

A coevolutionary framework for engaging trading partners in interorganisational e-commerce

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Thesis submitted for the degree of Doctor of Philosophy in the Faculty of
Information Technology, University of Technology Sydney.

2006

Statement of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of the requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

Bruce McCabe, December 2006

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Signature removed prior to publication.

Acknowledgements

The following people must be acknowledged for their contribution to this thesis. The work is as much theirs as mine.

First and foremost, my thanks go to my wife Jane, for her patience, good humour and encouragement throughout the journey, and to my children, Sean and Elise, for their endless inspiration.

Thanks must go to my supervisors, Dr. Robert Kay, Professor Jim Underwood and Professor Louise Young, for not only putting up with me and doing all the things that good supervisors should do, but also being so generous with their friendship and guidance, and for introducing me to worlds I never knew existed.

Lastly, my thanks go to all the managers, in so many organisations and industries, who gave up hours of their valuable time to be interviewed. Without their generosity and goodwill this research could never have been completed.

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Abstract

The objective of this research was to produce a better understanding of the way trading partners engage in interorganisational e-commerce systems in order to help practitioners.

An interpretive philosophical approach was taken via an empirical study of ten e-commerce interorganisational systems, spanning a variety of technological approaches, trading scenarios and industry settings. Using semi-structured interviews, qualitative data were collected and a thematic analysis undertaken. The results suggested coevolutionary theory as a useful perspective for understanding the context. An in-depth case study was then used to build a detailed coevolutionary interpretation for the history of change, technological development and engagement in a single system.

The resulting framework incorporates social and technological components in a three level coevolutionary hierarchy. The e-commerce system is reconceptualised as a socio-technical trading system, and the move to Internet based trading operations as part of the ongoing evolution of that system. Under this interpretation interdependencies and coevolutionary effects, both between components and between levels, lie at the heart of understanding why trading partners are successfully or unsuccessfully engaged in e-commerce. Successful engagement is characterised by positive feedback loops, and failure is characterised by negative feedback loops and whole-part coevolutionary competition.

1. Introduction

Background

Australian organisations are expending considerable resources pursuing information technology initiatives with labels such as supply-chain management (SCM), electronic data interchange (EDI), business-to-business (B2B) e-commerce, e-procurement and supplier portals. Although the individual labels and objectives may differ, these initiatives share a common challenge in needing to engage trading partners in a manner timely enough that the return on the investment for the system is not compromised, and substantive enough to provide a long-lasting outcome.

The ability to achieve timely and substantive engagement of trading partners has frequently been a decisive factor in determining whether initiatives are successful, or even viable enough to go ahead in the first place. A practitioner implementing an EDI system in the early 1990s observed: “expanding trading partners seems more difficult than implementing EDI in the first place” (Stelzer 1993, p-43 in Iacovou, Benbasat & Dexter 1995). Today, the problem remains as real and substantial as ever. A representative of the Australian Leisure and Hospitality Group recently described implementing an interorganisational finance and reporting system across 690 liquor outlets as “a monumental task” (Mills 2006b). A representative of Orica, an explosives and chemicals company, said his organisation hoped to get all business customers placing orders over the Web directly from their accounting packages, but noted that this involved convincing “thousands of tradespeople and small businesses that it is economically worthwhile” (Hayes 2006). Coles Myer, one of Australia’s largest retailers, in 2003 allocated AUD 604 million to overhauling its supply and distribution systems, with a large part of this allocated to electronic trading with suppliers (Frew 2003; Woodhead 2004). Although it has thousands of suppliers for the products that stock its supermarket shelves, Coles Myer took two years to achieve data synchronisation with the first 300 (Mills 2006a). Similar projects are underway at two other major retailers, Woolworths and Harvey Norman (Fairfax Business Media 2006). Disparities between goals and actual achievement have been particularly dramatic in e-procurement systems initiatives. The government of the State of Victoria, for example,

aimed to achieve electronic trading with 20,000 suppliers by 2004, but managed only 250 (Braue 2004).

Successful engagement goes beyond just the decision to adopt, and it requires much more than just technical systems connectivity: it requires trading partners to make and accept adjustments to their established business processes. Process reengineering can represent a far greater challenge than implementing the technologies, as Yen & Ng (2002) demonstrated in the context of interorganisational e-procurement systems in the Hong Kong textile industry. A representative of Corporate Express, a multinational office products company that invested heavily in integrated e-commerce with its trading partners, recently summed up the experience with the comment: “the biggest issues haven’t been technical, they’ve been aligning business processes” (Bushell 2004, p-4).

In interorganisational systems, business processes must be reengineered for both initiator organisations and trading partners. Riggins & Mukhopadhyay (1994), building on work by Benjamin, DeLong & Scott-Morton (1990), found that the extent to which trading partners reengineer their business processes has a strong impact on the benefits realised by the system initiator.

...an initiator may not realize some expected benefits that otherwise might occur due to the need to coordinate the implementation of the system with external, and potentially recalcitrant, trading partners (Riggins & Mukhopadhyay 1994 p-41).

Gibson & Edwards (2004) also noted that organisational change is a critical challenge in this context. Using the example of e-commerce enabled supply chains in the motor industry, they argued that not tackling this properly, and using market power to manipulate suppliers further down supply chains, limits what can be achieved and prevents benefits from being realised. They called for much more research in the areas of business process reengineering and business restructuring models.

When practitioners apply traditional IS planning techniques to these more complex types of interorganisational systems they produce poor results, as summed up by Finnegan, Galliers & Powell (2002, p-462):

As such system configurations become more complex, an approach where one organisation develops a system and simply extends it to other organizations

will be inadequate, especially when business processes have to be altered. However, early IOS tended to be developed internally and extended to, or imposed upon, others (Webster, 1995)...Thus the perspective of existing systems planning approaches is that of a single organisation and its environment, assuming that inter-organisational complexity can be reconciled.

The challenges do not appear to have abated with time. More than two decades ago, Barrett & Konsynski (1982) pointed out that many organisations restricted both the application and the number of interorganisational information systems they participated in, based on factors such as cost minimisation, avoiding tight integration and conflicts with existing policies. A decade later, the challenges were widely documented in EDI deployments (e.g. Swatman & Swatman 1991; Saunders & Clark 1992) and a decade later again, a wide range of leading academic and industry experts reported that very substantial challenges applied to adoption and implementation of B2B systems of all types (Dai & Kauffman 2002).

Emerging opportunities and technologies continue to drive new interest in the development of e-commerce systems spanning trading partners. In 2003, I conducted a survey of the largest 2000 Australian and New Zealand companies and found that a third had initiated projects to conduct integrated e-commerce with suppliers with another third planning to do so by 2006 (McCabe 2003). Australian companies such as Chep, Gillette, Linfox, Capilano Honey, Visy, Proctor & Gamble and Metcash recently participated in a pilot of radio frequency identification technology (RFID) tags in their supply chains, with the goal of sharing location-based data for palettes, containers and packages simultaneously across many trading partners (Mills 2006a). The proliferation of e-commerce initiatives across every industry sector tells us that finding new insights is more important than ever and scholars have called for more research to be undertaken along organisational and supply chain dimensions (Grieger 2003; Gunasekaran et al. 2004; Gibson & Edwards 2004).

All of these issues can also be related to an underlying picture that is broader than the phenomenon of e-commerce. The trend towards network forms of organisation (Powell 1990; Fulk & DeSanctis 1995; DiMaggio 2001) indicates that understanding how electronic linkages are developed between trading partners is a fundamental part of understanding and facilitating new organisational forms in many industries. Addressing

the challenges associated with these linkages may be seen as part of a wider, pervasive need to identify strategies to manage interdependence between organisations in the context of modern information systems (Rockart & Short 1989).

Inspiration and purpose of the research

The inspiration for this research came from my own observations of these challenges while working with managers in a variety of industries. Over a period of seven years, I have seen at first hand the challenges of building B2B e-marketplaces in Hong Kong, Singapore and Australia (McCabe 2000a, 2000b, 2001a) and developing interorganisational e-procurement systems in Asia and Australia (McCabe 2000c, 2001b, 2003). Engaging small business¹ trading partners appears to be an especially important challenge in Australia where the economy is dominated by small enterprises. In 2003, I was commissioned to produce a series of case studies on interorganisational e-commerce systems for the Australian Government (National Office for The Information Economy 2003a, 2003b, 2003c). The systems in those case studies substantively changed the way transactions were conducted between trading partners. In one of these, a fruit juice company was connecting with suppliers of key inputs as well as its distribution partners and major retailers. In another, a manufacturer of packaging products was engaging its suppliers of tinsplate and cardboard. In the third, a manufacturer of heavy earth-moving equipment was introducing electronic transactions for spare parts ordering and its hydraulic oil analysis service with its major business customers. In all three cases, achieving the goals involved significant investments in integration between computer systems in and between organisations, and the senior managers I interviewed repeatedly emphasised the substantial and unexpected challenges encountered as they worked to engage trading partners. The challenges were much greater than initially anticipated and had required them to undertake expensive customisation of systems to suit different trading partners, make significant

¹ ABS-derived conventions have been used: small businesses employ 1-19 people; medium businesses employ 20-199 people; large businesses employ 200 or more people. The first two categories combined are referred to as small and medium sized enterprises (SMEs). Very small businesses are small businesses employing 1-4 people.

commitments to interactions between managers at multiple levels, and initiate a variety of schemes to assist trading partners during the transition.

The main purpose of this research was to help people like these—the managers charged with initiating and developing e-commerce systems—to move beyond the application of intraorganisational and traditional IS strategies and offer them alternatives better suited to interorganisational initiatives. It set out to answer the following question:

What new enabling strategies for practitioners could help facilitate the successful engagement of trading partners in interorganisational e-commerce systems?

At the same time, I aimed to make a theoretical contribution that would better explain phenomena within these systems as trading partners were engaged.

An interpretive journey

This thesis describes an interpretive journey as I sought a deeper understanding of how trading partners become engaged as participants in e-commerce systems. I hoped it would lead me to new and better strategies for practitioners—the e-business managers, supply-chain managers and IT managers responsible for initiating such systems.

The journey began in 1998, as my first casual observations of e-commerce systems began to shape my understanding of them. This thesis, therefore, is really an account of the last part of the journey, where I set out to research the problem formally and much more rigorously. It begins with my exploration of the existing research literature, to identify why engagement is sometimes successful and why it sometimes goes wrong. The disappointing results of this exercise, providing many conflicting answers and little in the way of practical strategies, convinced me that a new model was needed for conceptualising the process of engaging trading partners. Social, economic or technical issues all matter when engaging trading partners, and all perspectives must be considered in the strategies that are pursued. The themes observed in data collected from ten e-commerce systems then steered me towards an investigation of coevolution as a way of understanding these developments. I subsequently conducted an interpretation of an in-depth case study, using coevolution as a lens, and induced a new

coevolutionary framework for describing the social and technological changes, and the relationships between them, as trading partners are engaged in these systems.

During this interpretive journey, my own conception of “engaging trading partners in e-commerce” changed significantly. Initially, I thought of an e-commerce system in technical terms and saw the engagement process as imposing a technical system onto a group of organisations. I then began to see an e-commerce system in terms of many interdependent components, and it became apparent that I needed to incorporate social elements (routines) into my understanding of what a system was. Engagement was reconceptualised as a process of adaptation. By the end, I saw routines and technical components as parts of a continuously evolving trading ecosystem, and engagement was about coaxing this ecosystem along an evolutionary trajectory where trading became more integrated.

Terminology

In this paper the term *e-commerce* refers to the use of computer networks to conduct business electronically (Hayashi 1996). The types of information shared or exchanged between businesses (e.g. purchase orders, invoices, inventories, deliveries, supply/demand data, materials specifications, designs or contracts) is open, as long as it is associated with the conduct of business. The term *interorganisational information system*, or *IOS*, refers to systems that differ from internal information systems because they allow information to be sent across organisational boundaries (Johnston & Vitale 1988). The focus of the research is squarely on business conducted between trading partners. In order to be clear about the type of systems being studied, therefore, the combined term *e-commerce interorganisational system*, or *eIOS*, is used throughout the document.

Excluded from the research are e-commerce systems connecting businesses with consumers (systems popularly tagged as business-to-consumer, or “B2C”), and simple forms of interorganisational e-commerce requiring little investment, systems development or adaptation on the part of trading partners. Examples of the latter type are sending/receiving text-based e-mails and making occasional credit card purchases via the Web, such as when buying a book from Amazon.com or making an online hotel reservation.

Using this definition, EDI systems—the precursors to many more modern Web-based systems—are considered one type of eIOS. EDI systems use value added networks instead of the Internet as the communication medium. They tend to be associated with higher costs (because of the transaction fees associated with value added networks) and a relatively more consistent set of standards for exchanging electronic trading documents.² Those differences notwithstanding, EDI systems still use computer networks to conduct business electronically and send information across organisational boundaries.

The term *system initiator* is used in this document to make a clear distinction between the organisation driving the process of engaging trading partners, and the organisations being engaged. The strategies derived from the research are intended primarily to help managers working for system initiators.

Strictly speaking, both system initiators and the organisations being engaged are trading partners of one another, but for simplicity the term *trading partner* is used to refer to members of the latter group. When I started this research I referred to systems initiators as ‘system owners’, but I changed this when I found that system initiators are not always ‘owners’ in the strictest sense of the word, such as when a system was hosted and managed by an intermediary organisation.

Whereas the term *barriers* is commonly used in the literature (e.g. Li & Williams 1999; Scupola 2002) to refer to negative factors that inhibit the engagement of trading partners, there is no convention for describing positive factors. For the sake of brevity, I have used the term *enablers* when referring collectively to factors and strategies that facilitate the successful engagement of trading partners in an e-commerce system.

² Predominantly based on United Nations / Electronic Data Interchange for Administration, Commerce and Transport standards. Commonly abbreviated as UN/EDIFACT.

Structure of this thesis

An overview of the stages of research and analysis, and the order in which they were undertaken, is provided in Figure 1, below. The structure of this thesis follows the same progression.

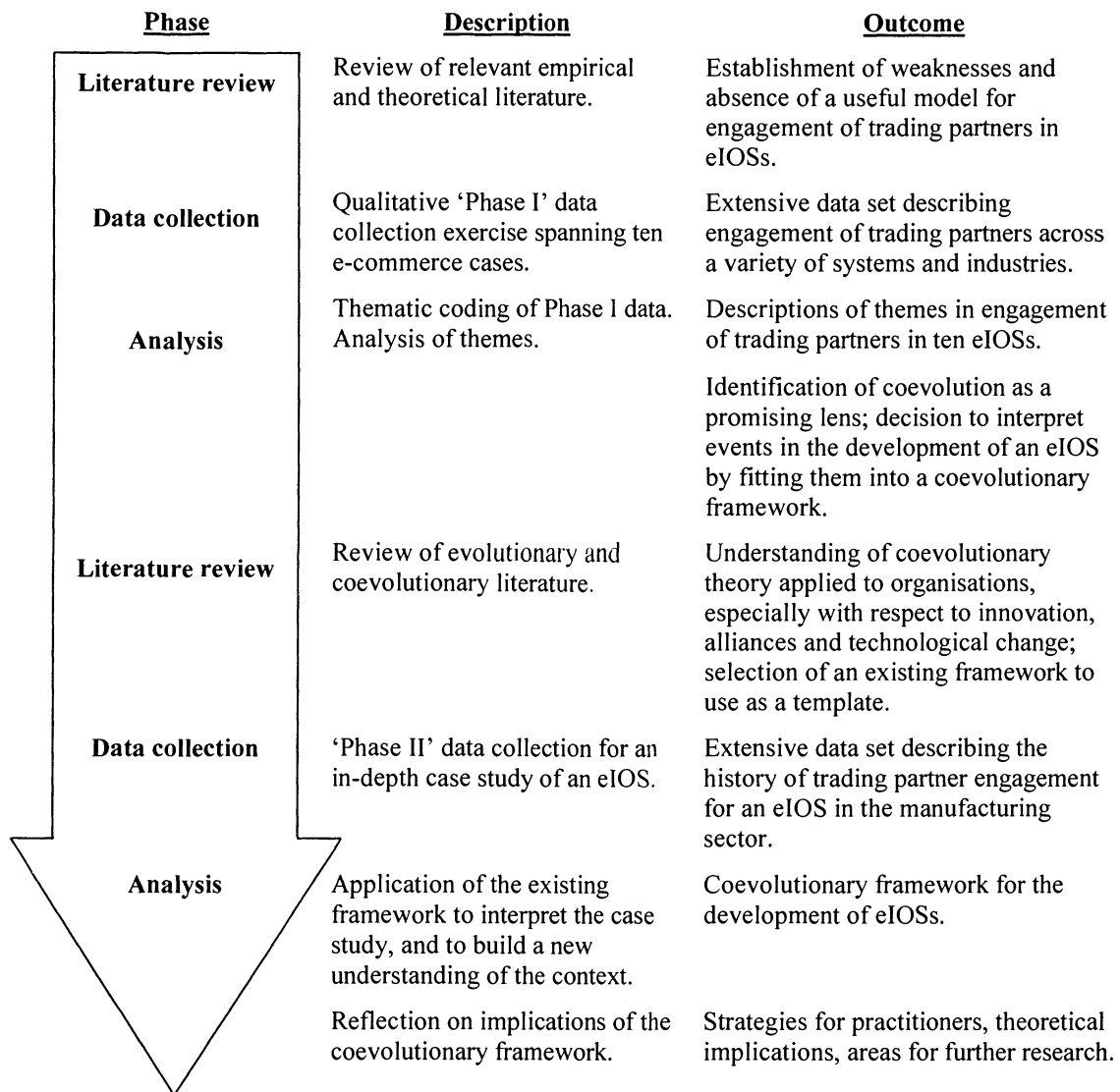


Figure 1: Stages of research and analysis

Chapter 2, directly after this introduction, covers the philosophical perspective, case study method and research techniques applied when gathering and analysing data on ten eIOSs (the "Phase I" research); and also the the method and research techniques applied for gathering and analysing data on a single eIOS case study (the "Phase II" research).

Originally I wrote two methodology chapters which were inserted at places within the developing narrative that reflected when, and how, I came to make the methodology decisions that I did. The more traditional arrangement, however, is to have a single methodology, and I later combined these into one Chapter and moved it to the front of the thesis. When reading Chapter 2, therefore, the reader is asked to bear in mind that much of its content deals with decisions that were actually made much later in my interpretive journey.

All the other Chapters, however, are arranged in sequence as a developing narrative.

Chapter 3 details my initial review of relevant e-commerce adoption and interorganisational systems literature. The limitations and confusing picture created by this research are discussed, leading to my decision to conduct field work to search for simplifying themes. Chapter 4 discusses the results of my initial study across ten e-commerce interorganisational systems operating in Australian industry and how the common themes in these systems, characterised by considerable adaptation and interdependent change, led me to an investigation of coevolutionary theory. In Chapter 5 I review evolutionary and coevolutionary theory as it relates to the context, including its application to organisations, technological innovation and alliances. I discuss the potential for coevolutionary theory to provide a useful lens for interpreting eIOS developments. My selection of an existing framework for technological coevolution, to be adapted for this purpose, is described. In Chapter 6, I interpret a single eIOS case using coevolutionary theory as a lens. The system and its history are described, and a step-by-step description of my interpretation is given, leading to the presentation of a new coevolutionary framework for eIOS development. Lastly, my conclusions, implications of the interpretation for practitioners, theoretical and methodological contributions, and avenues for further research are presented in Chapter 7.

Contribution of the research

This research makes the following contributions:

First and foremost, in line with my principal objective, the research outcomes suggest new strategies for practitioners deploying eIOSs. These strategies offer the potential to produce better outcomes in industry and provide a foundation that future researchers can build and extend on.

Secondly, the research makes several theoretical contributions. It addresses a gap in the e-commerce and IOS literature by building a relatively simple interpretation of eIOS development that is capable of accounting for the complex forces and processes of change when trading partners are engaged in these systems. In doing this, I have extended coevolutionary theory into a context where it has not been applied before. This work opens the way for further extensions and adaptations of coevolution to information systems phenomena characterised by continuous adaptation and complex interdependencies.

Lastly, the research makes a methodological contribution by applying a hermeneutic process to the interpretation of phenomena in the eIOS context.

2. Methodology

The next stage in my research would be to conduct my own analysis, using data collected from the field, to learn more about key turning points and factors influencing trading partner engagement, and to look for common themes. A case study method within an interpretivist methodology was used to achieve this. A discussion of my methodological choices is provided in this Chapter, along with a description of the techniques used in sample selection, data collection and analysis.

Later, after I completed this analysis, I conducted a second phase of investigation, which I have labelled “Phase II” in this thesis. The methodology for that phase is described in the second half of this Chapter.

2.1 Philosophical perspective

An interpretive philosophical approach was chosen. The rationale for this was tied to the outcomes I sought. Interpretive studies assume:

That people create and associate their own subjective and inter-subjective meanings as they interact with the world around them. Interpretive researchers thus attempt to understand phenomena through accessing the meanings that participants assign to them” (Orlikowski & Baroudi 2002, p-55).

The principal objective of this research was to identify new enabling strategies for practitioners, but a review of the literature (see Chapter 3) had established both the inadequacy of empirical surveys for this purpose, and the absence of a suitable theoretical model for engaging trading partners in eIOSs. In searching for simplifying themes I was looking for a better interpretation of the phenomena taking place within those systems. To do this I would use the observations, descriptions and meanings supplied by actors participating in those systems.

In the manner described by Orlikowski & Baroudi (2002), eIOS systems were understood and communicated by the actors within them as subjectively constructed interpretations of elements such as job roles, procedures, departments, organisations, services and software. No two interpretations were the same, making it mandatory for the observer (myself) to overlay my own interpretations to conduct the analysis. In line

with other interpretivist studies conducted in information systems (e.g. Walsham, 1993; Lee & Baskerville 2003), generalizations were then made within the setting of the e-commerce cases included in the study.

