for study at appropriate levels of complexity. It is evolutionary in nature

and is content driven. Supplementary case material was gathered to validate the final research framework and to confirm the factors for success of an e-business implementation.

New Theory in the eBT Matrix

The eBT matrix detailed in Table 2 represents the highest level of detail within the eBT journey. Specifically this represents the highest level of abstraction of a model of eBT. The model is viewed as progress in 3 stages of continuous change of eBT. Migration at each stage should be interpreted as all aspects of business improvement during *integration* tempered by *differentiation*, for realising B2B *value propositions*. The changing management objectives across the stages eBT progress through the exploitation of self-service, the empowerment of employees, and the e-readiness of business partners essential to accommodating emergent change.

eBT Outcomes and Performance Gains

Table 2 represents a map of the issues distilled from the findings of this longitudinal three-stage study. It is used to demonstrate the interdependence of the dimensions of e-business architecture and the stages of progression. The results of the analysis can be mapped along the e-business stages of growth as: integration of e-business technologies for e-malls and B2B commerce, differentiation of products and services for e-business positioning, and the realisation of value propositions of the e-partnerships.

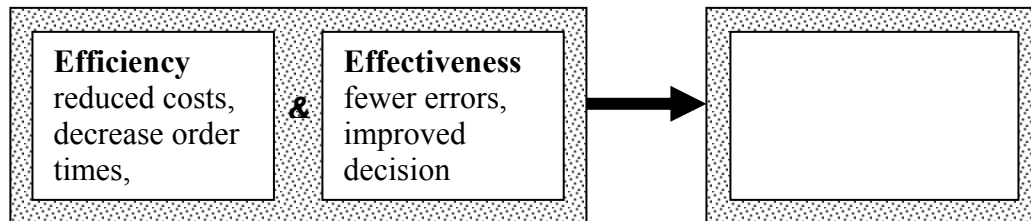


Figure 4 Criteria for eBT (matrix) Outcomes and Performance Objectives

In Figure 4 represents the generic eBT outcomes and Performance objectives and the relationships between them; efficiency, effectiveness, virtual and economic value adding. This presents new theory of changing management objectives. Improving performance in all elements of the eBT matrix is the means to sustain competitive advantage.

The performance gains are centred on improving operating efficiency, effective use of desktop self-service applications by employees, and the realisation of complementary value adding with B2B interaction. Management practice focuses on the exploitation of self-service, the empowerment of individuals, and the extensive relationship building with multiple alliances.

Stage 1 - Integration of technologies is critical for cost reductions and operating efficiencies;

Stage 2 - Differentiation of products and services is critical for e-business market positioning through effective sourcing.

Stage 3 - Realisation of value propositions within B2B interactions is critical for migration to an e-Enterprise, in which relationships are built to combined economic and virtual value adding.

CONCLUSIONS

An analysis of research methodology literature revealed several options for case-based methodologies for theory building. The combined application of case methods by Carroll et al. (1998), Klein and Myer (1998), and Eisenhardt (1989) is proposed as an appropriate method for maintaining a balance between research rigour and relevance. This composite case-based method provides a focused yet flexible, structured yet dynamic approach to case study interpretive research. It provides a research method for the exploration and examination of the topic, with the following recommendations (Carroll, et al. 1998):

- focused to maximise the benefits of scarce resources (time, manpower and money),
- flexible to allow theory to emerge from the data collected and integrate unexpected outcomes,
- structured to guide the researcher and assure rigour and relevance,
- dynamic to record the process of knowledge and theory building.

Multiple-case designs are desirable when the intent is description, theory building, and theory testing. Also, multiple-case designs allow for cross-case analysis that lends weight to the extension of theory.

The method brought together the antecedents of e-business success through ERP using the findings from multiple case analyses against three separate research models: Benefits of B2B interaction, e-business change, and virtual organising. A single model of e-business transformation (eBT) was identified that focuses on realising the benefits of B2B interaction, that is, from virtual organising by utilising the facilitators of successful e-business change. This model of eBT represents a comprehensive view of e-ERP as the fusion of the three research models, mapped into various stages of e-business development: integration, differentiation, and demonstration of value propositions.

The research method of triangulating distinct frameworks was chosen for its ability to examine complex phenomena at various levels of abstraction. A weakness in the application of the research method was the

openness to a variety of interpretations. At a technical level the weaknesses included verification of interview data, interpretation of data collected, and perception bias of the researcher

Clearly research is repeatable. Claims of external validity must await further examination with a wider sample of projects with different contexts and motives. Other researchers are urged to apply similar multi-viewed analysis.

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