I considered the contrasting approach of conducting the research from a positivist philosophical perspective to be unsuitable. According to Orlikowski & Baroudi (2002, p-55), positivist studies are:

Premised on the existence of a priori fixed relationships within phenomena that are typically investigated with structured instrumentation. Such studies serve primarily to test theory, in an attempt to increase predictive understanding of phenomena.

The positivist conception of generalisability seeks to identify universal laws that can be generalised across different settings, but the objective of this research was not to prove eIOS systems behave according to fundamental laws or principles. Orlikowski & Baroudi (2002, p-55) listed the criteria for classifying studies as positivist as: evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from the sample to a stated population. This research, however, was initiated without an initial formal proposition or testable hypothesis, and I had already found substantial challenges in attempting to produce quantifiable measures of factors involved in take-up of eIOS systems, as discussed in Chapter 3. Finally, it was not considered reasonable to attempt a formal generalisation to the entire population of eIOS systems, even if a very large sample of such systems could be obtained and studied, given that such systems embody so many variations and complexities, and new forms and variations of such systems are being developed all the time.

2.2 Research method

A case study research method was used. A case study is an empirical inquiry that investigates a contemporary phenomenon in its real-life context (Yin 2002). Case studies are the most common method of undertaking qualitative research in information systems (Orlikowski & Baroudi, 2002; Alavi & Carlson, 1992), are a valuable tool for theory building (Eisenhardt 1989) and have been used to understand e-commerce and to

produce models of IOS development and adoption (e.g. Ihlström & Nilsson 2003, Kumar, van Dissel & Bielli 1998; Finnegan, Galliers & Powell 1999).

Benbasat, Goldstein & Mead (2002, p-83) proposed four questions to judge the appropriateness of using a case research strategy:

1. Can the phenomenon of interest be studied outside its natural setting?
2. Must the study focus on contemporary events?
3. Is control or manipulation of subjects or events necessary?
4. Does the phenomenon of interest enjoy an established theoretical base?

They suggested that, when considering the answers to these questions, a case research strategy is most useful when the phenomenon of interest cannot be studied outside its natural setting and when it is necessary for a study to focus on contemporary events. Conversely, a case research strategy is unsuitable if manipulation of subjects or events is necessary. They also suggested that case studies in a rich natural setting can be fertile ground for generating theories.

Judged against these criteria, the case methodology was eminently suitable. First, it would be very difficult for me to build a rich picture of what occurs within an e-commerce system by attempting to study it anywhere but in its natural setting. Duplicating or simulating such a system outside of its natural setting, together with all its social, economic and technical complexities, would present considerable practical challenges. Indeed, almost the only path available for analysing the events that occur as trading partners engage in such a system is to talk to the people participating in it. Second, the eIOS system is a relatively new phenomenon in organisational studies, and one that is still developing rapidly, so almost all the events of interest are contemporary. Third, manipulation of events or subjects was neither necessary nor desired. Fourth, while a range of theoretical perspectives had been applied to the phenomenon of interest, they exhibited significant inadequacies and the objective was to build a better interpretation. Fertile ground for generating theories was precisely what I desired.

Case studies have also been identified as well suited to capturing all the events and changes that have occurred within and between organisations and groups of

organisations (Galliers & Land 2002), an important consideration given the inter organisational nature of the phenomena I was investigating.

The research strategy, particularly the decision to collect data spanning a variety of case studies and to conduct a thematic analysis, was also influenced by qualitative research methods suggested by Strauss & Corbin (1998) who advocated allowing theory to “emerge from” the data in order to be more likely to “provide a meaningful guide to action” (Strauss & Corbin 1998, p-12). The principal objective of the research was, from the beginning, directed at producing a more meaningful guide to action for practitioners.

2.3 Sample selection

Candidate systems were initially identified by conducting searches of online news databases, magazine archives and via Google to identify Australian organisations thought to be pursuing substantial e-commerce interorganisational information systems with trading partners. Representatives of major software and services companies (Mincom, Optus, SAP, Oracle and Microsoft) that provide e-commerce platforms were also approached and asked to identify likely candidates.

Minimum criteria were applied when selecting candidate systems:

- (a) The system had to use the Internet to enhance commercial business processes, and be in operational use.
- (b) The system had to be genuinely interorganisational with initiators having engaged, or attempted to engage, multiple trading partners.

These criteria were applied to ensure that the systems studied were of the eIOS type, and to ensure that there were real experiences to draw upon when it came to learning about engaging trading partners.

To ensure a range of contexts were considered, an attempt was made to select candidates that represented a variety of industries (manufacturing, building, insurance, etc) and business processes (materials purchasing, document sharing, manufacturing processes, etc). Finnegan, Galliers & Powell (2003) provided some inspiration for this in their selection of interorganisational systems with different configurations and in different industries (in their case a database system to share product information

between pharmacists and wholesalers, an EDI based trading system for price cataloguing and invoicing between importers, wholesalers and retailers of grocery products, and a system that allowed independent organisations to operate as a virtual organisation to provide combined on-line products and services over the Internet). Like myself, they aimed to produce findings more generally applicable to the variety of forms that interorganisational systems can take.

Case name	Respondents (system initiator)	Respondents (trading partners)	Semi-structured interviews	Unstructured interviews / follow-up calls
Alpha	1	4	5	4
Beta	2	3	5	1
Gamma	3	3	6	3
Delta	1	3	4	2
Epsilon	4	3	7	5
Zeta	2	2	4	0
Theta	1	3	4	1
Lambda*	1	0	1	0
Omicron	2	3	5	2
Sigma	1	2	3	3
Rho**	1	0	1	0
Omega	2	3	5	3
TOTAL	21	29	50	24

* Data collection discontinued due to case not meeting criteria.

** Data collection discontinued due to inability to access appropriate respondents.

Table 1: Interviews conducted during Phase I data collection

It was expected that a large proportion of all those approached would reject participation in the study, so initial approaches (see below for description of the approach method) were made to representatives for 44 systems. Of these, 12 indicated a willingness to participate and to provide access to relevant executives. Data collection commenced with these 12, which are listed in Table 1.³ Data collection was

³ Note that generic names (Alpha, Beta, Gamma, etc) have been substituted for the names of companies that acted as system initiators. As a convention in this document, I also use the name of the system initiator when referring to an individual case.

subsequently terminated for one of these (Rho) when it proved not possible to access the appropriate respondents, and for another (Lambda) when it was found that the case did not meet the selection criteria because it was not yet in operational use. The final study thus ended up spanning ten systems.

2.4 Data collection

Interviews were the principal data source. Interviews were conducted with managers in both system initiators (the organisations driving the process of engaging trading partners in an eIOS) and their trading partners (the organisations being engaged). To achieve a deeper understanding of events I considered it important to gather data from both sides of the relationship as, for example, Barua & Lee (1997) did in gathering manufacturer and supplier standpoints to research EDI system adoption.

Interviews were supplemented by secondary data in documents provided by respondents, including technical documents, planning and strategy documents, marketing and communications materials, and e-mails.

Targeted respondents in the first instance were executives identified as having overall responsibility for the e-commerce system within the initiator organisation. When not identified in initial searches, the senior IT officer for the organisation was approached and asked to identify the most appropriate person. All approaches were made by telephone. Using a snowball sampling method (Knoke & Kuklinski 1982), initial respondents were then asked to nominate colleagues that should be interviewed, to identify trading partners that had been asked to use the system, and to identify any specific trading partner executives that should be interviewed. All of these people were then also approached by telephone.

Securing the participation of systems initiators in the first instance was very challenging, with a high number of rejections (see previous section), but a relatively high degree of cooperation was provided by individuals once companies had agreed to participate, and I did not experience serious obstacles to securing additional respondents.

A weakness in the method was the dependence on system initiators to identify trading partners that could be approached to participate, leaving open the possibility of selection bias towards trading partners with stronger/more positive relationships with system

initiators. No practical alternative to the selection strategy was identified, but two mitigating strategies were followed. First, system initiators were asked to identify a wide as possible range of trading partners to choose from. Second, wherever it was apparent that some trading partners had experienced difficulties engaging with a system, or had rejected it altogether, I specifically asked that respondents from that group be identified so at least one could be included in the study. A related weakness was that access to respondents was not unrestricted. Management in the initiator organisations were never willing to provide completely unfettered access because they wished to limit the time impact on employees and colleagues. Consequently, they directed interviews towards the personnel perceived (by company management) to be most important in the initiative.

Another, minor weakness, was that the systems studied were all operational. While some of them were far from healthy and appeared likely to fail in the future, this approach excluded study of systems that had already failed. Identifying systems that had already failed and tracking down member organisations and respondents willing to be interviewed was impractical. This limitation was not considered too serious. The emphasis was on understanding the enablers of engagement and the sample appeared to be more than adequate for this purpose: it contained systems where some trading partners had been engaged successfully while others had not, and systems that had struggled through difficult periods in their history.

An e-mail was sent to respondent candidates with a synopsis of the research objective, and anticipated interview format, and every respondent was handed a sheet containing this information before the beginning of each interview. Respondents were informed that anonymity would be preserved so as to encourage a frank and open dialog.

Interview duration ranged from 15 minutes to 120 minutes, but most interviews were approximately 30 minutes in duration. They were carried out over the telephone (32 interviews) and face-to-face (18 interviews).

The interviews were semi-structured and followed a very simple questioning process: respondents were asked to narrate the history of their organisation's involvement with the e-commerce system, including how the system, their organisation and take-up of the system had progressed. During the course of the narrative, I prompted for additional

information on key turning points and factors that helped or inhibited engagement. The discussions thus progressively zeroed-in on important themes. The semi-structured approach provided the advantage of freedom for the respondents to talk about the subject, thus generating information and themes that were not predetermined by the interviewer. The template I used in these interviews is included in Appendix B.

All interviews were recorded with the permission of the respondent, and Microsoft Word-formatted transcriptions were subsequently generated from the recordings.

Additional calls were sometimes made to respondents after the interviews for the purpose of clarifying points or filling gaps in the narrative, and respondents on a few occasions called or met me again to provide more information. Additional data from these unstructured interviews were captured in handwritten notes.

In total, 21 interviews were conducted with respondents in organisations acting as system initiators, and 29 interviews were with respondents within targeted trading partner organisations. With the exception of case Sigma where 3 people were interviewed, and the two systems where analysis was discontinued, between 4 and 7 people were interviewed for each system. The number and spread of semi-structured and unstructured interviews is summarised in Table 1.

Systems included in Phase I spanned building and construction, telecommunications, manufacturing, agriculture, business services, insurance and financial services. Trading partners targeted within these systems included customers, suppliers, distributors, contractors and joint-venture partners.

Respondents were almost exclusively comprised of very senior managers. Seven respondents were the most senior executives in their organisations (holding the job title of General Manager, Managing Director or Proprietor). Four of the respondents held the most senior IT role in the organisation (Chief Information Officer, General Manager of Information Technology, Director of IT). The remaining 39 respondents held a range of job titles and included managers for corporate services, billing, operations, merchandise, administration, shared services, finance, procurement, accounting, materials, scheduling, and distribution channels.

The data collection process spanned the period May – August 2005. Fifty respondents were interviewed in total, and approximately 32 hours of recordings were subsequently transcribed.

Ethical issues were considered and incorporated into the methods. These are detailed in Appendix A. Design and execution of the data collection phase was undertaken under the ethical guidelines set down by the Faculty of Information Systems at the University of Technology, Sydney.

2.5 Analysis and interpretation

Throughout the course of this research I followed a hermeneutic process to produce my interpretation of the data. A hermeneutic circle describes the process of arriving at an understanding of a text as a whole by reference to its individual parts, and by understanding each individual part by reference to the whole. Both the whole text and its individual parts can only be understood by referencing each other, hence the ‘circular’ nature of the interpretive process (Gadamer 1975). Myers & Avison (2002) and Boland (2002) have argued that hermeneutic analysis is a valuable methodology for studying information systems. When hermeneutic analysis is used in information systems studies:

The object of the interpretive effort becomes one of attempting to make sense of the organization as a text-analogue. In an organization, people (e.g. different stakeholders) can have confused, incomplete, cloudy and contradictory views on many issues. The aim of the hermeneutic analysis becomes one of trying to make sense of the whole, and the relationship between people, the organization, and information technology (Myers & Avison 2002, p-11).

The hermeneutic interpretive approach is particularly suitable for tackling routines as units of analysis. Pentland (1994, p-490) pointed out the connection between routines, language and observation:

We use grammar to describe certain aspects of a routine. What we actually observe, empirically, is never the whole routine, or the whole language, but only specific instances of it.

When studying routines as a unit of analysis, in other words, it is necessary to interpret from grammatical descriptions of specific instances and parts of routines such as 'answering the telephone' or 'authorising a credit card'. Hermeneutic interpretation was then seen to be an especially relevant approach given that e-commerce and IOS literature emphasised that such systems were consistently underpinned by changes to business processes.

Other examples of hermeneutic interpretation in information systems studies include Davis, Lee, Nickles, Chatterjee, Hartung & Wu (1992), Lee (1994) and Boland (2002).

In the analysis undertaken in this research, I interpreted data gathered from interviews with participants in e-commerce interorganisational systems in the context of an existing world view on the underlying mechanics and principles of e-commerce systems. This world view was underpinned by the e-commerce and interorganisational literature and observations and experiences or e-commerce accumulated prior to conducting this study. The interpretive process moved iteratively between a "precursory understanding of the parts to the whole and from a global understanding of the whole context back to an understanding of each part." (Klein & Myers 1999, p-71). The parts, in this case, were hundreds of passages of textual data transcribed from respondent interviews.

To identify common themes, a thematic analysis (Boyatzis 1998) was undertaken after all the Phase I data had been gathered. Open coding was first applied to the data (Strauss & Corbin 1998), which consisted of textual transcriptions of completed interviews. Each transcript was hand coded applying line-by-line analysis, where coding involves close examination of the data phrase by phrase and sometimes word by word (Strauss & Corbin 1998, p-119). Categories (themes) were then generated as the coding progressed.

The NVivo software package was used to store and manage the categories so created, and to record the line-by-line classifications made against the content of each transcript.

Non-numerical Unstructured Data Indexing, Searching and Theorising (“NUD*IST Vivo” or NVivo) is a qualitative research tool supplied by QSR International Pty Ltd⁴ for organising, coding and analysing qualitative data (Fraser 1999). I employed it in this research because of the large number of textual documents that had to be managed and organised: every interview had an associated document, as well as emails, reports supplied by respondents, and sets of notes made by myself. NVivo provides a powerful, flexible interface for linking, coding and editing text-based documents. This flexibility was especially helpful in allowing ideas and data coding to be developed in parallel.

NVivo organises research into “projects” containing collections of “documents” (rich text files containing the data being analysed) and “nodes” (folders that can be created by the researcher to store ideas and categories). Both documents and nodes can be given attributes and assigned to “sets” (groups of documents that can then be handled as a single unit if desired).

Each interview transcript document was assigned attributes according to both the organisation the respondent worked for, and the case name (i.e. the specific eIOS) with which that interview was associated. These attributes were used to group documents into sets, with a set created for each system.

The list of themes was expanded as the coding progressed, a new node being created for each theme. After the first pass was completed, two further passes were conducted over the data to ensure every theme had been properly considered against every transcript. Following this stage, themes that were essentially identical, such as “providing implementation assistance” and “providing technical support” were merged together.

At the completion of the coding process, the reporting capabilities of NVivo were utilised to view and print the coding contained in each node (i.e. all the coded text corresponding to each theme) and to view and print the coding for each set (i.e. to examine themes as they applied to each case). The reports assisted in identifying the number of cases in which the theme was important, and in analysing the relative importance of each theme within individual cases. The themes that recurred across

⁴ www.qsrinternational.com

multiple respondents were then written up. The write-up of the thematic analysis is included in Appendix C.

Following the completion of the thematic analysis, another analysis was undertaken. This constituted a reflection by me, in a hermeneutic cycle, on the themes, the findings and perspectives identified in the previously reviewed literature, and other accumulated perspectives on organisational and technological change.

The hermeneutic interpretive process continued through all the research described in this thesis. It was to expand to include new perspectives and new data as I conducted a review of coevolutionary literature, and then it would expand once again as I analysed the Phase II data and undertook to reinterpret the Omicron case study in coevolutionary terms. A detailed discussion of how I followed the hermeneutic process during the later interpretation and induction of the coevolutionary framework for eIOS development is included in the second half of this Chapter, below.

2.6 Phase II methodology

The second half of this Chapter describes the methodology I used for Phase II. I took these decisions after the Phase I research had been completed and it may be helpful for the reader to come back and re-read this section after reading to the end of Chapter 5.

In Phase II, after undertaking an extensive data gathering exercise to build up a case history for the Omicron system, I looked within it for the coevolutionary concepts that had been described by Rosenkopf & Nerkar (1999). I tested my ideas as I went along and adapted them to fit the context where it was logical to do so. Through this exercise I induced a new coevolutionary framework for engaging trading partners in e-commerce. With the new framework in hand, I then returned to my primary research objective by considering what the findings suggested in the way of new and better strategies for practitioners.

2.7 Research method (Phase II)

As in the earlier research, a case study method within an interpretivist methodology was used. The same qualities of the case study method remained important: its suitability for capturing all the events and changes occurring within and between organisations, and

the difficulty of building a rich picture of an e-commerce system without studying it in its natural setting and talking to the people participating in it.

My review of the coevolutionary literature had further reinforced to me the suitability of this method in my research context. Not only have case studies been used extensively to research interorganisational systems and processes (e.g. Bastos 2001; Ibbott & O'Keefe 2004; Munkvold 1998) but they have also been advocated as an approach to understanding intrafirm processes in organisational evolution (Shapira 1994) and used extensively as an instrument for developing theory relating to coevolution, technology and alliances (e.g. Rosenkopf & Tushman 1988; Yates 1993; Yetton, Johnston & Craig 1994; Arino & de la Torre 1998; Koza & Lewin 1999; Rosenkopf & Nerkar 1999; Peters, Heng & Vet 2002). Rosenkopf & Tushman (1988), for example, studied the technology case of flight simulators, and Rosenkopf & Nerkar (1999) the case of optical disc drives. Yetton, Johnston & Craig (1994) used a case study to explore the coevolution of business strategy and technological change, as did Peters, Heng & Vet (2002), and Kay & Cecez-Kecmanovic (2001) used the method to investigate the coevolution between information system and organisation in a financial service context. Arino & de la Torre (1998) used a case study to investigate the coevolution of collaborative ventures between two organisations, a scenario that shares similarities with the eIOS context, and Koza & Lewin (1999) used a case study of a network alliance system to induce a coevolutionary model for network alliances.

The case study method employed now would differ from that which I employed earlier by being more extensive and also incorporating a longitudinal element. Koza & Lewin (1998) pointed out that longitudinal studies provide unique opportunities for empirical and theoretical interpretation in the application of evolutionary theory in organisations, and Aldrich & Ruef (2006, p-268) noted that:

All research designs intended to address evolutionary processes entail some longitudinal component. Researchers tend to collect such data retrospectively when their interest centers on an extended period or process of historical interest. They are more apt to use prospective designs when their interest centers on activities that may be completed over a brief period.

I decided, therefore, to combine both retrospective and prospective elements to build up a detailed picture of the history of the system, including events that had occurred recently and issues facing respondents at the time of interviews.

2.8 Case selection (Phase II)

I first re-examined the data on hand from my earlier research. In each of the cases, I found that more data would be required to undertake a coevolutionary interpretation. The questioning process that I had followed was focussed on teasing out key turning points and factors helping or inhibiting take-up. It had not been designed to compile a complete history of the systems. A reasonably complete history of the development of a system, and the engagement of trading partners in it, was, however, an important prerequisite for undertaking a coevolutionary interpretation. For the case selected then, the first task would be to gather additional data to fill in any gaps in the chronology, validate the timing of the events already documented, and to build richer descriptions of the key events and turning points.

I selected case Omicron for the coevolutionary interpretation partly because its case history was relatively more complete compared to others, giving me a head start in filling the gaps. Two other factors were also important. First, it represented a relatively common scenario in industry (a manufacturer attempting to move to electronic trading processes with some of its key distributors). I considered this might help broaden the relevance of my interpretation. Second, Omicron managers had been enthusiastic about contributing to the research process to date, and reacted positively when asked about participating in additional interviews.

2.9 Data collection (Phase II)

Semi-structured interviews were conducted using the same methods documented in Phase I, but this time with prompts that were designed to capture all the decisions, events and changes that were important in the history of the system and engagement of trading partners. The questioning instrument I used in these interviews has been included in Appendix E. The biggest gaps in the Omicron case history existed in understanding events from the trading-partner perspective, so more respondents were sought from Omicron's distributors. Omicron provided assistance in identifying additional candidates and in making introductions, but asked that this be limited to five

organisations so as to limit the disruption/inconvenience to its distributors. Five additional trading partner respondents were subsequently interviewed. A representative of Omicron's technology partner on the project was also interviewed to provide a different perspective on events, especially those relating to technical developments, and to cross-check the recollections of others, and the Omicron managers interviewed in Phase I were re-interviewed.

A longitudinal mode of data collection was employed, with sets of interviews conducted at three time points over a 14 month period, beginning with the interviews conducted in May 2005 as part of the Phase I data collection effort, and ending with interviews conducted in July 2006. The Omicron study thus combined retrospective data on the system, spanning a period of approximately seven years, with data from an ongoing prospective data collection exercise for the most recent 14 months.

This approach was preferred over field observation or participatory methods partly because of the difficulties of securing access and partly because of the danger of influencing the evolution of the system and organisation if the latter method was used. As noted by Doz (1996), those approaches can make it:

Extremely difficult to be sure not to influence ongoing processes and still maintain a legitimate presence in the field insofar as managers would quickly be tempted to seek advice from the researcher and ask the researcher to intervene in the process, as a *quid pro quo* for allowing further observations (Doz 1996, p-58).

Documents, in the form of internal reports and descriptions of specific components of the system, were sought and obtained from respondents to produce a more complete understanding of the event chronology and to clarify the workings of the various technical components. After completion of the semi-structured interviews, and as the case history was being written, additional short, unstructured interviews were conducted via telephone to check facts and clarify event details.

The semi-structured and unstructured interviews that contributed to the Omicron case study are documented in Table 2.

	System initiator respondents	Trading partner respondents	Technology provider respondents	Total semi-structured interviews	Unstructured interviews / follow-up calls
May-Aug 2005 interviews	2	3	0	5	2
Nov-Dec 2005 interviews	2	5	1	8	9
July 2006 interviews	3	0	2	5	5
Total	7	8	3	18	16

Table 2: Interviews conducted in Omicron case study

A methodological weakness here was that the longitudinal element of the Omicron study was limited to just over a year, a relatively small period compared to the full history of the Omicron eIOS which spanned, in total, eight years. The duration of the longitudinal element was ultimately decided by access to the respondents. In the final round of interviews, Omicron managers asked that no further interviews be conducted with trading partners and indicated that they wished to end involvement in the research. Consequently, the full history of events relied heavily on retrospective data, leaving open the possibility of recall bias affecting the quality of information collected from respondents. I mitigated against this by cross-referencing accounts between respondents and secondary data sources where possible, but some loss of accuracy was inevitable, especially in relation to the early origins of the project. This is likely to be a common challenge to further research at this level of analysis. Whereas studies focusing on community and population level effects may be able to draw upon a variety of industry sources to build up event histories, studies focussed at the organisation level appear to be much more reliant on directly accessing respondents to document and interpret the events taking place within organisations.

Once again, I used the NVivo software package to store and manage the data collected. After compiling the descriptions of events and actions at Omicron in chronological order, I wrote up a draft case history. This was then revised with the benefit of additional clarifications and corrections obtained from respondents via telephone. As a final step to ensure integrity, two senior managers at Omicron and a representative of Omicron's technology partner were asked to read the case history for factual accuracy and completeness, and some minor corrections and amendments were made.

2.10 Analysis and interpretation (Phase II)

I continued to follow the interpretive philosophical approach discussed in the first half of this Chapter, and to employ a hermeneutic process to analyse and interpret the data. The suitability of this approach had been reinforced during my review of coevolutionary literature where I noted that Donald Campbell, one of the major contributors to the application of evolutionary theory in organisations, had identified hermeneutics as a promising approach in organisational evolution (Hendrickx 1999).

I employed the Rosenkopf & Nerkar (1999) framework as a lens through which to re-interpret events at Omicron, adapting their ideas to fit the eIOS context with each cycle of interpretation. By using coevolutionary theory as a lens to arrive at a new way of thinking about eIOSs, and to help practitioners trying to engage trading partners, my approach was very similar to the way in which Finnegan, Galliers & Powell (2003) employed triple loop learning as a lens to examine the planning of interorganisational systems.

So far, as my research had progressed through the various stages documented in Figure 1, the interpretive process had expanded to include additional elements. My world view had been supplemented first by the e-commerce/IOS literature review, then by the data I collected on ten eIOSs, then by the coevolutionary literature. I would now reflect on all of this as I considered new data.

At one level I would use the observations, descriptions and meanings supplied by actors participating in the Omicron system to attempt to understand the phenomena taking place in the system. My interpretive process would move between these levels in the hermeneutic circle, shifting from the text-analogue, provided by the transcriptions of interviews with individual respondents, to my attempt to make sense of the Omicron system as a whole.

At another level my sense-making effort would also be informed by my testing concepts and interpretations against my understanding of both coevolutionary theory and e-commerce systems in general.

Here, my understanding of coevolution was itself an interpretation of the research conducted by others, with a particular emphasis on the concepts set down by Rosenkopf

& Nerkar (1999). The ideas of Kay & Cecez-Kecmanovic (2001) and Aldrich & Ruef (2006) would also be influential.

My understanding of e-commerce systems was partly an interpretation of research conducted by others but was also a product of personal, first hand observations of systems that I made before beginning this research, and first hand observations of the ten systems that I made in the first stage of this research. Put another way, to understand individual events, components and changes at Omicron it was necessary to understand where the system as a whole was being directed, and also to understand something of the broader world of e-commerce systems, what they represented and where they are going. Likewise, understanding the Omicron system required both an understanding of its parts and an understanding of the broader context of e-commerce.

The resulting coevolutionary framework for eIOSs was, therefore, “developed through an ongoing dialogue between pre-existing understandings and the data, derived from participation in the world” (Ezzy 2002, p. 28).

3. Review of relevant research

I began my journey with an investigation of the existing literature to see what had already been done in relation to the research question. What, in other words, did we already know about why things go right, and why things sometimes go wrong, when initiators try to engage trading partners in e-commerce interorganisational systems? I found that only a very small amount of research existed that dealt directly with strategy in this context, but that a much more extensive pool of research could be related to various aspects of the problem. Consequently, I broadened the investigation to consider this literature as well.

At first, my investigations centred on empirical research. I found that the majority of literature relevant to the context was in fact of this type, mostly employing surveys as a research instrument to examine adoption factors, especially inhibitors to adoption. This is consistent with the findings of Urbaczewski, Jessup & Wheeler (2002, p-273) who also noted, while building their taxonomy of e-commerce research, that the literature was dominated by the “greatest preponderance of data-based, empirical research”. I then moved on to explore literature employing various theoretical perspectives, and the same sequence is followed in the layout of this Chapter.

3.1 Empirical research

I found the richest rich source of empirical literature was that investigating the adoption of EDI systems. Scholars attempted to tackle the issue of adoption of EDI systems in the early 1990s (e.g. Saunders & Clark 1992; Swatman & Swatman 1991) and the particular challenge of engaging smaller trading partners in EDI has also been singled out for specific research (e.g. Chau 2001a, 2001b; Iacovou, Benbasat & Dexter 1995). Although some elements of the technology have changed over time, this literature was very relevant: computer networks were still being used to send business information across organisational boundaries, and the challenge of engaging multiple trading partners was essentially the same.

The weakest literature was that dealing with the very general case of business adoption of the Internet and e-commerce. I had to discard most of this as offering little or no value to my research goals. Studies could not be legitimately used as a basis to analyse enablers for trading partner engagement to eIOSs when they failed to specify the type of

e-commerce being attempted. Respondents to surveys that failed to make this clear in the questions, for example, could have been referring to relatively simple forms such as getting connected to the Internet, building a company information website, or making occasional business purchases from other websites using a credit card. On the other hand they could have been referring to the much more substantial undertaking of implementing interorganisational systems to conduct integrated e-commerce processes with trading partners. For the most part, however, empirical e-commerce studies made no such distinctions in their questions, data collection or analysis. Using the research was problematic because adoption factors are not necessarily interchangeable between these scenarios. Stansfield & Grant (2003), for example, established that interest and usage of Internet technology by businesses cannot be taken to imply a transition to full blown electronic commerce. Similarly, Mehrtens, Cragg & Mills (2001) found significant differences between the model for EDI adoption developed by Iacovou, Benbasat & Dexter (1995) and a model that worked for general Internet adoption. External pressures came from different sources in each case, and factors such as organisational size and financial resources only came into play in the former scenario.

Most of the empirical literature employed surveys to explore adoption factors for e-commerce IOSs. Beginning with the earliest studies in the 1990s, scholars have sought to shed light on drivers, inhibitors, motivators and other considerations. In the following paragraphs I give six examples of survey based studies and their findings.

An early example is Saunders & Clark (1992), who found cost to be an important factor in inhibiting EDI adoption but that perceived benefits, trust and dependency between trading partners do not significantly affect the intention to adopt EDI.

Grover (1993) captured a list of variables involved in the adoption of innovations and then conducted a survey to test their significance in the adoption of interorganisational systems targeting customer organisations. He concluded that adoption was strongly dependent on the degree of top management support; if organisational members perceive a system as compatible with their value system, experience and technological prowess they tend to adopt; if systems are perceived as complex, organisations are less likely to adopt; organisations are more likely to adopt if management was aggressive and more willing to take risks; size of organisation and sophistication of its IS infrastructure are good predictors for adoption.

A survey conducted a few years later by Drury & Farhoomand (1996) compared organisations in various stages of adoption of EDI and found non-adopters tend to overemphasise standards and to underestimate costs compared to adopters, but the principal barrier to adoption was management attitude. They argued that adoption could be accelerated if systems plans were linked to corporate strategy and supported by top management, steps were taken to encourage early user involvement in planning and implementation, a diagnosis was conducted to determine levels of user resistance, and additional educational and internal communication strategies were employed to disseminate knowledge about EDI to users.

Premkumar, Ramamurthy & Crum (1997) surveyed 181 firms to test potential determinants of EDI adoption in the transportation sector. They found that the most important factors were size of the firm, competitive pressure, customer support and top management support.

Chau (2001a) surveyed determinants of small business adoption in 627 small businesses and found that they did not consider EDI to be something that delivered major strategic benefits or competitive advantages and had an unbalanced view of direct and indirect benefits, focussing much more on the immediate short term benefits in assessing the technology. Prior experience of EDI and the perceived level of support from the vendor were also found to be important determinants. In another survey of 460 non-EDI adopters, Chau (2001b) found the three most significant inhibitors all related to the degree of organisational readiness, and that actual and perceived “ability to adopt” is more important than “benefits of adoption” as a factor. He concluded that lack of knowledge, skills and organisational resources are overarching reasons why small business is not adopting EDI.

Finally, Power (2004) surveyed 553 Australian organisations in the fast moving consumer goods (FMCG) sector to examine the relationship between human resource management practices and their adoption of B2B technologies. He argued that there was a link between effective management of human resources and effective implementation of B2B e-commerce enabling technologies. Implications for managers included not focusing exclusively on the capability of technologies and paying more attention to human capabilities, and making specific efforts to engage and involve

employees more comprehensively—going beyond user training to make them active participants in the organisational learning process.

Each of these survey based approaches contributed more adoption factors to a list that kept getting longer. Just in the few examples above adoption factors included: cost, top management support, organisational compatibility, risk-taking in management, size of firm, sophistication of IS infrastructure, understanding role of standards, realistic cost estimates, management attitude, linking plans to corporate strategy; early user involvement, user resistance, education and internal communication strategies, competitive pressure, customer support, perceived benefits, perceived competitive advantage, prior experience of EDI, perceived support from the vendor, organisational readiness, knowledge and skill levels, organisational resources, effective management of human resources. To me this was confusing, and it did nothing to help refine my understanding of what was most important when engaging trading partners.

The typical approach in empirical research has been to isolate and test one or more organisational characteristics as independent variables against adoption, but this appears to be ill suited to the hundreds of variables involved in the deployment of interorganisational systems. Also typical is focussing on only one person/job role in a survey (e.g. Chau 2001a; Chau 2001b; Grover 1993). This is a significant limitation when successful interorganisational systems implementations must necessarily factor a great many stakeholder types (Premkumar, Ramamurthy & Nilakanta 1994). These limitations are acknowledged by many researchers and underscore a need to pursue a deeper understanding that can more comprehensively account for economic, organisational and social factors. Swatman & Swatman (1991), for example, pointed out that organisational, managerial and strategic areas are important and that it is a mistake to look at implementations as a technical problem.

Moving on from surveys, case studies seemed to offer a way to dig deeper into systems and the processes of engagement. Many scholars have employed case study methods, sometimes in conjunction with surveys, to try to build a deeper understanding of adoption factors and the nature of eIOS systems. In the following paragraphs I describe eight examples and their findings.

The earliest one I reviewed was that of Reich & Benbasat (1990), who conducted case studies on eleven interorganisational systems where the targeted trading partners were customers, and used the data to examine factors discriminating between high and low adoption of the systems after several years. They found that low quality pilot tests, low customer awareness of the need to change, the absence of a champion and poor support for the sales force act as inhibitors of long term adoption and penetration.

Swatman & Swatman (1991) reflected at length on the nature of EDI systems and posited that the real benefits were often qualitative, in areas such as better inventory control and improved trading partner relationships. They argued that much more focus should be placed on organisational, managerial and strategic issues involved in implementing EDI. They highlighted trading partner pressure, contractual arrangements that clearly define liability and accountability, the involvement of top management, integration of information received from external sources with existing organisational systems and practices, and progressive phasing of EDI into the organisation, as factors that can positively influence adoption.

Iacovou, Benbasat & Dexter (1995) tested EDI adoption factors against seven case studies of small businesses that had been asked to adopt EDI. They found that the strongest explanatory variable was external pressure from EDI initiators, that there was a strong link between trading partner dependency and adoption, that a moderately positive relationship existed between perceived benefits and adoption, and that the relationship between organisational readiness and adoption was weak. Going further than most scholars in turning their investigations into strategy recommendations for practitioners, Iacovou, Benbasat & Dexter (1995) recommended developing a plan from the beginning that covered adoption by small trading partners, and making individual assessments of each partner's EDI preparedness level. They also recommended influence strategies, including promotional efforts, financial and technological assistance to partners with low organisational readiness, and coercive tactics. They noted that the level of organisational impact was related to integration between EDI and other systems, and argued that coercive tactics should be avoided because they could compromise the level of cooperation and trust in trading relationships. The rationale for this was that threats will result in non-integrated systems with low impact for the unprepared, coerced and unmotivated adopters. Raymond & Bergeron (1996) drew

similar conclusions about coercion, finding that quality of the organisational context (support, implementation process and control procedures) was most critical to releasing the benefits from EDI, and that this quality was higher when small firms implemented EDI voluntarily instead of having it imposed upon them. The level of integration of eIOSs was also looked at by Kettinger & Hackbarth (2004), who found that a firm's capacity to perceive e-commerce networking benefits had the strongest influence on the degree of integration undertaken.

Clark & Stoddard (1996) used four case studies and a survey in the US grocery retail sector to show that both process innovation and technological innovation go hand in hand for successful EDI implementations. They found that the largest payoffs for both retailers and manufacturers were produced when process and technological innovation were combined. They concluded that the combined approach is necessary to achieve dramatic performance improvements both within organisations and for their channel partners.

Li & Williams (1999) used six case studies and a telephone survey to illustrate how the development of interfirm systems in the electronics industry facilitated new interfirm collaboration in previously unforeseen areas. They identified three layers of barriers to interfirm networking: operational barriers centring on technical problems and resultant lack of trust, barriers to sharing sensitive information, and barriers formed by differences between firms and the need to develop common knowledge in terms of aims, culture, structure, procedures, languages, accountabilities and timetables.

Allen, Colligan, Finnie & Kern (2000) conducted a qualitative case study of an eIOS in the UK motor vehicle leasing and repair industry. From a review of the literature they first identified factors impinging on the success or failure of IOSs. They then examined each of these in the context of the system and concluded that the system initiator should adjust its strategy to refocus on managing the 'soft' (non technical) aspects of managing the community. They used the results to argue that non-technical social and political factors are much more important than technical factors.

Wong & Turner (2001) used a survey of 41 businesses and semi-structured interviews with six of these in an attempt to build in-depth insights into the complex human, technical, organisational and contextual factors that influenced the adoption and

utilisation of B2B e-commerce. Most interestingly, they recognised that initial adoption did not necessarily mean continued utilisation, and attempted to analyse the key drivers for adoption and utilisation separately, something not attempted in other research reviewed. The key adoption drivers they identified included the desire to move with the times or stay ahead, business needs such as the need to update old technology or the need to improve management practices to accommodate company growth, internal champions for the technology, potential benefits of e-commerce, pressure from business partners, and bank moves to conduct business electronically. Drivers of continued utilisation were considered separately and included the need to obtain up-to-date information, proven benefits of e-commerce, customer demands, increased reliance on technology to accommodate Australia's new goods and services tax, wider usage of e-commerce by other companies in their industry, and penalties imposed by banks for non-electronic transactions. They concluded that the most important drivers of both adoption and utilisation came from the external business environment, such as business partner encouragement, financial institution activities and competitive pressures.

Lastly, Scupola (2002) used case studies to explore the problems and benefits encountered by Italian businesses when adopting B2B e-commerce. A strong finding was that chance was the most important factor, with adoption and initial discovery driven by acquaintance, interest and random exploration of Internet technologies. Chance was a stronger factor than strategic necessity and strategic opportunity. Lack of education and knowledge, and fear of putting a product portfolio on the Internet and the risk of having it exposed to competitors, were found to be major barriers to the adoption of business-to-business e-commerce. Unlike many other studies, cost was found not to be an issue for any of the companies in the study.

All of these case studies, however, did nothing to simplify or refine the list of adoption factors. Indeed, they only served to make it longer. To the earlier list I could now add coercion/trading partner pressure, trust, effective communications, politics, power relations, pilot tests, having a champion, clarity of contractual arrangements, progressive phasing in of systems, data standards, extent of integration between EDI and other systems and provision of technological assistance. Taking into account the many other studies that have been conducted beyond those reviewed here, the complete list must be very long indeed!

The work of Dai & Kauffman (2002) further reinforced to me that a bewildering range of views and ideas exists on this subject. They interviewed leading academic researchers and industry managers associated with B2B e-commerce to gather expert views on the barriers, problems and strategies associated with adoption and implementation and found that perspectives varied greatly. Scholars and industry experts related adoption challenges to everything from organisational and behavioural hurdles to network externalities, the absence of technology standards, computer systems compatibility, trust between participants and market preparedness.

The real challenge here, in the context of my research goals, was that an endless list of possible explanations for success and failure does not help the practitioner very much. There is no structure that can easily be applied to it, there is no way of easily prioritising it, and the strength and relative importance of any individual factor is difficult to assess for any given context. Perhaps the icing on the cake is Scupola's (2002) finding that chance is an important factor (the most important factor, according to Scupola). It makes sense that prior knowledge and prior experiences of the Internet will play a role in how trading partners react, but this does not tell the practitioner anything useful, except perhaps that he might roll the dice to guess at the probable success of a new project. The ever growing list also does nothing to help scholars narrow their focus for new research either, as already demonstrated in the example of Allen, Colligan, Finnie & Kern (2000), and as I was finding myself.

Another real problem with the empirical research was the tendency for findings to contradict one another. Contradictory findings exist, for example, with respect to the importance of cost as a factor. In some studies (Telstra 2003) it is cited as a strong factor while in others it is identified as a smaller factor (Australian Bureau of Statistics 2004) or not a significant factor at all (Scupola 2002). Many studies highlight perceived benefits, organisational readiness, and external pressure cite as important adoption factors (Iacovou, Benbasat & Dexter 1995; Ihlström & Nilsson 2003; Mehrrens, Cragg & Mills 2001; Scupola 2002; Sensis 2004; Telstra 2003; Wong & Turner 2001) where others cite lack of time, lack of knowledge and lack of skills (Stansfield & Grant 2003) and others place security issues as among the strongest concerns (Sensis 2004; Telstra 2003). Scholars have different views on external pressure as a factor, often noting its importance as an influence (e.g. Swatman & Swatman 1991; Bouchard 1993; Wong &

Turner 2001) but sometimes arguing that external pressure and coercive tactics produce poor outcomes and limit the benefits obtained from systems (e.g. Iacovou, Benbasat & Dexter 1995; Raymond & Bergeron 1996). It seems most likely that all of these findings are legitimate in the context in which they were researched, but that the strength and importance of each varies a great deal from situation to situation, which makes generalising about adoption factors exceptionally difficult.

There is little either to isolate what sets eIOS systems apart from other types of information systems or to derive enabling strategies from understanding their unique character. Adoption factors, such as cost, complexity, security and management support, are almost universal considerations in any information system. Telling practitioners that reducing the cost of e-commerce systems will make those systems more likely to be adopted by trading partners, for example, says nothing new. The same advice could be applied to the adoption of accounting software, laptops, mobile telephones and almost any other type of technology.

I now decided to investigate different theoretical lenses through which engaging trading partners in e-commerce had been explored, in search of a better explanation or model of what takes place within these systems.

In contrast to the volume of empirical literature, my searches revealed much less literature of this type. Some of what was relevant related to interorganisational systems more generally than the e-commerce variety (e.g. Pickering & King 1995), and some related more to alliances and collaboration in the information technology context (e.g. Konsynski & McFarlan 1990; Kraut, Steinfeld, Chan, Butler & Hoag, 1999). A small amount of research dealing with electronic marketplaces was also included, but I had to be discerning about what I used. Bakos (1998) defined electronic marketplaces as using information technology to match buyers and sellers, facilitate transactions, provide institutional infrastructure, aggregate product information, discover prices and provide procurement and industry specific expertise, giving some idea of the variety of systems that fall under this label. Because electronic marketplaces could be relatively simple online mechanisms, rather than the integrated interorganisational systems that were the focus of my research, the few papers that were included directly tackled adoption issues and related to systems of enough complexity to give the findings some relevance.

3.2 Economic perspectives

Several scholars had attempted to tackle aspects of my research question using economic models and perspectives, in particular transaction cost economics (Williamson 1981, 1994) which focuses on economic exchanges and rational decision making based on opportunities and the transaction costs that relate to those exchanges, and resource dependency theory (Pfeffer & Salancik, 1978) which focuses on the dependencies between organisations and how organisations try to minimise these dependencies.

Clemons & Kleindorfer (1992) developed an early economic model for making investments in interorganisational information technologies. They focussed on supplier/buyer interactions and the costs and benefits of technology in facilitating such interactions. They used a bargaining viewpoint to develop a model for predicting the likelihood of cooperative interorganisational system investments based on factors such as implementation costs, switching costs, profits and number of buyers in the consortium. Providing a list of factors did not extend much on the contribution of the empirical research, but other studies showed more promise in linking findings to strategy. Riggins & Mukhopadhyay (1994), for example, looked at interorganisational information systems from the perspective of interdependent benefits between the participating organisations. They conducted case studies of two buyer-initiated EDI systems where the way in which trading partners implemented the system would have a direct effect in the benefits realised by the buyers. They found that these cases confirmed adoption of buyer-initiated modifications by the trading partners produced benefits for the buyers, but did not necessarily produce benefits for suppliers. The implication for practitioners was that system initiators should go beyond simply looking for ways to influence *if* their trading partners adopted the system to find ways (either employing incentives or, when sufficient leverage exists, by mandating) of influencing *how* trading partners implemented the system. The considerable practical challenge of extending control beyond the adoption decision to specific process reengineering within trading partners was acknowledged:

Although a buyer may convince its suppliers to adopt the EDI technology, either by subsidy or coercion, the firm then faces a problem in that it may not

be able to dictate how adopting trading partners actually implement the IOS (Riggins & Mukhopadhyay 1994, p-41).

Work by Wang & Siedman (1995), Riggins, Mukhopadhyay & Kriebel (1995) and Barua & Lee (1997) led to recommendations on subsidisation strategies. Wang & Siedman (1995) modelled EDI adoption using economic factors including supply, demand, prices, adoption costs, transaction volumes, bargaining power and number of suppliers. They used the model to identify circumstances where it may not be optimal for suppliers to adopt EDI, and to suggest that, in circumstances when the buyer can derive significant savings, and supplier adoption costs are relatively high, it will be in the best interests of the buyer to subsidise its suppliers rather than mandate adoption. They also used the results to build an economic explanation for why, despite lower transaction costs, many companies end up reducing their supplier base after implementing EDI. Riggins, Mukhopadhyay & Kriebel (1995) focussed on the economics of subsidisation as a strategy to facilitate system adoption by suppliers. They found that, if adequate information about supplier joining costs is available, then buyers can employ differential subsidy payments and may only need to subsidise a subset of suppliers to a point after which positive externalities force the other suppliers to join. Barua & Lee (1997) also concluded that manufacturers can successfully use subsidies to partially offset a supplier's setup cost and investigated in some depth the circumstances under which subsidies are best employed. They applied economic modelling to analyse adoption of an EDI system, choosing the case of a manufacturer and two of its suppliers. They analysed the adoption decisions from both manufacturer and supplier standpoints by using, and extending upon, Reinganum's (1981) technology adoption model. They concluded that sometimes suppliers have to join EDI networks out of strategic necessity, regardless of cost structure and associated benefits, because of their competitive position. The trading partners in the system exhibited unequal bargaining power and coercive tactics were employed by the manufacturer. Barua & Lee (1997) acknowledge a weakness of this research to be its generality to cooperative relationships (i.e. with a more equal distribution of power). For the practitioner, they advised measurement of economic impacts of strategic interorganisational systems and analysis of supplier incentives.

Koch (2002) examined B2B electronic commerce marketplaces as an alliance process. Using an ethnographic investigation of two marketplaces, she integrated resource dependency and transaction cost theoretical perspectives to explain the process by which organisations form and join. She posited a model to explain (using transaction cost theory) the initial formation of the marketplace by participants as a reaction to environmental pressures and to explain (using resource dependency theory) the joining of other organisations as a product of reciprocity, asymmetry and legitimacy contingencies. Koch (2002) suggested that organisations in non-competitive industries have a better chance of achieving complete industry involvement in a marketplace, that involving distributors and the network of relationship they draw upon can be important, and that unless powerful members of an industry form the marketplace they are unlikely to join it. The conclusions focused on initial conditions, but offered little in the way of practical strategy once the targeted trading partners had been selected, and I had to place a question mark over the generalisability of these findings beyond the specific case of e-marketplaces. Tomak & Xia (2002) investigated the formation of marketplaces using game theory (Shapiro 1989), an application of transaction cost economics where the costs and benefits, and thus the decisions, are dependent upon choices made by others. They tried to use the model they created as the basis for explaining how different conditions can favour either exchange-based B2B systems or peer-to-peer systems.

Like Koch (2002), Subramani (2003) also combined transaction cost economics and resource dependency perspectives, this time in a study of the distribution of benefits in a supply-chain IOS between a large Canadian retailer and 131 of its suppliers. Noting that such relationships were largely asymmetric, with benefits unevenly distributed and network leaders often gaining some benefits at the expense of supplier firms, Subramani (2003) proposed that patterns of use for supply-chain IOS technologies be categorised as exploitation or exploration (March 1991), and suggested that use for exploitation was likely to be associated with higher business-process specificity (the degree to which a supplier's key business processes are particular to the requirements of the retailer, increasing dependence on the supplier the supplier's bargaining power), and that higher use for exploration was likely to be associated with higher domain-knowledge specificity (the degree to which a suppliers critical expertise was particular to the requirement of the retailer, enhancing reliance on the retailer).

I found a significant challenge of these economic approaches, in the context of my research goals, to be their reliance on detailed mathematical models to support their conclusions. The resulting equations are too complex even when they deal with only a few variables, and obtaining data to populate them (e.g. approximations of supplier adoption costs) would be difficult or impossible in practice. When, for example, Riggins, Mukhopadhyay & Kriebel (1995) suggest using subsidisation strategies when adequate information about supplier joining costs is available, they leave the practitioner with the very significant unanswered question of how to collect joining cost information, data that to a very large extent will be hidden within the supplier organisation. This challenge increases rapidly with any attempt to combine different economic models or introduce more variables to make models more accurate and more generalisable to different situations. Consequently, they cannot be easily employed by managers, except perhaps as a guide to economic factors that matter when planning a system.

The other major shortcoming of economic approaches was that they ignored social factors altogether, and social factors are undoubtedly important, as I had seen from the findings in the empirical literature reviewed earlier. Kumar, van Dissel & Bielli (1998) also pointed out that perspectives that focus on transaction costs, or assume technical-economic rationality, can have limited explanatory power given the important roles played by trust and relationships.

3.3 Social theoretical perspectives

Compared to economic approaches, I found a larger number of studies that applied social theoretical perspectives. The most prominent themes here by far were the use of innovation diffusion theory and institutional theory, but systems adoption had also been investigated from the perspectives of trust, cooperation, conflict and power.

Innovation diffusion theory looks at adoption of innovations in terms of social systems and communications structures, such as interpersonal networks (Rogers & Shoemaker 1971; Rogers 1983). There is a strong emphasis on time and on understanding how various attributes of the social system impact the rate of adoption (Rogers 1983). It has been widely applied to questions of how technologies are successfully adopted (e.g.;

Rogers 1983; Kumar & Kumar 1991; McKenney, Mason & Copeland 1997; Mustonen-Ollila & Lyytinen 2003).

Innovation diffusion has been used to examine the general case of adoption of e-commerce technologies (Beck & König 2002; Seyal & Rahman 2003; Limthongchai & Speece 2003), and a few scholars have tackled the specific case of adoption of eIOSs.

One of the better studies in this context was conducted by Premkumar, Ramamurthy & Nilakanta (1994), who used innovation diffusion theory to investigate the problems firms had in implementing EDI. They collected data from 2001 US firms that had implemented EDI and found that relative advantage, elapsed time, costs and technical compatibility were the innovation diffusion factors that best predicted adoption. Unlike other studies looking at the problem from a diffusion perspective, they distinguished between internal diffusion and external diffusion and identified both as essential requirements for successful interorganisational systems. Splitting the problem into two was a step beyond the traditional application of diffusion and appeared to be a better reflection of the unique properties IOS context. Relative advantage and elapsed time were found to be most important predictors for internal diffusion, while technical compatibility and elapsed time were most important predictors for external diffusion. These scholars also appeared to have a better appreciation for the social complexity of the context, pointing out that for implementations to be successful, systems

have to satisfy the needs of many constituents—top management, internal users in the functional areas, external users (customers/suppliers), and IS personnel. Each group has different stakes in the system. For example, the sales department may have been thrust with EDI by its major customer, which will reflect in a very satisfied customer but perhaps an unsatisfied functional area user. For a system to be truly successful in implementation, it must satisfy all (or most of) the stakeholders (Premkumar, Ramamurthy & Nilakanta 1994 p-181).

More typically, however, scholars have applied innovation diffusion to the e-commerce IOS context in much the same way as they would for adoption of any technology. Examples include Munkvold (1988), Kendall, Tung, Chua, Ng & Tan (2001) and Dreidonks, Gregor, Wassenaar & van Heck (2005). Munkvold (1998) used innovation

diffusion principles to study two systems where collaborative technology was being implemented between small and medium-sized businesses. He found adoption factors included geographical dispersion, high communication costs, high task and organisational complexity, perceived strategic importance of collaboration, concentrating on maintaining relations with existing customers and suppliers, the need for coordinating autonomous actors and the level of heterogeneity in technological platforms. Kendall, Tung, Chua, Ng & Tan (2001) surveyed businesses in Singapore to investigate receptivity to the adoption of e-commerce against the innovation attributes suggested by innovation diffusion theory. They found that relative advantage was the most important attribute, followed by compatibility with needs and trialability, and that observability and complexity were not important innovation attributes. Dreidonks, Gregor, Wassenaar & van Heck (2005) used innovation diffusion theory to analyse adoption of B2B electronic marketplaces. They proposed that important adoption factors include knowledge exchange of positive experiences, the presence of leading/forcing stakeholders, and the destruction of existing social capital among stakeholders. They suggested managers can identify critical factors with regard to the social context, communication channels between early and potential adopters, the role of leading or forcing stakeholders in their industry and the role of critical mass and liquidity to better design electronic markets.

These more traditional applications of innovation diffusion, however, completely fail to capture the complex nature of these systems. They suffer from the tendency, as McMaster & Wastell (2005) pointed out of innovation diffusion studies in general, to oversimplify and reduce adoption decisions to simple binary choices, and to polarise the world into innovators and imitators.

Initially, innovation diffusion appeared to be very useful because interorganisational e-commerce systems are a form of technological innovation, and engaging trading partners can readily be conceived as an attempt to diffuse innovations through a specific community of trading partners. The emphasis on extended social networks, communications channels and change agents in innovation diffusion, however, is an important limitation. While larger interorganisational e-commerce systems certainly feature extended social networks with diffuse and indirect communications channels between many members, other systems are made up of just a few collaborating

organisations (sometimes only two). Furthermore, interorganisational systems, even those spanning only two organisations, are for the most part extremely complex and involve many different types of people with many different (often conflicting) objectives. This was pointed out by Munkvold (1998, p-431), with IOS implementation described as more of a “complex point-to-point technology transfer than a diffusion process, in that the users are targeted at the outset”. McMaster & Wastell (2005) picked up on these themes in their critique of the application of innovation diffusion in information systems research, noting that:

“Causation” in the social realm is complex, situated and ideographic. It is a basic ontological error to infer from the statistical properties of populations (correlation coefficients etc.) that such simple unidirectional causal laws operate at the level of individual social actors or groups.

Moving on from innovation diffusion theory, I found that a few scholars (Chatterjee, Grewal & Sambamurthy 2002; Teo, Wei, & Benbasat 2003; Cousins & Robey 2005) had applied institutional theory to the adoption of Web technologies, interorganisational linkages and B2B e-commerce. Institutional theory (Parsons 1956; DiMaggio & Powell 1991; Zucker 1987) focuses on the way in which organisational roles become socially entrenched expectations, and how these expectations can explain subsequent decisions and developments.

Chatterjee, Grewal & Sambamurthy (2002) used institutional theory to examine factors in achieving higher levels of organisation assimilation of Web technologies (assimilation being defined as the extent to which the use of technology diffuses across organisational work processes and becomes routinised in activities associated with those processes). They found positive support for all three of the factors they examined: top management championship, having a strategic investment rationale, and extent of coordination of Web initiatives across executives and departments, and cited this as reinforcing the importance of institutional factors in the success of these initiatives. Teo, Wei, & Benbasat (2003) used institutional theory to examine the role of coercive, mimetic and normative pressures in influencing adoption of interorganisational linkages by financial organisations in Singapore. They concluded that normative pressures (influence stemming from the extent of adoption by all the trading partners with which the firm has links) exhibited the strongest influence. The authors noted, however, that

the result may have been influenced by the unique context of being conducted in the Singaporean business community. Cousins & Robey (2005) used institutional theory to analyse the role of intermediaries in B2B e-commerce. They explained why public B2B metals exchanges exhibited less ability to survive than private systems on the basis that trading partners regarded the latter constructs as more legitimate extensions of existing trading relationships. This implied that practitioners should be careful not to pursue B2B models that require too great a departure from roles that the participating organisations are normally expected to play, given the values, norms, rules and beliefs present in their environment.

After institutional theory I found a disparate collection of papers that had examined systems adoption from the social perspectives of trust, cooperation, conflict and power.

Meier (1995), for example, classified IOS introduction and usage in terms of whether the goal was competitive advantage or to fulfil a strategic necessity, and whether it was being introduced to enhance an existing product or service or as a stand-alone business. He argued that different relationship and trust issues applied between trading partners depending on which of these scenarios applied, and that mutual dependency of system participants and coordination requirements made trust a key ingredient. Kumar & van Dissel (1996) examined interorganisational systems from the perspective of managing cooperation and conflict between organisations. They argued that in the case of networked IOSs the potential sources of conflict increase substantially and suggested that strategies for managing this risk revolve around non-technical mechanisms such as bargaining and negotiation for conflict resolution; channel diplomacy; exchange of ideological education, propaganda and people; and setting up supraorganisational goals, conciliation and arbitration mechanisms. Elg & Johansson (1997) examined decision making in interfirm networks as a political process, based on power and the notion of resource interdependencies as a motive for interfirm exchange. They emphasised that decisions made within the network, as well as overall structural change, are influenced by the way firms handle the political process. Hart & Saunders (1997) analysed adoption and use of EDI from the perspective of trust and power, developing a series of propositions relating to practitioner strategies. They pointed out that trust is strongly related to power in the interorganisational relationships and how it is exercised (i.e. persuasive and coercive use can produce very different outcomes) and related power

back to the source and extent of dependencies between the trading partners. They argued that “a critical condition of successful EDI use over time is trust. And further, the probability of building trust is considerably greater when noncoercive, or persuasive, power is used, rather than coercive power” (Hart & Saunders 1997 p-39). They went on to hypothesise that firms using coercive mechanisms exhibit less EDI use and correspondingly less internal computer integration.

Kumar, van Dissel & Bielli (1998) tested the explanatory power of a variety of theoretical perspectives by using the case study of an eIOS in the Italian textile industry. The resulting interpretations of events in the build-up and failure of this system were used to argue that perspectives which focus on transaction costs, or assume technical-economic rationality, have limited explanatory power. They found an interpretation of the same system using perspectives from the literature on trust and relationships to be much better, and concluded that trust and collaborative relationships are vital concepts for interpreting such systems. They went further to suggest that theory based on these concepts is more likely to create win-win strategies suited to organisations trying to produce collaborative advantage through interorganisational IT systems. For practitioners considering implementing these systems, they concluded that:

Traditional development approaches need to be augmented with additional strategies that, as a precursor to development, examine the existing patterns of culture, relationships, and trust (or distrust) in the development situation and take them into account for devising a development and implementation strategy (Kumar, van Dissel & Bielli 1998, p-221).

Electronic networks and virtual organisations were examined from the perspective of the role played by interpersonal relationships by Kraut, Steinfeld, Chan, Butler & Hoag (1999). They found that electronic networks and interpersonal relationships did not substitute for one another and were complementary methods of coordination rather than competing mechanisms. The same firms that reported using electronic networks heavily also reported using personal relationships heavily, and reliance on personal linkages was associated with better outcomes and mitigated the negative consequences of using electronic networks. This relates to earlier findings of Pickering & King (1995) in their investigations of the more general case of interorganisational computer intermediated communications (i.e. including email communications) who suggested that

organisations that depended on employees with highly developed social ties can be expected to create and maintain computer intermediated communications more readily.

Ibbott & O'Keefe (2004) noted that prior research such as Hart & Saunders (1997), had often been performed on systems where power is used coercively and initial trust is poor. They examined the role of trust in the planning, development and implementation of two interorganisational systems, concluding that trust and control act on and shape each other over time and that trust must be managed differently in IOS scenarios where no prior relationships exist between firms as compared to scenarios where prior relationships exist. They suggested that high levels of trust allow a 'journey approach' to be taken with an IOS, with no fixed plan or development methodology, and allowing partners to guide the endeavour rather than commit to detailed plans up front. Ibbot & O'Keefe (2004) advocated that practitioners include boundary-crossing individuals in their work groups to promote trust and consider pursuing journey-oriented or improvisational approaches from the outset because they also had the effect of building trust.

Brown & Lockett (2004) suggested that trust could also be contributed by third party intermediaries, such as service providers, that could be employed to help to facilitate and legitimise the adoption of e-commerce applications across a business community.

Overall, I found that social theoretical approaches were almost as problematic as economic approaches. As well as taking perspectives that are individually too narrow, they shared many of the challenges of economic approaches in that many of the models and resulting strategies would be exceedingly difficult to act upon for practitioners. The conclusion by Kumar, van Dissel & Bielli (1998), that existing levels of trust should be taken into account as a precursor to development, makes for an excellent example. How exactly, should a manager assess trust between organisations? How should differences in trust between individual people at different levels be handled? Are there units of measure for trust that can be employed for consistency? These are not easy questions to answer when trust is such a difficult concept to pin down and definitions span cognitive, social and economic perspectives (Husted 1989). McKnight, Choudhury and Kacmar (2002) demonstrated a typically complex attempt to pin down trust in an e-commerce context, and even then they only managed to deal with the case of B2C e-commerce.

Many of the studies had the effect of adding to an already confusing list of adoption factors identified from the empirical research. And like economic models, social models suffered from the exclusivity of their approach: they did not account for economic factors which are undoubtedly also important. Each model seems to be addressing only a small part of the picture and would be dangerous for a practitioner to adopt in isolation.

3.4 Technology-centric and other perspectives

I found a very small number of studies that emphasised perspectives that were quite different to those I have already described, such as technology standards, IOS typologies, and organisational learning. I deal with these briefly in this section.

Reimers (2001) and Chen, LaBrie & Shao (2003), for example, looked at the problem from the perspective of industry-wide XML⁵ standards. Reimers (2001) examined the role of XML standards in promoting more rapid engagement in B2B systems. By reviewing what could be learned from the adoption of standards in EDI systems he concluded that, because the main difficulties for implementing B2B e-commerce systems stem from 'higher' level standards, such as agreements around semantics and pragmatic agreements on procedures and expected actions after transactions are received, it cannot be expected that application of XML standards will itself significantly reduce barriers to implementation. Chen, LaBrie & Shao (2003) combined technology diffusion theory and transaction cost theory to build a framework that businesses considering e-commerce initiatives could use to decide when they should adopt an XML standard. The major parameters of the framework, which represented an overall measure of effort and cost for adopting XML, were degree of sophistication of intranet applications and degree of sophistication of extranet applications. Organisations were encouraged to use the framework to make decisions about feasibility and/or timing of XML standards adoption based on a consideration of their

⁵ Specific examples of Extensible Markup Language (XML) standards developed for e-business include FinXML and FpML in the finance sector, XBRL in accounting, Rosettanet in the computer equipment manufacturing sector and ebXML (a replacement for UN/EDIFACT standards for EDI, introduced earlier).

current status against these parameters. In a related approach, Al-Naeem, Rabhi, Benatallah & Ray (2005) discussed technical integration⁶ as a key success factor in B2B systems and proposed a framework to help practitioners navigate the complex landscape of integration approaches, patterns, models, technologies, standards and protocols in order to make more effective design decisions.

Technology-centric approaches like these, however, appeared to me to be the most limited of all, because there are such strong arguments that non-technical social and political factors are far more important (e.g. Allen, Colligan, Finnie & Kern 2000). The specific approach of examining the problem from the perspective of adoption of industry-wide XML standards is further limited because it is only applicable to systems designed along broadly consistent lines in an industry, and therefore on a position to take advantage of XML standards created by a standards body. It has no applicability to unique e-commerce systems, developed by small groups of trading partners, that do not conform to some broader pattern.

In a different approach, Choudhury (1997) proposed a typology of different types of IOS and focused on understanding decisions relating to IOS type. He linked the characteristics of demand uncertainty and market variability to the choice of type of system (multilateral systems, electronic monopolies or electronic dyads). The strategic significance of the system, and the size and bargaining power of the firm initiating it, was then linked to the decision over whether to develop the system competitively or cooperatively. The assumption that e-commerce IOSs can be so readily categorised, however, is problematic. It is by no means certain that the many subtle varieties existing today can be covered by a simple typology, let alone new variations on the theme that may be encountered in future.

⁶ Cost and difficulty in technical integration is viewed by these scholars as a fundamental part of the challenge and it is not hard to find evidence to support this view. Data from the Australian Bureau of Statistics (2004), for example, showed 84 percent of Australian businesses receiving orders via the Internet or Web had no automated links between those systems used to receive orders and other business systems, such as accounting or logistics packages.

Finnegan, Galliers & Powell (2003) took an organisational learning perspective, applying triple loop learning theory to the IOS context. Triple loop learning theory, or TLL, separates planning into three types of 'single loop' learning: design management, debate management and might-right management (Flood & Romm 1996). Finnegan, Galliers & Powell (2003) took planning guidelines for interorganisational systems identified from earlier work (Finnegan, Galliers & Powell 1999) and examined three case studies through the lens of TLL theory to draw conclusions as to the relevance of TLL to the planning process. They concluded that TLL may be useful in explaining much of the activity that was labelled planning during the development of these systems but that none of the organisations had in fact utilised any of the techniques. This approach was exceptionally awkward, and would be difficult to translate into practical guidance for managers, which may help explain why only one application of TLL in this context was found in the literature. Despite the limitations, however, I saw in this work a genuine attempt to step beyond traditional intraorganisational strategies to identify strategies uniquely suited to the context of interorganisational systems.

3.5 Summary

I have summarised the limitations of empirical, economic, social and technical research perspectives in Table 3. The empirical literature was especially limited because it only seemed to generate an ever growing list of adoption factors, it was confusing, and the findings frequently contradicted each another between studies. Rather than simplifying understanding, every new study only added new considerations. Unfortunately, I found that theoretical models of interorganisational systems were also disappointing. While these have attempted to move beyond the checklist to provide deeper explanatory power, using a variety of economic and social perspectives, each model only analyses a slice of the complex dynamics involved in developing and deploying eIOSs. It is never enough to consider just a slice. Practitioners cannot afford to focus on an economic model at the exclusion of power and trust considerations, nor can they look at institutional forces without considering economic factors that will impact trading partner engagement. Taking a single view makes it almost certain that something important will be left out. While each of these perspectives is relevant, and can be of some help, practitioners will have great difficulty distilling them into something relatively simple, and usable, that can be applied to a variety of contexts.

On top of the limitations applicable to each of these perspectives individually, several other criticisms can be made of the literature more broadly. Firstly, there is a preponderance of research focussed on initial conditions and the initial adoption decision but, as Wong & Turner (2001) pointed out, initial adoption does not necessarily mean continued utilisation. For the practitioner, much of it is only useful for assessing likelihood of a positive decision and does little to inform them about strategies to improve the chances for successful engagement beyond that decision: it can help decide *if* to pursue an eIOS with a trading partner (i.e. feasibility assessment) but not to decide *how* to pursue it. Barnett & Carroll (1995) pointed out that resource dependence theory, institutional theory and transaction cost economics perspectives can all be criticised for their emphasis on organisational change as an adaptive response of individual organisations without paying sufficient attention to the processes of change, or how the change occurs within the organisation. Secondly, there is everywhere a very large question mark over generalisability of findings. Who could ever be confident, for example, that the recommended strategies coming out of a study of e-marketplaces in the meat industry, and strategies derived from a study of supply-chain systems in the aircraft parts industry, will be interchangeable?

Despite the large quantity of research, the literature has the disappointing effect of offering the practitioner a small flashlight to probe the very deep shadows of the dynamics of these systems. It provides many glimpses, or fragments, of a complete picture that remains largely hidden. Broad insights into the nature of eIOSs are elusive, and a theoretical model that can more comprehensively account for the range of underlying factors is missing. The spread of perspectives that still exists with respect to this problem (Dai & Kauffman 2002) reinforces the need for a model for eIOSs that is not time-limited, extends beyond initial conditions, and remains relevant in a background of continuous technical, social and organisational change.

At the end of this review I was left with a lot of unanswered questions with respect to my research goals. Did any of the models offer a relatively stronger or more promising avenue for practitioners compared to the others? Was there a sensible way of combining some of these perspectives for practitioners? To answer these questions I decided that I would try to find some simplifying themes in data collected from the field.

Research perspective	Description	Limitations	Examples
Empirical	Surveys, case studies. Mostly testing organisational characteristics and other factors as independent variables against adoption. The largest body of research. Has generated a very long list of adoption factors and actionable strategies.	The findings vary greatly with context. Results are often contradictory. The type and complexity of e-commerce being studied is often ambiguous. These issues make it difficult to generalise from empirical studies, and only limited confidence can be applied when formulating strategies from them.	Chau 2001a; Clark & Stoddard 1996; Iacovou, Benbasat & Dexter 1995; Ihlström & Nilsson 2003; Mehrtens, Cragg & Mills 2001; Premkumar, Ramamurthy & Crum 1997; Scupola 2002; Sensis 2004; Wong & Turner 2001; Stansfield & Grant 2003; Telstra 2003
Economic	Focus on understanding the economic transactions that underpin the creation and acceptance of interorganisational systems (e.g. transaction cost economics, resource dependency theory).	Closely relates to business case concepts (costs, benefits, etc) used routinely by practitioners in industry, but resulting models are generally quantitative and complex, incorporating variables that are exceptionally difficult to quantify in practice. Important social, political and technical factors are ignored.	Barua & Lee 1997; Clemons & Kleindorfer 1992; Koch 2002; Riggins & Mukhopadhyay 1994; Riggins, Mukhopadhyay & Kriebel 1995; Subramani 2003; Tomak & Xia 2002; Wang & Siedman 1995
Social	Focus on importance of relationships, communications, institutional roles, trust and power in interorganisational systems (e.g. innovation diffusion, institutional theory).	Models are mostly qualitative and are easily understood, but variables such as 'trust' and 'power' are still exceptionally difficult for practitioners to assess in practice. Important economic and technical factors are ignored. Innovation diffusion yields practical strategies, but is mostly applicable to systems implemented across large communities. It has limited relevance to systems spanning only two or three collaborating organisations.	Chatterjee, Grewal & Sambamurthy 2002; Cousins & Robey; 2005; Elg & Johansson 1997; Hart & Saunders 1997; Ibbott & O'Keefe 2004; Kraut, Steinfield, Chan, Butler & Hoag 1999; Kumar & van Dissel 1996; Munkvold 1998; Premkumar, Ramamurthy & Nilakanta 1994; Teo, Wei, & Benbasat 2003
Technology-centric	Focus on system design, technology selection, standards setting for e-commerce.	Limited value because technical factors appear to be much less important than economic factors, social factors, and process change in the IOS context. It is difficult to generalise from technical models when technology is in a state of continuous change.	Al-Naeem, Rabhi, Benatallah & Ray 2005; Chen, LaBrie & Shao 2003; Reimers 2001

Table 3: Existing research perspectives and limitations

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4. An analysis of ten systems

The next stage in my research would be to conduct my own analysis, using data collected from the field, to learn more about key turning points and factors influencing trading partner engagement, and to look for common themes. I collected and analysed data across twelve systems. A detailed discussion of the research method, sample selection, data collection, analysis and interpretation is found in Chapter 2. In the first part of this chapter I present and discuss the raw results of the thematic analysis. I then describe how I related findings back to my earlier review of e-commerce and IOS literature and how this led me to investigate a completely different theoretical perspective through which to consider the context – that of coevolutionary theory.

4.1 Results

I completed this part of the research in August 2005. The ten eIOSs that I managed to include in the sample, described in Table 4, represented a spread of industries and business processes to which e-commerce was being applied.

This spread was a good outcome: I had hoped to span a variety of technological approaches, trading scenarios and industry contexts in order to find themes that were especially pervasive. My overall goal was to identify strategies that would be useful to practitioners in a broad range of eIOS situations, so I considered it important to base any attempt to refine, or extend upon, existing theoretical perspectives on data that had also been derived from a range of eIOS situations.

The themes identified across the ten cases are described in Table 5 in their raw form, exactly as they were first interpreted from the analysis and before I attempted to relate them back to the literature I had reviewed. The order in which they are listed in the table roughly reflects the prominence of each theme across the entire sample: the most prominent themes are listed at the beginning and least prominent at the end. Note that some of the themes considered relatively weak for the entire sample were still extremely important in individual cases or small number of trading partners to which they applied. An example of this was meeting initial and ongoing system performance expectations, which was a major theme mentioned by every respondent interviewed in one case, but did not rate in the rest of the sample.

Case no.	Case name (coded)	Industry sector(s)	Key business processes targeted
1	Alpha	Building & construction	Work allocation, electronic procurement.
2	Beta	Steel	Quoting, purchasing, invoicing.
3	Gamma	Finance	Invoicing, reporting.
4	Delta	Agriculture	Quoting, purchasing, invoicing, planning, trade information sharing.
5	Epsilon	Building & construction	Document sharing, workflow, project coordination.
6	Zeta	Manufacturing, wholesale	Pricing/catalog, purchasing, invoicing, reporting and analysis.
7	Theta	Telecommunications	Quoting, ordering, customer management.
8	Omicron	Manufacturing, wholesale	Pricing, purchasing, order status provision.
9	Sigma	Insurance, healthcare	Quoting, invoicing, status checking, information aggregation.
10	Omega	Manufacturing, fast moving consumer goods	Planning, inventory management, purchasing.

Table 4: System descriptions for ten eIOS cases

The full thematic analysis has been included in its complete and unabridged form for the reader—including detailed descriptions of individual observations and references to individual cases and responses—in Appendix C. With an eye on the practical goals of this research, these findings were also converted into a basic checklist for practitioners, which has been included in Appendix D. The checklist was used as the basis for a report to the Australian government (McCabe 2006).⁷

Major turning points and the duration of the eIOS projects have been documented separately, in Table 6, in order to provide a summary history of these systems. Each of these turning points relates to when a broad change occurred in the

⁷ The preparation and publication of that report was kindly funded by the Australian Government through the Information Technology Online (ITOL) Program.

successful/unsuccessful engagement of trading partners in a system. Individual trading partners, of course, experienced many of their own turning points when they made decisions about a system, and these were reflected in the themes. The intention in this table, however, was to identify the big, across-the-board turning points in engaging trading partners. Each was either described this way by initiator respondents, or interpreted this way by me based on my collective picture from many interviews. In one case (Zeta) no turning points could be identified, whereas in others (e.g. Epsilon) there were six or seven key turning points. Not all turning points were positive, such as in the case of Epsilon where a deterioration in system performance temporarily stopped engagement then left a negative impression that continued to hamper engagement even after the problem had been addressed.

When comparing the two tables, it is important to keep in mind that themes did not have to be associated with turning points to be important. The need to avoid duplicating business processes, for example, was a very strong theme in nine of the ten cases. Everywhere I looked I found trading partner respondents that had either limited or avoided engagement because an eIOS asked them to re-key business data into more than one system. Despite being such a strong theme, it was only associated with one system-wide turning point, in the Omicron case. In this case, the system had been redesigned by the initiator to eliminate the need for its trading partners to re-key data, with excellent results.

Theme	Description
1 Acting to achieve a fair distribution of benefits and costs	Perceived benefits and costs were a strong theme in all 10 cases, with almost every respondent discussing engagement in terms of what the system did or would do for their organisation. Trading partners that had taken up a system were much more likely to see substantial benefits for either their organisation or—just as importantly—for their own customers. Distributing benefits and costs fairly between initiators and trading partners was critical: differences significant enough to be perceived as unfair slowed engagement.
2 Avoiding the duplication of existing business processes / seeking to rationalise already duplicated business processes	A strong theme in 9 of the 10 cases. Trading partner respondents described duplication of existing processes as reducing their motivation to adopt or make further use of a system. A common example of duplicated business processes was the requirement to re-enter data into an eIOS that had already been entered into an internal system. Trading partners were much less likely to be engaged when an eIOS duplicated existing business processes instead of altering or replacing them. Conversely, trading partners were more likely to be engaged when a system helped them rationalise or avoid duplicated processes.
3 Creating effective communication channels to receive and act upon feedback from trading partners	A theme in all 10 cases was the need to solicit feedback from trading partners and to act upon it by adjusting the system and/or the way engagement was undertaken. Trading partner respondents frequently described the availability of feedback channels, and the willingness of initiators to act upon them, as a critical factor in engaging with the system. Channels included feedback via account managers, trainers and other personnel, direct access to project teams to pass on concerns, problem reporting via technical support, and formal user groups. Successful system initiators all implemented many changes and revisions to systems over time.
4 Pre-packaging and removing complexity from the system, its implementation and the engagement process	Simplifying, pre-packaging and removing complexity helped the engagement process. This was a strong theme in 6 cases. It applied to system design, information and communications relating to the system, demonstrations of the system and the implementation process for the system. In 3 cases, pre-packaged system demonstrations helped trading partners grasp implications and potential benefits. In 2 cases, reducing the number of system options available accelerated engagement. This was relatively more important when engaging small business trading partners, because the decision-makers tended to make more immediate adopt/reject decisions.
5 Minimising the organisational change required of trading partners	Minimising organisational change was a theme in 5 cases, and an especially important enabler for trading partner engagement in 3 of these. References related to the difficulty of changing established procedures built around financial systems and entrenched workplace practices. Decreasing the changes asked of trading partners increased the likelihood of successful engagement. In one case, breaking down the required changes into smaller, manageable steps was an important enabler.
6 Targeting specific people / job roles within trading partners	Targeting the right people / job roles within trading partners was strongly linked to successful engagement outcomes in 7 cases. References were made to job roles such as logistics managers, billing managers, project directors, purchasing officers, content managers and designers, depending on the context. IT managers were sometimes acknowledged as important, but the primary targets for successful engagement were always business roles.
7 Using the most appropriate staff to engage trading partners	Identifying and selecting the right personnel to ‘sell’ the system to trading partners was an important enabler in 6 cases. This extended beyond having the right personal qualities to the nature of the job role. Better results were achieved when people were used with the same professional background as the personnel targeted. Appointing a specialised person/team to own the process of taking the message to trading partners was a valuable enabler in 4 cases. Asking regular account managers to do this generally led to poor outcomes.
8 Using other organisations to assist in the engagement process	Positive and negative assessments of systems, received from trusted peers in the trading partner community, had considerable impact on engagement in 4 cases. This was partly because trading partners sought to reduce risk by waiting to learn from the experiences of others, and partly because of competitive pressures (the desire not to be left behind their peers). Successful strategies included early targeting of the influential members of an industry, and conducting ‘pilot phases’ to serve as a proof of concept.
9 Segmenting the engagement strategy for different	Splitting the engagement strategy into two or more parts, so that different priorities, tactics and timing were applied to different types of trading partners, assisted engagement. This was a strong theme in 5 cases, and a weak theme in 3 others. Segmentation was undertaken using

categories of trading partner	a variety of criteria. The technical capability of trading partners was the most common consideration. Other criteria included transaction volumes, different business models of trading partners and relative benefit to trading partners. Segmenting on the basis of business size alone, without assessing technical capabilities, was not useful.
10 Identifying competing priorities in trading partner organisations	The timing of engagement with respect to competing priorities within the target organisation was a theme in 4 cases. When other priorities dominated management thinking, any new e-commerce project, even if recognised as valuable and viable, could not gain traction. The impact was always expressed as delayed engagement, rather than rejection of the system. Initiators that attempted to move e-commerce projects up the priority list were not successful.
11 Providing trading partners with implementation assistance and technical support	In 3 cases initiators achieved positive results by providing proactive technical assistance and sending experts out to trading partner premises to do some or all of the work necessary to implement the system. In each case it represented an adaptation to the strategy to overcome early disappointments. For complex or difficult to use systems, a lack of help desk support greatly inhibited engagement.
12 Addressing trading partner concerns over independence and lock-in	Concerns about e-commerce systems increasing dependence on the initiator, increase the initiator's market power and/or make it more difficult to dismantle a trading relationship in future, were expressed by 4 trading partner respondents, each in a different case. For these organisations it was a critical factor in engagement.
13 Coercion from system initiators	Coercion was a theme in 3 cases. In one of these it was a very strong theme referenced multiple times by every trading partner respondent. It was a key factor in promoting initial take-up, but it also led to resentment, and trading partners were subsequently predisposed to limiting their use of the system.
14 Direct subsidisation from system initiators	Direct financial subsidies were used extensively in one case and mentioned by a single trading partner in another case. Despite subsidies being of a substantial nature the engagement results were not clear cut. Subsidies were observed to be a factor that could bring forward the timing of engagement but would not affect the decision to engage.
15 Meeting initial and ongoing system performance expectations	Performance of the e-commerce system was a strong theme, mentioned by almost all trading partner respondents, in 1 case. Although the system response times appeared to be relatively reasonable on the surface, the real problem was that they had fallen well short of expectations. This substantially slowed the rate of take-up.
16 Adjusting to the value propositions that are important to different trading partners	Benefits for trading partners, and reasons for engaging, varied greatly between cases. They included additional revenues, cost savings, more rapid business outcomes, time savings, reduced errors, reduced workload, better quality information and deeper relationships. Most interestingly, reasons also varied greatly within each case: different trading partners often engaged for very different reasons depending on circumstances and organisational priorities.
17 Removing uncertainties from the trading partner business case	A theme in 3 cases. Trading partners did not engage because they could not determine if it would produce a net benefit to their organisations. Unknown/open-ended costs were cited as the reason. In one case the initiator improved engagement outcomes by individually assisting trading partners to develop their business case.
18 Support within the system initiator organisation	In 3 cases the engagement process was interrupted by interdepartmental conflicts within the initiator organisation. In two of these, conflicts were between business units and the IT department.
19 Providing training to trading partners	Training was specifically employed as a method of increasing take-up in 4 cases, but results were poor. Training took the form of pre-implementation seminars, post-implementation workshops and, in one case, ongoing classes to introduce new trading partner employees to the system. In only one case, however, was it associated with positive engagement outcomes. Successful engagement was much more closely linked to how straightforward a system was to use/self learn (see 'removing complexity from the system').
20 Other minor themes	Other, minor themes included: achieving better engagement outcomes when trading partners had already experimented with e-commerce initiatives and/or developed an e-commerce strategy; the ability for one person to derail engagement; more costly engagement when trading partners had poorly maintained data in their internal systems; the tendency for managers in small business trading partners to make rapid accept/reject decisions, and for managers in large trading partners to take weeks or months.

Table 5: Raw themes in engaging trading partners, ten eIOS cases

Case name	Major turning points in trading partner engagement	Project duration
Alpha	Project begins (2000) Information outputs delivered to phone/PDA devices (2002) Switch from procurement to work allocation as a core function (2002) Changed market conditions drive up usage (2004) New technology and service partnership (2004) System redesign: simpler to use, added functionality (2004)	5 years
Beta	Project begins (1998) Switch to new technical data and transaction standards (2003) New technology partner (2003) Addition of quoting functions (2004)	7 years
Gamma	Project begins (2000) Changed market conditions drive interest (2003) Similar systems begin appearing elsewhere in market (2003) Adoption by a trading partner influential in the industry (2004)	5 years
Delta	Project begins (2000) Revised system released with new technology (2003) Transfer of system to an intermediary organisation (2003) Engagement broken down into easier steps for trading partners (2004) Provision of onsite implementation assistance (2004)	5 years
Epsilon	Project begins (2000) Transfer of system to an intermediary organisation (2002) Changed market conditions (2003) Switch in focus from procurement to electronic document management (2003) Adoption by an influential trading partner in the industry (2004) Switch in targeted personnel, staff engaging trading partners (2004) Performance problems (2005)	5 years
Zeta	Project initiated (2003) No major turning points identified.	2 years
Theta	Project initiated (2002) Addition of order tracking functions in third system release (2005) Program to supply technical support and onsite assistance (2005)	3 years
Omicron	Project begins (1998) New project champion (2003) Introduction of new technology (2004) Switch in focus to engaging small trading partners (2004) System redesign to rationalise duplicated processes (2005)	7 years
Sigma	Project begins (2000) Refocus on status checking, information aggregation functions of the system (2002) Switch in targeted personnel (2004)	5 years
Omega	Project begins (2001) System redesign (2003) Provision of onsite implementation assistance (2004)	4 years

Table 6: Major turning points in ten eIOS cases

4.2 Discussion

As Table 5 illustrates, a relatively large number of themes were identified, and it was immediately apparent to me that they complemented many of the adoption factors that I had gathered from the literature earlier, such as perceived costs, perceived benefits, organisational readiness, top management support, trading partner pressure, dependency issues, system complexity, providing technological assistance. This did not mean, however, that I was able to easily simplify the existing list. The very different experiences across the ten cases reinforced my earlier conclusion that take-up factors vary greatly between different industries and system types.

One of the findings—the importance of not duplicating existing business processes—represented an entirely new addition to the list of considerations for practitioners. I had not encountered it in any of the existing literature, but it was certainly a very strong theme in the systems I examined. Trading partners were much less likely to be engaged when a system resulted in duplication of existing processes and procedures, most commonly manifested in having to re-key the same data into both the new e-commerce IOS and into some internal system they were already using (such as an accounting or customer management system). Comments like the three below were very common:

We had reservations because then we would virtually be double handling, having to enter into our database and then into the on-line system.

They are happy to key it into their spreadsheet, but not happy to go onto the website [as well].

[Distributor] took it on board, but he never placed orders through to us, because of the double keying, it was [only] used as a centre to get all the information...they still fax their orders through.

Trading partners were also much more likely to be engaged when they saw that systems helped them rationalise multiple processes and procedures, or even eliminated them altogether (such as the scenario where several e-commerce interorganisational systems that operated in parallel were replaced by a single system). Although previous researchers had not published the same finding, some of them (Iacovou, Benbasat &

Dexter 1995; Al-Naeem, Rabhi, Benatallah & Ray 2005) had certainly highlighted systems integration as important to realising the benefits of e-commerce, a finding that I consider to be related—i.e. systems integration is a mechanism that can help reduce duplication of processes. Indeed, in my study, duplicate processes appeared to be more common with smaller trading partners because initiators tended to spend money developing sophisticated systems integration for only their larger trading partners.

My objective at this point, however, was not to add to an already long and complex list of adoption factors, but to look for simplifying themes that might help me cut through them. I wanted to see if any model offered a relatively stronger or more promising avenue for practitioners or whether there was a sensible way of combining perspectives for practitioners. To tackle this I considered the findings against each of the various economic and social perspectives identified in the review of relevant literature.

Relating themes to economic perspectives

I began by considering what the themes told me about the economic perspectives I had reviewed. Many of themes related to economic adoption factors. These included the importance of a reasonable value proposition for trading partners, the need to remove uncertainties from the business case, the role that can be played in assisting the trading partner to build the business case, and the importance of system initiators effectively articulating the benefits to their trading partners. Comments like this were typical from trading partner respondents:

The costs for them are actually relatively low [but] it is a major investment on our part. If they really wanted us to jump on board they should have been here with their cheques.

These themes gave some support for the value of transaction cost economics (TCE) as a perspective for understanding engagement in eIOSs, but it was also quickly apparent that they reinforced the problems of complexity encountered when modelling systems this way. One example of this was the importance of ‘fairness’ in the distribution of costs, risks and benefits between initiator and trading partners. I had found that for many trading partners it was not enough to be presented with a business case that demonstrated a significant net economic benefit to their organisations. It was also important that the distribution of costs and benefits be perceived as fair, and what was

perceived to be fair depended on such things as the investment made by the system initiator to develop the system and the risks and dependencies that each party was being asked to take on. The following comment from a trading partner respondent was typical:

[Initiator] must be getting some benefit by us dealing with them electronically, so if we can accommodate them good, but my personal opinion is that we should be receiving more.

Furthermore, in line with Urbaczewski, Jessup and Wheeler's (2002, p-283) observation that a "consistent finding across both case studies and economic models is that surplus IOS benefits are interdependent and unequal between buyers and sellers" I had found benefits were almost universally unequal (because they were biased towards the initiator) but an unequal distribution could still be considered fair. Incorporating fairness in a TCE model would be a very difficult proposition indeed, and significantly add to the existing complexity of such models, but without it, no TCE model could hope to predict engagement outcomes with any confidence.

A second example was the higher relative importance placed, by some trading partner organisations, on benefits delivered to their own customers. Generating higher quality service outcomes for their customers had been described by these respondents as a more important reason for engagement than the internal, efficiency-related benefits that they had been promised. Any attempt to include this phenomenon in a TCE model, however, would multiply its complexity by requiring consideration of outcomes for these additional 'downstream' organisations (and potentially whole supply chains) in addition to the direct economic considerations between initiator and trading partner.

The themes provided some limited support for resource dependency as an economic lens for understanding developments. For some trading partners, addressing concerns over independence and lock-in had been critical. They did not want to see the initiator's market power increase and worried about the system making it more difficult to alter trading relationships in future. In the cases of Delta and Epsilon, transferring ownership of the system to an intermediary organisation had been an important turning point because it addressed such concerns. All of these events could be interpreted on the basis of organisations trying to minimise their dependencies on system initiators. It was

very clear, however, that this theme only explained one small part of the engagement story, and it was a theme completely absent from some cases. Looking at these systems from a resource dependency perspective could only ever be of limited usefulness to practitioners, and was not a promising avenue for further investigation. In fact, any economic model of any complexity would have been limited in explaining engagement in these cases because more of the themes related to social issues. As one initiator respondent noted:

The biggest problem I've got is cultural change, convincing people to use the system, because it's a different way of doing business.

Relating themes to social perspectives

I now moved on to considering the themes against the social perspectives I had reviewed. Here, many themes could be related to issues of trust, power and cooperation, but the most relevant theoretical perspective, by a considerable margin, was innovation diffusion. The themes lent a lot of weight to the importance of communication and the people doing the communicating, key elements of innovation diffusion theory (Rogers 1983).

Particularly striking was the importance of having effective communication channels to receive and act upon feedback from trading partners. Respondents in every case made references to this. Systems were never exactly right when they were first launched and inevitably needed fixes, updates and modifications to better suit trading partners and allow engagement to progress. If good feedback channels existed and the initiator was willing to act on feedback, then it stood a reasonable chance of getting the system right. As an initiator respondent put it:

I think the biggest thing that I have learnt that we have had to do is open communication, that is the underlying factor. It's so critical, the technology is important, but the key is actually the understanding and the communication between internal and external parties that are involved. If you don't have that, and you are not keeping people up to date and having open communication, it just falls apart.

Connecting with the right personnel within trading partners was also very important. A decision to target very specific job roles was an important turning point in the Epsilon and Sigma cases. This comment from an Epsilon respondent illustrates the importance of project construction managers in accepting a system:

If I'm a project construction manager all I care about is the project. I don't care what head office tells me to do because I am rewarded—my bonuses are dependent—on me delivering that project on time or before time...If there is anything I perceive is going to hold me up, even though there really is a business benefit, well then I am going to question why I should do it.

The same respondent described the better engagement results achieved when his organisation was able to target people in that job role more effectively:

It is often the project manager that pushes upwards. They see the benefits so they are willing to give it a go.

It was also important to select appropriate personnel for the task of liaising with trading partners: staff in job roles that were more compatible with targeted personnel could establish a better rapport, while regular account managers were often found to be ineffective promoters of a system. Finally, innovation diffusion was supported by the importance that trading partners placed on advice and information received from peers. Dialog between trading partners engaged and those yet to take it up played a key role in four cases, such as in the following example:

I then spoke to a couple of other [contacts] to just find out what their experience with taking on [the system] was like, and I got some pretty good reports.

Selecting the right personnel and the importance of information received from peers could be interpreted as characteristics of 'change agents' in the language of innovation diffusion (Rogers 1983).

All these themes, and the fact that it was easy to conceptualise trading partner engagement in terms of communications and the 'selling' of concepts between people, lent support to the use of innovation diffusion as a lens for understanding these systems. Of the social models, then, I had isolated innovation diffusion as being most relevant. It

still did not represent, however, a promising approach for achieving my research goals. Firstly, my analysis made it clear that innovation diffusion theory was not useful for describing events where only a few organisations are involved. In cases Theta, Zeta and Omega, for example, relatively fewer trading partners were targeted and all communications relating to engagement connected back to only one organisation—the system initiator. No communication between the trading partners was mentioned in these cases, and they quite possibly had no interaction with one another of any other kind. There was no ‘diffusion’, as such, only an effort by one organisation to convince others to engage. The description of engagement as a point-to-point technology transfer, as used by Munkvold (1998) was more accurate here, because extended social networks with diffuse and indirect communications between members were nowhere to be found.

A second and bigger problem was that the communication processes I had observed were very complex indeed. Adoption decisions were rarely clear cut and rarely attributable to a single person. In reality, the engagement of a trading partner, especially a large organisation, was a fuzzy, drawn out process involving many small decisions made by many people. Furthermore, different value propositions applied to different trading partners in the same system, so the nature and rationale for their decisions varied. All of this reinforced the complex nature of engagement and supported the criticisms of innovation diffusion, made by McMaster & Wastell (2005), as tending to oversimplify interactions and reduce adoption decisions to simple binary choices.

My observations with respect to subsidisation and coercion reinforced the difficulty of relying on an economic or social model in isolation to describe the engagement process. I found that direct subsidies sometimes sent the wrong message to trading partners about the merits of the system they were being asked to adopt. Subsidies were not, therefore, a strategy that could be considered on the basis of straightforward economic merits, as done for example, by Wang & Siedman (1995) and Riggins, Mukhopadhyay & Kriebel (1995). Social considerations were essential as well. Similarly, I found that coercion could make an initial adoption decision more likely but could also discourage an active partnership to improve and progress the development of an e-commerce system after initial adoption. The following comment was typical:

We'll use it only on a project basis, we certainly don't use it internally...We have to use it.

This matched the findings of Iacovou, Benbasat & Dexter (1995). It was clear to me that simple models for engagement based only on economic dependency could not account for such effects.

Perhaps most catastrophic of all for existing social and economic approaches, was the observation that different trading partners, even those that appear similar to one another in their business focus and goals, often engage with the same system for entirely different reasons, an apparent outcome of variations in circumstances, history, and the great variety of differences in personal priorities and perspectives to be found among managers. As one respondent, from an initiator organisation, described it:

No two [trading partners] have the same reason for using it. They are all different. Reasons change too—the reasons they use us now are not necessarily the same as the ones when they adopted.

Reflecting on all of this, my earlier observation that many of the existing research studies produced contradictory findings was unsurprising. In fact, such contradictions must be inevitable when any empirical study is vulnerable to the subtle differences in the very wide range of system-types, industries and business processes. Superficial, survey-based studies are doomed to yield strategies that practitioners cannot confidently apply in a range of different eIOS contexts.

I had reinforced my earlier findings that neither economic models built around factors such as supply, demand, implementation costs and switching costs, nor social models built around communications, trust and politics, are up to the task of explaining events in these systems. At the very least, a combination of economic and social theoretical perspectives would appear necessary to build an adequate explanatory capability, although existing attempts, such as that made by Koch (2002) to combine TCE with resource dependency theory, have been unsatisfactory.

Reflecting on turning points

Turning my attention now to the major turning points in trading partner engagement, the very dramatic changes in direction that had occurred made a strong impression on me.

In most cases big turning points had been associated with changes in the technology used, or even complete redesigns of the system. In many cases even the purpose of the system had been extensively revised, either with new capabilities added (e.g. order tracking in the Theta system), or by shifting the development effort to one function over others (e.g. the switch to work allocation as the core focus for the Alpha system). The following comment, from a trading partner respondent, illustrates how a redesign turned things around in his case:

Then they had a roll out of a new version, and lo and behold, all these things were fixed. They had listened to [trading partners] and changed it, redesigned it. Now I am one of their most vocal supporters because it is by far the best. They just listened to people.

Adaptation was obviously very important, and I saw a strong link between this and the importance of feedback channels, described earlier, and the need to make major and repeated adaptations to systems to achieve good engagement outcomes. Participants in these systems saw it the same way:

They consulted us before they released it and they have consulted us ever since. They have taken all our issues on board and generally have been able to improve the system with our suggestions.

Start with a pilot because that way you can beg a bit of forgiveness if things are not quite as they should be, plus you use it as an opportunity to get feedback, to get a small release quickly out to deliver improvements.

Most interestingly, major adaptations to the systems and system goals were not, for the most part, carefully planned or directed in advance. A comment from another trading partner respondent serves to illustrate:

There is a bit of trial and error for all of us as to what is right and what is not right there...[Initiator] were slow to respond and realise some shortcomings in their platform, and they were forced to come out and actually see some of that for themselves before they actually instigated the redevelopment.

Indeed, the history of every system could be viewed as a history of trial and error exercises, with initiators making many attempts, modifications, re-designs and new attempts until they found what worked.

Changes were often driven by feedback from trading partners, as in the above example, but sometimes they were driven by changes in market conditions or the availability of new technologies through a new partnership (as happened, for example, in case Beta). System initiators learned from the results they achieved or failed to achieve. Often this had been very expensive, with considerable time and money spent on concepts that were never adopted and had to be discarded entirely. Similarly, trading partners were learning about systems as they attempted to adapt procedures and use them, leading them to suggest changes and making them active participants in the design process. Each of the cases could be seen as a community of organisations making adaptations to processes and technologies to zero-in on a solution that worked for everyone. Clearly this could take a long time: Table 6 shows that seven of the ten systems had been an ongoing work in progress for more than five years.

In some cases the final system, and the purpose of the system, bore no resemblance at all to what had originally been proposed. In case Epsilon, for example, the e-commerce system had initially been conceived as an electronic procurement system for companies to purchase building materials (bricks, timber, concrete, etc) electronically from materials suppliers. Early efforts to engage trading partners met very little success, but when electronic capabilities were added for exchanging tender documents relating to construction projects this proved more popular. Eventually, the initiator switched the focus entirely to the electronic exchange and management of all documentation (plans, designs, engineering specifications, etc) associated with construction projects and this represented a major turning point in engagement. By the end, the system had become something completely different from its initial concept.

As I considered this it became clearer to me that these systems featured so many complex interdependencies that it was impossible to predict adoption outcomes in advance. If an initiator wanted to achieve successful engagement outcomes, then it had to be prepared to implement changes in response to feedback from trading partners, because asking its trading partners to change was not enough. There was a co-dependency and need for simultaneous adaptation that had to be appreciated. When

system initiators were successful in engaging trading partners they were managing to facilitate change in technologies and processes across multiple organisations simultaneously. The challenging nature of all this was embodied in the exasperated remark made by one of the initiator respondents:

It's not just your own organisation and culture you've got to deal with. It's the other's as well. It's like a double whammy.

I began to see interdependencies as a central and defining feature of eIOSs. Every case involved technological interdependencies between software used by trading partners and software used by initiator organisations. Changing the way an electronic document was generated in one, for example, always required a corresponding change to the way a document was received and interpreted in another. Interdependencies were a dominant factor in making any progress anywhere. In case Epsilon, for example, successfully moving to a central electronic repository for construction drawings depended on changing business processes in drawing offices and building site offices. At the same time, changing those business processes depended on identifying an acceptable standard for the electronic documents that could work with many different project management solutions used by construction companies. In order to understand trading partner engagement properly, it was fundamental to understand interdependencies.

Coevolutionary characteristics

It was these characteristics—long histories of change and adaptation, interdependent changes across multiple organisations, the critical importance of feedback channels—that were strongly suggestive to me of coevolutionary theory. I had already come across papers using coevolution (Arino & de la Torre 1998; Koza & Lewin 1998) when I had searched the alliance literature for research applied to the e-commerce IOS context, and the expression 'coevolution' now appeared to me to be an especially good description of the way in which business processes and technical elements of eIOSs were steadily adapted across multiple organisations in a mutually interdependent way. Perhaps I could use this perspective to help practitioners understand how systems successfully progress through all these cycles of adaptation?

Further reflections on the e-commerce and IOS literature reinforced my view that coevolution was relevant to this context. Coevolutionary perspectives had not yet been

applied to address my research problem. Researchers had, on the other hand, drawn attention to interdependencies between the technologies, people and processes associated with these systems, noted the importance of ongoing adaptation in these systems, and referenced the role of past developments in shaping future developments in eIOSs. With respect to interdependency, for example, Clark & Stoddard (1996) showed that process innovation and technological innovation go hand in hand for successful EDI implementations, and Li & Williams (1999, p-114) pointed out a need to study organisational and technological change in IOSs as interdependent, evolving processes:

Interfirm innovations are often closely related to organizational innovations within the firm...It is therefore important not only to examine interfirm collaborations through interfirm networks in isolation but also in conjunction with studies about organizational innovations through information systems within the firm.

Allen, Colligan, Finnie & Kern (2000, p-21) drew upon the language of interdependent relationships in ecosystems when they described the TransLease interorganisational e-commerce system as:

A complex electronic community, dependent on the existence of symbiotic relationships. As such the problems that the system's users and developers experienced can be attributed to factors that impeded the mutual benefit accruing from participation in the system.

Chatterjee, Grewal & Sambamurthy (2002, p-66) went further and actually used the word coevolution (although they did not apply the theoretical perspective) in describing the complex interdependencies that must be understood and managed in e-commerce initiatives:

The effective assimilation of Web technologies requires their integration into existing organizational work processes and this might necessitate changes to current technologies and work processes...however not many firms succeed in orchestrating the coevolutionary changes to their technologies-in-use, organizational structures, processes, and incentive and reward systems to successfully assimilate Web technologies into their e-commerce initiatives.

With respect to ongoing adaptation, Lee (2004) concluded that adaptability was essential in supply chain networks to accommodate changes to trading partners, competitors, markets and strategies, capturing this message in the phrase “adaptation of the fittest” (Lee 2004, p-107), and concluding that:

Companies must be able to give up the efficiency mind-set, which is counterproductive; be prepared to keep changing networks; and instead of looking out for their interests alone, take responsibility for the entire chain (Lee 2004, p-112).

With respect to past developments shaping future developments Li & Williams (1999), in their case studies of motor manufacturing and retailing eIOSs, noted the way in which IOS implementations themselves led to new enhancements:

Once two firms have established a successful interfirm network at the routine transaction level, new and strategically important applications based on the same or more powerful links are often developed (Li & Williams 1999, p-108).

In one case examined by Li & Williams (1999) a retailer and clothes supplier established a system for electronic trading and only later conceived the idea to expand it to allow the electronic exchange of designs. In another, a Japanese car maker established electronic trading with suppliers which later led to the introduction of 'synchronous supply' arrangements, providing suppliers with direct access to planning and forecasting information on the manufacturer's mainframe, and joint development of products by exchanging computer-aided design (CAD) data. If adaptations to interorganisational systems and associated business processes could lead to new, totally unforeseen variations, then these observations were strongly suggestive of path and history dependence.

I also found support for investigating coevolutionary theory in literature dealing with information systems in organisations more broadly. Moore (1993, p-75) suggested that coevolutionary theory could be particularly useful in the modern business community because:

Much has been written about cooperative networks, under the rubric of strategic alliances, virtual organizations, and the like. But these frameworks

provide little systematic assistance for managers who seek to understand the underlying strategic logic of change. Even fewer of these theories help executives anticipate the managerial challenges of nurturing the complex business communities that bring innovations to market.

Child & McGrath (2001) argued that the transition from an economy based on materials to one based on flows of information, with the attendant shifts in how the core activities of an organisation are defined, meant that future IS research methodologies should adopt configurational, coevolutionary analytical approaches and Orlikowski & Barley (2001, p-145) suggested that:

The transformations currently occurring in the nature of work and organizing cannot be understood without considering both the technological changes and the institutional contexts that are reshaping economic and organizational activity.

Finally, Adner (2006) argued that managers should take an innovation ecosystem perspective when looking at their innovation strategy, by which he meant looking at it from the perspective of the collaborative arrangements by which firms combine parts of an offering into a cohesive solution for customers. Acknowledging the role of information technology in facilitating these ecosystems, he highlighted new dependencies and risks that they presented, including interdependence risks (risks relating to all the other components that must be successfully developed and deployed for an innovation to be successful, and integration risks (risks relating to all organisations that have to adopt the innovation before the customer can benefit). Adner (2006) advocated replacing strategies of identifying and defending positions in their innovation ecosystem with iterative strategies that accommodated the process, and the order, in which their ecosystem could be expected to emerge over time.

The question I had arrived at then, at this stage in the research, could be summarised as follows:

Can coevolutionary theory offer a useful framework for describing the development and acceptance of an interorganisational e-commerce system between trading partners?

I now decided to generate a better understanding of the eIOS context by trying to describe it in coevolutionary terms. My first step would be to review the literature dealing with coevolution in organisations. This would deepen my understanding of the theory and confirm its suitability for the purpose I had in mind. At the same time I would look for an appropriate template or model that I could adapt for my purposes.

5. Coevolution, organisations and e-commerce

In this Chapter I discuss my review of the coevolutionary literature. Coevolution is based on the principles of evolution, so I found it necessary to first go back and understand how evolution has been applied to organisations. The chapter begins, therefore, with a discussion of the core principles of evolution, dealing first with their original application in the natural world, and then discussing the adaptation of these principles to organisational phenomena. I then pause to reflect on the advantages, for interpreting the eIOS context, that were already evident in the evolutionary underpinnings of coevolution, before discussing the different levels and units of analysis used in evolutionary literature.

After providing some evolutionary foundations, I then progress to coevolutionary theory itself, once again beginning with its origins in biology before returning to organisations and describing the characteristics of the theory in this context. This is followed by a discussion of different approaches, extensions and applications of the theory with respect to organisations. Although coevolutionary theory has never been specifically applied to the engagement of trading partners in e-commerce, I did find it had been applied to two areas with a relationship to my context. The first of these was the formation of alliances between organisations, and the second was technological innovation in organisations.

During this exercise I was both investigating the suitability of coevolution for the context and searching for existing models that I might be able to use or adapt later. My evaluation of the literature against these goals is discussed throughout. In the last part of the Chapter, I discuss my selection of a coevolutionary model to use as a template for making my own coevolutionary interpretation.

5.1 The application of evolutionary theory to organisations

All evolutionary-based theories are built upon the core principles of variation, selection, retention by inheritance, and the struggle for survival, as originally explored by Darwin (1859) with respect to the natural world. In biological terms, Darwin's theory of natural selection is neatly summarised by Gribbin (2002 p-355):

First, offspring resemble their parents, but in each generation there are slight differences between individuals. Only the individuals best suited to the environment survive to reproduce, so the slight differences which make them successful are selectively passed on to the next generation and become the norm.

This theory is one of the most important ideas in the whole of science, producing a rich heritage of scientific work, and culminating in the discoveries, in the twentieth century, of the biological mechanisms for inheritance and variations (Gribbin 2002).

The application of the same principles to organisations can mostly be traced back to the work of Campbell (1965, 1969). Campbell saw the potential to take the variation/selection/retention sequence from biology and re-apply it to understand changes in organisations, and the selection and preservation of those changes in future organisations. Businesses, after all, also seemed to live and die in a perpetual struggle to compete and survive. Other early pioneers of the application of evolution in organisations included Friedman (1953), who used the ideas to describe how firms behave when seeking to maximise expected returns, and Winter (1964) who investigated models of differential selection in firms, but McKelvey & Baum (1999) point out the especially important influence Campbell had on all the organisation science that followed. Evolution was developed further with respect to organisation theory by Aldrich (1972, 1979, 1999), Kaufman (1975), Aldrich & Pfeffer (1976) and Hannan & Freeman (1977), and then later by Nelson & Winter (1982) and McKelvey (1982 1994, 1997), and I will return to ideas developed by these scholars through this chapter. Scholars such as Farrell (1970), Dunn (1971), and Hirshleifer (1977) contributed to the development of evolutionary ideas more broadly in economics, but these are less relevant to the organisational context. A comprehensive review and

update on the application of evolutionary theory to organisations was undertaken recently by Aldrich & Ruef (2006).

Aldrich & Ruef (2006, p-16) set down the key evolutionary processes, as adapted from biology to the organisational context, as follows:

Variation is a change from current routines and competencies or a change in organizational forms. It can be intentional, when people actively generate alternatives and seek solutions to problems, or blind, when it happens independently of conscious planning.

Selection is the differential elimination of variations. It can be external, when forces outside the organization affect its routines and competencies, or internal, when forces inside the organisation do so.

Retention is when selected variations are preserved, duplicated or otherwise reproduced so that the activities are repeated in future. It can happen both within organizations, via mechanisms such as specialization, role standardization and the acquisition of habits by individuals, and between organizations, by institutionalization of practices in beliefs and values.

Struggle describes the contest for scarce resources within and between organizations. Within organizations, struggle occurs as members pursue individual incentives as well as the goals of the firm.

These principles are fundamental to any evolutionary or coevolutionary theory, and would necessarily feature in any coevolutionary interpretation of trading partner engagement in eIOSs.

An advantage of using evolutionary theory to model organisational change is it 'assumes that organizations do not follow a fixed path of development' (Aldrich & Ruef 2006, p-161), readily accommodating the elements of uncertainty and dispensing with ideas of predetermined organisational change. This means it can account for both changes that come about by chance and changes that come through rational decision making, and can also account for changes that do not contribute to better outcomes for businesses or produce outcomes that damage or threaten the business. As Aldrich & Ruef (2006, p-21) pointed out:

Management and business strategy writers usually focus on selection systems that improve fitness, whereas an evolutionary approach alerts us to the possibility that many selection systems are irrelevant or not tightly connected to environmental fitness.

The inclusion of intentional variations in the organisational context is a point of disagreement among scholars. Campbell consistently took the view (Baum & McKelvey 1999) that the variations in evolutionary theory applied to organisations should be predominantly blind—where the outcome is not predetermined or known for certain—rather than intentional, where variations are introduced by managers in direct response to changes in the business environment. Blind variation parallels the Darwinian tradition more closely, while intentional variations can be viewed as closer to Lamarckism⁸, which would not be acceptable in the natural sciences. Since then, however, scholars have argued that models can readily accommodate both blind and intentional variations (Nelson & Winter 1982) and that the management beliefs and values that influence practice should be considered in coevolutionary theories along with organisational and environmental phenomena (Dijksterhuis, Van Den Bosch & Volberda 1999).

McKelvey (1994) made an extensive case for the advantages of evolutionary theory for explaining organisational change. These include less need for assumptions about human behaviour and rationality, a more objective base for organisational analysis, getting away from a science centred on managers, and simplicity in requiring far fewer statements and assumptions to explain an adaptation. Evolutionary theory offers a way to get past the focus on initial conditions. Barnett & Carroll (1995) pointed out that the models of organisational change with the best potential should consider, as evolutionary theory does, both the process of organisational change (how change occurs) and the content of organisational change (why change occurs).

⁸ Jean-Baptiste Lamarck believed that animals could develop new characteristics from within, in response to newly experienced needs and changed conditions (Gribbin 2002 p-337).

Evolutionary theory in organisations can accommodate other theoretical approaches within it. Aldrich & Ruef (2006, p-12) conceived evolutionary theory as a generic framework, or an overarching perspective, that is flexible enough to serve as a:

Meta-theory within which other approaches are acknowledged and appreciated. Evolutionary models do not specify the engines driving variation, retention and selection, and thus they depend on ideas from other approaches for their power.

Using this conception, selection criteria in organisations are:

Set through the operation of market forces, competitive pressures, the logic of internal organizational restructuring, conformity to institutionalized norms, and other forces (Aldrich & Ruef 2006, p-21).

An example of this incorporation of other theoretical approaches as engines driving evolution is seen in Jones (2001), where both institutional and resource-based theories are accommodated in interpreting the coevolution of entrepreneurial careers, institutional rules and competitive dynamics in American film. Aldrich & Ruef (2006) demonstrated that a variety of theoretical approaches can be related to, and accommodated by, the variation, selection and retention forces that underpin evolutionary theory, and described relationships to three theoretical approaches that I had found common in the e-commerce literature (see Table 7, below).

Perspective	Variation	Selection	Retention
Transaction cost economics	Variation introduced via intendedly rational action	Selection involves actions to minimise transaction costs	Retention via transaction-specific investments
Resource dependence	Variation introduced as managers try to avoid dependence	Selection via asymmetric power relations	Retention a temporary result of coalitions and bargaining
Institutional	Variations introduced from external origins, such as imitation	Selection via emergent understandings and compromise	Retention is problematic; depends on learning and sharing

Table 7: Three perspectives as they relate to evolutionary theory.

[reproduced from Aldrich & Ruef (2006, p-36)]

5.2 Reflection on evolutionary concepts

As I became familiar with evolution as a theoretical perspective for understanding organisations, I gained a deeper appreciation of its qualities. Even before reviewing the coevolutionary literature, the evolutionary underpinnings of coevolutionary theory were already providing signals that this perspective would be useful.

One advantage was the accommodation of both blind and intentional variations. A useful coevolutionary interpretation in the eIOS context would, in my view, also need to accommodate both. First, chance and unforeseen events played an important role in eIOSs. I had observed this in the way new technology partnerships and new system functions had accidentally become turning points, surprising the initiator, and Scupola (2002) had also emphasised the role of chance in the systems he researched. Second, to be useful to practitioners, any interpretation would also need to incorporate intentional variations to accommodate strategic actions taken by the practitioners themselves. With respect to the disagreements between scholars over the inclusion of intentional variations, I found reassurance in the fact that Darwin produced his enormously powerful biological theory for natural selection without knowing anything about the mechanisms behind variation at all (Gribbin 2002). My goal was merely to develop an interpretation of developments in the eIOS context, so it seemed to me that I had a good chance of producing a satisfactory outcome whatever the nature of the variations.

Being able to accommodate other theoretical approaches as engines driving evolution was useful because it meant that economic and social forces might both be accommodated in a single interpretation of events, potentially overcoming a major limitation of the existing literature. It also suggested that an interpretation could still account for concepts such as interorganisational trust, for example, without having to isolate or measure them. Furthermore, in my analysis of ten eIOS cases, I had established that different trading partners often engage with the same system for very different reasons. If an interpretation allowed me to describe developments without prior specification of the engines driving them then this would be consistently useful in situations where goals and motivations varied greatly across individual trading partners.

Needing fewer assumptions about human behaviour and rationality was desirable because, compared to intraorganisational systems, practitioners trying to initiate eIOSs were in an even more difficult position than usual. How could they maintain a deep understanding of what was going on in the minds of managers critical to successfully engaging trading partners when so many of them worked in entirely separate organisations (i.e. the trading partners themselves). If a coevolutionary framework provided a way to understand developments without this then it promised to be valuable.

Accounting for changes that do not produce better outcomes for businesses was another advantage. In my research I had already observed that systems did not always head in the 'right' direction. Some turning points led to reduced trading partner engagement. In any interpretation, developments leading to failure had to be accounted for when systems were not adopted, or when they were tentatively adopted and later abandoned, by trading partners.

Finally, evolutionary theory offered a way to get past the focus on initial conditions, a problem I had already noted earlier with respect to existing eIOS literature, and instead emphasise a better understanding of the process of change.

5.3 Levels and units of analysis

Literature dealing with evolutionary theory in organisations can be categorised according to the level at which the analysis is undertaken: analysis can be undertaken at the *organisational* level, *population* level and *community* level. It was also necessary, therefore, for me to make some consideration for what level of analysis would be most appropriate for understanding my context.

Organisation level research examines the evolution of sub-parts of organisations. Typical units of analysis for evolutionary studies at the organisational level are routines and competencies (Aldrich & Ruef 2006). Population level research takes whole organisations as the units of analysis (Hannan & Freeman 1977), a set of organisations of similar type being termed a population. Community level research examines interacting populations as units of analysis, a set of linked populations being termed a community. An important example of community level research is Baum & Korn's (1994) analysis of competitive and mutualistic interactions among firms operating in

five sectors of the Canadian economy and how these relationships bind the sectors of the Canadian economy into an integrated organisational community.

A limitation of population and community level approaches in my context was that they mostly exclude or ignore the possibility of change coming from within organisations and being driven by individual managers and workers (Meyer 1994; Shapira 1994). Internal adaptation can, however, also happen in response to cues within the organisation (Meyer 1994) and my goal of creating a framework useful to practitioners steered me towards a model that could accommodate change driven by those practitioners. Practitioners were most likely to exert their influence at the organisation level. I also noted that population and community-level studies tended to rely on foundings and failures of firms as indicators of evolution. That approach would be almost irrelevant to practitioners, because all the systems I had examined had a history shorter than the lifespan of the organisations associated with it. It seemed most likely, therefore, that a useful interpretation would need to consider the context primarily at the organisational level.

Baum & Singh (1994) also distinguished between ecological approaches—those seeking to understand the dynamic interactions within and among ecological entities such as jobs, workgroups, organisations, populations, communities and ecosystems, and systematic approaches—those aspiring to develop a theory of differences in organisational characteristics to explain the processes by which organisations persist over time. In systematic approaches, ideas like absorptive capacity are important, defined by Cohen & Levinthal (1990, p-128) as “the ability to recognize the value of new, external knowledge, assimilate it, and apply it to commercial ends” (see also Lane & Lubatkin 1998 and Van den Bosch, Volberda & de Boer 1999). The systematic approach was unsatisfactory for me, however, because it led back towards a focus on organisational characteristics as a predictor for take-up, and I had already seen the difficulties in doing this in previous literature. There seemed to me to be far more potential in taking an ecological approach to achieve a better understanding of the ‘dynamic interactions’ between organisations, in the form of engagement.

Any approach I was likely to use in interpreting the eIOS context, then, was likely to be ecological and include organisation level analysis. Having established this, I shifted my attention to look at what, in the evolutionary literature, constituted an organisation.

Aldrich (1979) defined organisations as goal directed, boundary maintaining and socially constructed systems of human activity. The goals can be coded formally or they can be implicit. The boundaries are socially constructed and distinguish members from non-members in the organisation. Following Nelson & Winter (1982), Aldrich & Ruef (2006, p-4) defined activity systems as ‘bounded and interdependent role behaviours – sets of routines and bundles of activities’. Differences between organisations can be explained in terms of differences between their goals, boundaries and the bundles of routines contained within them. Technological impacts on an organisation can also be explained in terms of changes to the roles and routines in organisational social systems (Barley 1990).

Following Levitt & March (1988) and Aldrich & Ruef (2006, p-4) routines can be defined as “forms, rules, procedures, conventions, strategies and technologies around which organisations are constructed and through which they operate”. Routines have been used as a unit of analysis for organisational change associated with customer service (Pentland 1992; Pentland & Reuter 1994). While routines are sometimes seen as sources of inertia (e.g. Shapira 1994), they have also been conceptualised as sources of variation. Feldman & Pentland (2003, p-115) noted that organisational routines can be sources of variety through their contingent and potentially contested nature because they are:

Produced by many people with different information, preferences, and interpretation, they are enacted over time and space, and they interact with other streams of action in such a way that it is not always clear where one organizational routine ends and another begins. For these reasons, organizational routines always have the potential for change.

Following March & Simon (1958), the rules and standard procedures that the people are following as they interact and go about their work need not be written down or formally specified but also include rules defined as cognitive regularities. Indeed, routines are interdependent with cognitive schemata (Aldrich & Ruef 2006; Miner 1994) in that people in organisations generalise from their experiences into knowledge structures (schemata) about people, roles and events (Howard 1994) and the adaptation of routines requires adaptation of the interdependent schemata for personnel involved in enacting those routines. Peters, Heng & Vet (2002, p-33), in their study of the evolution of IS

strategies, described successful IS strategies as when processes, procedures and rules became encoded and retained in organisational norms and standard procedures.

I would return to all of these descriptions of organisations, rules and procedures later, during the process of constructing my own coevolutionary interpretation of a system.

5.4 Coevolution

I now move on to my review of the literature that specifically relates to coevolution. As with evolution, I began again by looking at the basic principles as they were defined in the biological context. The discussion in this section, therefore, starts with those principles before progressing to the application of coevolution to organisations.

Much of the literature has been written from a positivist perspective, implying that systems coevolve according to rules or laws, and attempting to quantify and codify these laws using mathematical models. Levin & Lenski (1983) and May & Anderson (1983), for example, described dynamics of coevolution in biological settings using differential equations with variables such as population's density, absolute fitness, death rates and time, and McKelvey (1999a, 1999b) took a positivist approach in applying the theory to organisations. This was not the path I wished to take. As discussed in the methodology section earlier, I was following an interpretive approach. I did not seek to prove that trading partner engagement was the product of coevolutionary laws or rules and I had already observed that quantitative models of this phenomenon quickly ran into complexity problems that limited their value to practitioners. My goal was rather to use the literature and theory (positivist and interpretive alike) as a lens through which the process of engagement might be interpreted.

Coevolutionary theory builds on the principles of evolutionary theory to examine mutually interdependent evolutionary phenomena. It was first developed to help describe and explain natural ecological phenomena where species interact and affect one another's evolutionary outcomes. As Futuyma & Slatkin (1983) pointed out, the concept extends back as far as the idea of evolution itself. Although he did not coin the term, Charles Darwin explored the idea even as he set down his own ideas on natural selection:

A flower and a bee might slowly become, either simultaneously or one after the other, modified and adapted in the most perfect manner to each other (Darwin 1859 p-95).

The first scholarly use of the term ‘coevolution’ is ascribed to Erlich & Raven (1964) in their study of the evolutionary interaction between butterflies and plants.

All coevolutionary theory is based on the notion of mutual causality or reciprocity (Futuyma & Slatkin 1983). In nature, coevolution describes the situation where a trait in one species evolves in response to a trait in a second species, either directly or indirectly, and a reciprocal relationship exists where a trait in the second species evolves in response to a trait in the first. Care must be taken when applying the label ‘coevolution’: if systems do not display this reciprocity, or if only one of the traits is seen to evolve and the other is unchanging, the situation is effectively the same as studying an evolutionary response to a steady environmental factor. As Futuyma & Slatkin (1983, p-2) put it “Coevolution, too broadly defined, becomes equivalent to evolution”.

In biology, coevolutionary theory has been applied to a range of contexts including predator-prey relationships, competitor relationships and symbiotic relationships. Coevolutionary investigations have progressed from analysis of direct interactions between two species, such as between bees and flowers or wolves and deer, to more complex models taking into account multiple species and more complex, indirect interactions between those species. The former types have been distinguished as “pairwise” coevolution and the latter as “diffuse” coevolution (Futuyma & Slatkin 1983). In my context, and on the basis of my research so far, I saw relationships between initiators and trading partners as being symbiotic and of a pairwise, rather than diffuse type. Roughgarden (1983) subdivided symbiotic coevolutionary relationships as based on “parasitism if the guest exploits or harms the host, commensalism if the guest has little or no effect upon the host, or mutualism if both guest and host benefit from each other” (Roughgarden 1983, p-52). Reflecting on my own observations of eIOSs once again, most of the relationships appeared to me to be best characterised as mutualism, because initiators and trading partners found mutual benefit in doing business with one another, even if eIOSs themselves sometimes benefited initiators more than their trading partners.

Moving now from the biological roots of coevolution to literature applying coevolution in the organisational context, Lewin & Volberda (1999 p-526) summarised the key coevolutionary themes in the sociology, economics and organisational theoretical domains. In this, they set down the essential properties of coevolution in its application to strategy and organisations as:

Multilevelness—it has effects at multiple levels within and between firms and therefore may be considered at the community, population, organization and intra-organization levels;

Multidirectional causalities—with organizations, their parts and the environment all coevolving with one another;

Positive feedback—which describes a circularity or even recursive process by which interactions between systems mutually influence and reinforce changes in one another.

Nonlinearity—indeterminate feedback paths, sometimes leading to changes in one variable causing counterintuitive changes in another; and

Path and history dependence—where adaptation is dependent on the history and preceding characteristics of a population.

These properties, then, were those that had to be accommodated by any coevolutionary model that I borrowed from to interpret the eIOS context. Several of these properties were, of course, what had led me to coevolution in the first place. I had observed long histories of change and adaptation, interdependent changes across multiple organisations and the critical importance of feedback channels in eIOSs. At the same time, my thinking about the importance of feedback in the ten case studies was expanded at this point as I considered the circular nature of feedback described by Lewin & Volberda (1999). It seemed reasonable to consider the formal and informal feedback channels I had observed in my research as mechanisms facilitating circular feedback and allowing trading partners and initiators to cycle through variation-selection-retention events more easily.

One property that I had not considered previously was that of *multilevelness*. Most coevolutionary studies emphasised one level of analysis over others. Coevolutionary

theory has been applied at the population level, for example, to gain a better understanding of the relationships between entrepreneurial careers, institutional rules and competitive dynamics in the American film industry (Jones 2001); to analyse the emergence of new business models and organisational forms in the music industry (Huygens, Baden-Fuller, Van Den Bosch & Volberda 2001); to describe South East Asian family business groups as both a product and a source of their institutional environments (Carney & Gedajlovic 2002) and to analyse and compare trajectories in the fashion industry (Djelic & Ainamo 1999). Similarly, I anticipated that I would focus my own research at the organisation level. But the property of multilevelness articulated by Lewin & Volberda (1999) suggested combining levels of analysis as a way to provide a more complete picture of coevolution. Shapira (1994) advocated this approach, and Lewin & Koza (2001) also noted that coevolutionary frameworks incorporating multiple levels of analysis have the potential to explain both intra-organisational and macro-level evolutionary effects in one model.

Undertaking an analysis at multiple levels requires the consideration of a hierarchy of entities. A hierarchy of organisations, populations and communities was used by Rosenkopf & Tushman (1994) to analyse developments in machine tooling technology, AC versus DC power systems, and QWERTY versus Dvorak typewriter keyboards, and also used by Van De Ven & Grazman (1999) to examine the genealogies of health care organisations. Other hierarchies are also possible, however: the framework adopted by Van De Ven & Grazman (1999) was a nested hierarchy of managers within organisations within an industry.

All of this prompted me to ask myself if multilevelness was characteristic of eIOSs too. I began to tentatively think about eIOSs in hierarchical terms. In any given system, organisations were being asked to make changes to take advantage of new electronic systems and I could see that this could be broken down to changes asked of individual departments. Likewise, it seemed that organisations could be logically grouped together and examined as populations. Using case Epsilon as an example, construction companies, architectural firms, engineering firms and materials supply firms were being asked to use an e-commerce system for exchanging electronic documentation relating to construction projects. Many individual departments were impacted in these organisations including site offices, drawing offices, materials procurement, etc. At the

same time, these organisations came together as consortia (populations) and consortia, using different systems, interacted with each another in the construction industry (the community) I thus formulated a very tentative evolutionary hierarchy for case Epsilon which looked like Figure 2.

Level 1 (community)	Australian construction industry, made up of many consortia.
Level 2 (populations)	Project consortia for freeways, office towers, and other building projects, each made up of many organisations using a system.
Level 3 (organisations)	Individual construction companies, architectural firms, engineering firms, materials supply firms, etc, each made up of many departments.
Level 4 (departments)	Site office, drawing office, materials procurement, etc.

Figure 2: Tentative evolutionary hierarchy for case Epsilon

Later, as I developed my ideas, I was to completely revise how I thought about hierarchies in the eIOS context.

Returning to the coevolutionary literature, I found that various scholars had noted that different coevolutionary outcomes could be observed at different levels. Campbell (1994) and Baum (1999) described how evolution of entities at lower-levels can occur more rapidly than at higher levels, and noted that lower level trajectories can sometimes conflict with or undermine goals at higher levels in a phenomenon that Baum (1999) termed whole-part coevolutionary competition. Van De Ven & Grazman (1999) summarised the important implications of nested hierarchical perspectives, pointing out that they imply selection and adaptation processes can work simultaneously and differently at each level, that relationships between levels may be both positive and negative, and that we expect to see greater numbers of smaller variations at lower levels compared to higher levels. I was to return to these differences again later, when I conducted my own detailed interpretation of a system.

5.5 Coevolution and alliances

I found that a number of scholars had applied coevolutionary theory to alliances. These alliances, it has to be said, were not identical to the eIOS alliances of interest to me. The alliances studied by Koza & Lewin (1988; 1999) and Doz (1996), for example, were formed between very similar organisations (often direct competitors in the same

industry), whereas the e-commerce IOSs in my research were formed between dissimilar organisations that played complementary, co-dependent roles in industry (e.g. when they occupied adjacent positions in a supply-chain). The alliance literature also focused on organisations coming together and cooperating in various ways through social networks, whereas in my context the technological linkages between firms were of particular interest. I considered the literature relevant, however, because as e-commerce systems might be viewed as a by-product of inter-business collaboration and alliances, and I had already come across eIOSs being examined as an alliance process (e.g. Koch 2002).

Doz (1996) conducted longitudinal studies to analyse the evolution of cooperation in strategic alliances, a context that, like the eIOS context, requires managers to confront challenges in achieving common outcomes across organisations with different individual goals. He found that alliances were the product of both the implementation of initial designs toward set objectives, and emergent adaptations, and that successful alliance projects were highly evolutionary with many cycles of learning and adjustment (characterised by greater and greater adaptive flexibility and the willingness to make larger commitments). Failing projects, on the other hand, were highly inertial because learning was blocked by either initial conditions or by negative re-evaluation that lowered expectations and heightened suspicions between partners. Doz (1996) suggested that the early cooperation process in alliance development had a disproportionate impact on evolutionary processes and outcomes and, in the early phases, accomplishments in building quality into the cooperation process may be more important than the achievements in actual project outputs. He argued that early imprinting might help start alliances down an adaptive path with a better capacity to 'learn how to learn over a range of conditions' (Doz 1996, p-82).

Building on the earlier work on cooperative relationships by Ring & Van De Ven (1994) and strategic alliances by Doz (1996), a coevolutionary model for alliance formation in collaborative ventures was developed by Arino & de la Torre (1998) using a case study of a collaborative joint venture in the household products manufacturing industry. They proposed that alliance evolution consists of sequences of (re)negotiation, commitment and execution stages, and concluded that positive feedback loops are critical in the evolutionary process (negative loops lead to failure of the

collaboration) and relationship quality is both an outcome and a mediating variable (i.e. it should be considered as both an input to the success of the venture and an output of the interactions between partners). Like Doz (1996), they argued that procedural issues are critical from the start to foster a climate for positive reinforcement to build mutual trust and confidence.

The findings of Doz (1996) and Arino & de la Torre (1998) that early processes are critical reminded me of what I had seen in my own research. I had observed circumstances where trading partners trying out a system had encountered apparently minor performance problems, for example, but the poor response of the initiator had left a negative impression that lasted long after the performance had been fixed. I had also observed situations where it had been helpful to break down projects so that only small changes were requested in the early phases of engagement.

This work also reinforced to me the potential for coevolutionary theory to get past the focus on initial conditions that dominated e-commerce and IOS literature by describing developments post-commencement of a project. Doz (1996) employed the theory for the same reasons, noting the deterministic bias and lack of research on the process dynamics of alliances versus the abundance of research on initial conditions and early alliance formation.

Koza & Lewin (1998, 1999) applied coevolutionary theory to improving the understanding of how alliances form and dissolve. They characterised alliances on the basis of having, at any one time, either exploration or exploitation objectives, and advanced a coevolutionary model for the evolution of the alliance as a function of both the evolution of the firm's adaptation strategy and the attributes of the alliance itself (Koza & Lewin 1998). They argued that firm strategy and strategic intent for alliances coevolve with changes in the competitive, technological and institutional environment of the firm. As the strategy evolves, the intent of the alliance changes. In a case study of the Nexia alliance network in the public accounting industry, Koza & Lewin (1999) argued that Nexia could be explained in terms of absorptive capacity, identification, and control in the coevolution between the network and its environment. The idea that strategy and strategic intent coevolve with the environment of the firm paralleled my observation that, in many of the eIOS cases, the purpose of the system was extensively

revised over time so that the final system and its objectives sometimes bore no resemblance to what had originally been proposed.

5.6 Coevolution and technological innovation

The literature also demonstrated that coevolution was already useful in understanding how and when organisations adopt new technological innovations. This was particularly important as eIOSs, of course, were very much about technological innovation. In particular, coevolution had been used by many scholars to resolve the two contrasting perspectives that technological change drives organisational and community change, and organisational and community change drives technological change, by suggesting that both of these processes apply (Nelson 1994; Van De Ven & Garud 1989; Rosenkopf & Tushman 1994; Rosenkopf & Tushman 1998).

Most of these studies were focussed at the population level of analysis. Examples of population level studies of the coevolution of technology and organisations include a study by Barnett (1990) of organisational mortality in the early American telephone industry and another by Tushman & Anderson (1986) investigating the impact of technological breakthroughs on environmental conditions in the minicomputer, cement, and airline industries. The small number of studies undertaken at the organisation level focussed on coevolution between information systems and organisations, and most particularly the notion that IS planning evolves over time, with little application of formal planning methods (e.g. Galliers 1993; Yetton, Johnston & Craig 1994; Peters, Heng & Vet 2002). Yetton, Johnston & Craig (1994) studied an architectural firm where design and architecture information systems were updated, finding that the business strategy was an outcome rather than a driver of change, with the change process emerging incrementally, on a project-by-project basis. Kay & Cecez-Kecmanovic (2001) examined the effect of an information system implementation on a company, and the company on the information system in order to provide a deeper understanding of processes that underpin the resulting competitive advantages. Peters, Heng & Vet (2002) studied the evolution of an IS strategy within a leasing company and found the IS and organisational change coevolved, without the adoption of formal strategies or planning methods. As with the alliance literature beforehand, each of these studies again served to reinforce my own observations that the purpose and direction of eIOSs changed over the course of their histories.

Rosenkopf & Tushman (1988) used a combination of population and organisation level analysis to explore how interorganisational communities coevolved with technology in the flight simulation industry. The organisational communities of interest were the technical committees, task forces and standards bodies influencing the selection of flight simulator technologies, which they called cooperative technical organisations (CTOs). Rosenkopf & Tushman (1998) argued that technological uncertainty plays a key role in determining modes of technological and organisational evolution: in years of ferment, high technological uncertainty sees evolution defined by social construction (where new members move into CTOs and new community networks form). In years of incremental change, low technological uncertainty engenders technological determinism. Periods of incremental change follow after the establishment of a dominant design – a specific path, along an industry’s design hierarchy, which establishes dominance among competing design paths (Utterback & Suarez 1993). Rosenkopf & Tushman (1988, p-12) noted that for “nonassembled or simple assembled products...the locus of innovation remains within firms, and the influence of socio-political dynamics on the process is minimal” but that community based selection processes are more prevalent “for systemic technologies, where multiple, independent components are linked via sophisticated interfaces to create the end product”. In viewing flight simulators as systems of interdependent components, Rosenkopf & Tushman (1998, p-14) found that:

While the evolution of each component can be discussed separately, these paths are interdependent, as progress in one component can enable or retard progress in other components.

This description of flight simulators as a systemic technology made up of interdependent components linked via interfaces was striking to me, because precisely the same words could be used to describe an e-commerce IOS. Additionally, the consideration of communities, with evolution shaped by multi-organisational selection processes, appeared highly relevant to the eIOS context where selection decisions were also made by many managers spanning multiple initiator and trading partner organisations. I would return to their ideas later, when I sought to clarify my own interpretations about coevolution in the eIOS context.

I encountered a different approach in the work of Van de Ven & Garud (1994), who studied coevolution of technical and institutional events and characterised different phases in the evolution of an innovation (cochlear implants) by the type of evolutionary events that dominated. They interpreted the variation-selection-retention sequence in terms of novel technical events (a variation process where the event did not make or follow institutional rules), rule-making events (a selection process, evident if the event had the effect of creating or modifying institutional rules or routines) and rule-following events (a retention process, indicated if the event was programmed or governed by existing institutional routines or rules).

Also unique was the approach of Rosenkopf & Nerkar (1999), who proposed a three level analysis for technological coevolution where, instead of using organisations, populations and communities, they selected and defined levels around the technology, analysing the evolution of optical disc technology using a system level, a product level and a component level. They built their analysis around a framework that accommodated all of the properties of multilevelness, multidirectional causalities, positive feedback loops, nonlinearity and path and history dependence (Lewin & Volberda 1999) and, like Rosenkopf & Tushman (1998), they placed an emphasis on communities as selection entities, with many actors involved in shaping developments.

I now describe the concepts outlined in the Rosenkopf & Nerkar (1999) framework in detail and my rationale for selecting it as a lens through which to conduct my own coevolutionary interpretation.

5.7 The Rosenkopf & Nerkar framework for technological evolution

Noting that most studies of technological evolution are undertaken without regard for interdependence between multiple components, Rosenkopf & Nerkar (1999) used the case of optical disc technologies and drew on patent data, as well as anecdotal reports drawn from books, journals and press articles, to plot the development of knowledge increments, products and standards in the optical disc industry, and hence to derive a framework to help describe the complexity of technological evolution. They sought to demonstrate that simultaneously considering coevolution within and across levels of a product hierarchy (that of optical disc drives) provided a better understanding of the

process of technological evolution. Their framework was built around a three-level product hierarchy consisting of components, products and systems of use. Each product was viewed as a system of components, and products were in turn organised into systems of use (see Figure 3).

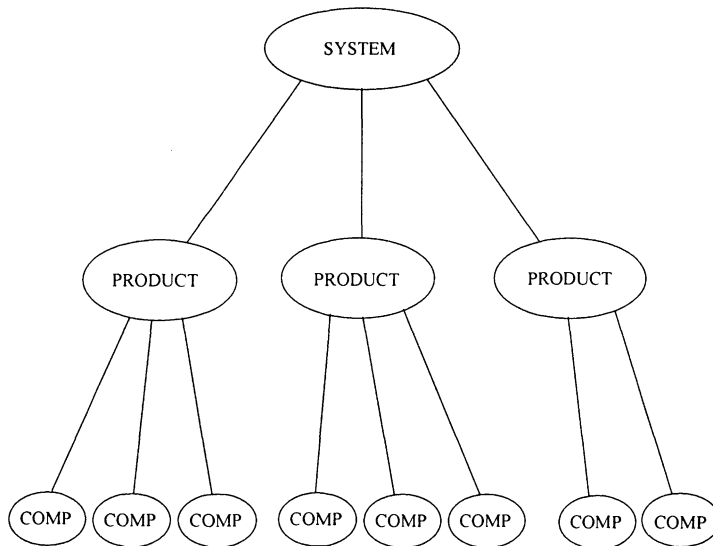


Figure 3: Product hierarchy for technological evolution

[From Rosenkopf & Nerkar (1999, p-170)]

I now summarise the key elements of the framework as they were described in their 1999 paper.

Components

Component technologies in the optical disc industry include optical servo units, optical storage technologies, polycarbonate discs, lasers, optical pickups, digital signal processors, and transducers. For each component technology an evolutionary trajectory can be identified, and a broad community of organisational actors including manufacturers, laboratories, universities, governmental and military bodies produce variations. These are termed component-specific communities. Some actors are involved in many of these communities while others will be involved in only one.

The component, then, is the most granular unit of analysis for technological evolution for Rosenkopf & Nerkar. It represents the smallest unit worth examining in order to

effectively represent the process and forms the basic building block for entities at higher levels.

Products

The two principle types of products in the optical disc industry are storage discs and players for retrieval and output. Product manufacturers select component technologies and bundle them into products. The locus of product-level variations rests at the firm level, in how manufacturers such as Sony and Philips/Matsushita select and bundle components. Firm-level selection and bundling of components produces variation at the product level. This variation is maintained because of path-dependent processes of exploration and exploitation (March 1991). Because products are composed of multiple components, interdependence between components strongly affects the evolution of products, and multiple component-specific communities are involved in the technological evolution of any given product.

Products, then, are seen by Rosenkopf & Nerkar as the logical assemblies of technological components, and these assemblies can easily take on other forms in other contexts. If we looked at the automotive industry context, for example, the obvious products would be different models of car, assembled from technological components by companies such as Ford and Toyota.

Systems

Products are coordinated into systems of use. In the case of the optical disc industry, storage discs and players are combined to form systems in this way. Standards—in the optical disc industry format standards such as compact disc (CD) and digital versatile disc (DVD)—are the most obvious markers of system level evolution. Convergence on a standard takes time, and when it occurs system-level evolution tends to become incremental. Thus system-level evolution tends to occur as a process of punctuated equilibrium. System selection is accomplished through the coordinated activity of a broad community of actors (in a similar manner to component level selection) termed the system-level community. In the optical disc industry these communities comprise coalitions of firms supporting various systems. Systems of use are shaped as products

are applied in the environment, and as various communities promote standardised practices.

Standards and dominant designs are an important way of marking system evolution for Rosenkopf & Nerkar, and this idea may once again be easily adapted to other technology-centric contexts. Returning to the automotive example, convergence on standards might be demonstrated by the classic four wheel configuration and the standardisation on the colour orange for turning indicators.

Coevolution

Variation, selection and retention processes operate simultaneously at each of the three levels and interdependent technological entities coevolve *within* each level of the hierarchy (within-level coevolution). Bundling and coordination of components means that developments in some components spur developments in others. Similarly, product innovations spur innovations in other products that they are bundled with in systems. Sometimes reverse salients occur (Hughes 1983) when one component lags development of other components in a product, leading firms to focus on overcoming the bottleneck. In the optical drive industry, CD storage capacity lagged laser and optical reader components and held back progress for optical drive products.

Variation, selection and retention processes interact *between* levels in the hierarchy, with evolution at one level causing evolution across other levels (cross-level coevolution). Downward causation occurs where the selection of higher level entities produces selection events in lower-level entities as well. Thus components do not just follow trajectories shaped by component-level forces, but are also influenced by forces operating at higher levels, such as firm-level decisions regarding the bundling of components (e.g. the evolution of laser and servo components may be influenced by the choices made by Sony about the way it builds its CD drives). Products are also influenced by system-level forces such as ties between firms, and competing coalitions. Whole-part coevolutionary competition occurs when evolutionary outcomes at different levels undermine, rather than complement, one another. In the optical drive industry, the Digital Audio Disc Council was unable to agree on standard industry format because different approaches were supported by coalitions only interested in promoting their

own technologies, and hence their own well being. The system-level problem of converging on a standard was thus compromised.

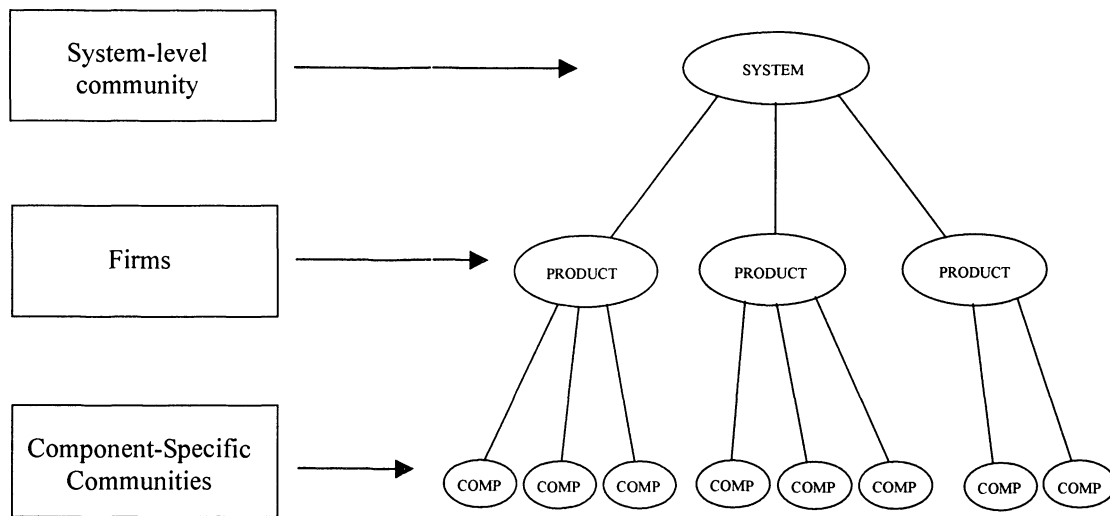


Figure 4: Selection entities and the product hierarchy for technological evolution

[From Rosenkopf & Nerkar (1999, p-172)]

Based on this framework, models for technological coevolution should consider both the hierarchical nature of components, products and systems and the organisational hierarchy of component-specific communities, firms and the system-level community (see Figure 4) that generates selection pressures.

Advantages of the Rosenkopf & Nerkar framework

Rosenkopf & Nerkar's (1999) sharper focus in the technology was both unique in the coevolutionary literature and particularly striking to me, for it seemed to offer a way to maintain my focus on the eIOS. The technological focus also seemed to make the framework more adaptable. The same concepts could be applied independently of whether the system spanned an organisation, a population of organisations, or a community of populations. I was encouraged by the fact that other scholars had successfully adapted the framework to different organisational/technological contexts. Jenkins & Floyd (2001) borrowed from it to describe the coevolutionary processes taking place within and between firms in the Formula 1 racing industry, and the

framework was adapted by Kay & Cecez-Kecmanovic (forthcoming) to propose a socio-technical framework for coevolution between information systems and organisations.

The value of this approach was also reinforced to me by IS researchers who had highlighted the multi-level nature of information systems. Sage & Cuppan (2001, p-326), for example, argued that modern information systems are best described as “systems of systems” and are characterised by evolutionary development and “emergent behaviours” that are properties of the entire system but that “do not reside in any component system”. Just as groups of organisations that create linkages and network relationships with one another can be conceptualised as an entirely new ‘network’ form of organisation (Powell 1990; DiMaggio 2001), so too connected information systems may readily be conceptualised as creating a new system. Reimers, Li & Chen (2004) similarly suggested that because B2B electronic commerce involves increasing levels of information systems externalisation, development strategies also require a multi-level approach. At this point I began to shift my thinking away from the hierarchy I had conceptualised earlier (see Figure 2) and to lean towards a hierarchy based on the notion of a system of components or subsystems.

For all of these reasons, the Rosenkopf & Nerkar (1999) framework appeared to offer an especially suitable template for me to borrow from as I attempted to interpret events in the eIOS context.

5.8 Summary

The review of the coevolutionary literature reinforced the potential of this theoretical perspective to produce a meaningful model for the engagement of trading partners in interorganisational e-commerce systems. It had already proved a useful lens for understanding organisational adoption of technological innovations and the formation of alliances, and it offered advantages in getting past the focus on initial conditions, extending to engagement beyond just initial adoption decisions, accommodating both intentional and chance-based events, and accounting for social and economic forces together. I found that I was able to tentatively conceptualise systems I had researched in coevolutionary terms.

During this review I did not find a model that directly applied to the eIOS context, but I did identify a promising perspective that appeared to be readily adaptable to my context. The Rosenkopf & Nerkar (1999) framework was built around technological coevolution, placed an emphasis on communities where multiple actors were involved in shaping developments, and at the same time accommodated all of the coevolutionary properties of multilevelness, multidirectional causalities, positive feedback loops, nonlinearity, and path and history dependence.

My next step would be to find out whether this framework, or an adaptation of it, could be usefully applied to phenomena in an eIOS context. At this stage my goals could be translated into a search for answers to the following questions:

Can the events that take place in the creation, acceptance and take-up of an eIOS be interpreted in coevolutionary terms? If so, what does the resulting framework suggest with respect to strategies that might facilitate take-up of an eIOS?

In the next research phase, which I labelled “Phase II” to distinguish it from the initial study across ten eIOS cases, I decided to answer these questions by revisiting one of the case studies I had already conducted, and to attempt to build a detailed coevolutionary interpretation of an operational eIOS.

6. Coevolutionary interpretation of case Omicron

6.1 Overview

This Chapter describes my interpretation of the Omicron case in coevolutionary terms. A discussion of the research method, sample selection, data collection, analysis and interpretation is found in Chapter 2. I begin here with some additional notes on the sequence of interpretive steps that I took in this part of the journey. A site description is then presented (Section 6.2), followed by a history of the project and the formation of the eIOS between Omicron and its distributors (Section 6.3). The major part of the chapter (Section 6.4) deals with the interpretation itself, and the induction of the eIOS coevolutionary framework. The findings are summarised in Section 6.5.

The interpretive process for Omicron was highly iterative. The content of this Chapter was developed in four major drafts, each of which involved many re-writes of individual sections. The actor observations and descriptions were drawn from the extensive transcripts and notes generated from interviews with a selection of those actors (see Chapter 2 for discussion of data collection). As in Phase I, the interpretation process was a double hermeneutic cycle drawing upon this textual data. This time, however, several other sources were also part of the interpretive process. The most important of these was the interpretation of technological evolution offered by the Rosenkopf & Nerkar (1999) framework and my earlier interpretation of data from the Phase I research.

Before I began to write my interpretation I did some preparatory analysis. Part of this involved writing up the case history, but I also produced a summary table of key events from the history (see Appendix F). I used the table in a first attempt to break down events by variation, selection and retention types. Separately, I made a first attempt to list the important components in the Omicron system. I then transferred the components, and the variation, selection and retention events, onto separate squares of paper which I organised into sequences and relationships by pinning them to a corkboard. My first draft was written with the aid of this board. I also made and modified hand-drawn diagrams throughout the interpretive process to help clarify my ideas. Some of these diagrams have been incorporated into the discussion.

I placed my initial emphasis on defining a hierarchy that offered a reasonable description of the key elements or components of the e-commerce system. My focus then shifted to evolutionary and coevolutionary processes (how were things evolving, why were they evolving and who was driving it) before coming back to the components again in a cycle that repeated several times.

Successive drafts were written with extensive referrals back to the original interview transcripts and to the Rosenkopf & Nerkar (1999) framework. As I developed each element of the framework I also reflected on its applicability to the other Phase I cases in a mental test of generalisability. During this process I found aspects of the coevolutionary model developed by Kay & Cecez-Kecmanovic (2001), and expanded upon in an unpublished manuscript (Kay & Cecez-Kecmanovic, forthcoming), to be relevant in parts of the eIOS interpretation. Frequent discussions were held with one of the authors (Kay), who also acted as a supervisor for this thesis, to clarify aspects of this work and to discuss coevolutionary themes as they developed in the eIOS interpretation.

Before writing the final draft, I reviewed the coevolutionary literature again to include references to new publications on organisational evolution (in particular Aldrich & Ruef 2006) as a final effort to ensure the interpretation was logically consistent with established theory.

6.2 Site description

Omicron Australia Pty Ltd (Omicron) is a manufacturer of industrial cleaning equipment including machinery, protective clothing, respirators and safety harnesses. It is a wholly-owned subsidiary of Omicron Cleaning Company⁹, a multinational that is headquartered in the United States and operates in 25 countries. The country headquarters and main office is located in the western suburbs of Sydney, with additional sales offices located in each of the State capitals. Omicron is a medium sized company of 204 employees with a turnover of approximately AUD 90 million per annum. The bulk of this revenue is through sales inside Australia, but approximately 20 percent of sales are exported to other Omicron subsidiaries in the Asia/Pacific region.

⁹ Generic identifiers have been substituted for company and product names throughout the discussion (e.g. “Omicron”, “EBI Services”, “E-Shop”) to preserve anonymity.

Growth in revenues has been strong in recent years: four years ago turnover was approximately AUD 50 million per annum, and it is expected to grow by another AUD 5-10 million in the next financial year.

Approximately 40 percent of Omicron's products are manufactured by its own factory, also located in the western suburbs of Sydney. Approximately 60 percent of its products are imported from suppliers in Europe, Asia and the United States. Omicron contracts an expeditor to handle imports from all of these suppliers, including the clearance of customs and claiming back import duties on products that are re-exported.

The company is structured into the following principal departments: production, marketing, sales, customer service, warehouse and finance. More than half the staff are employed in production, which operates as a self contained business unit and is located in its own factory facility several kilometres from the head office. The sales department has approximately 40 staff, customer service has 8, marketing has 7, and the warehouse has 15 staff. Omicron has managed to achieve its recent revenue growth without increasing the staff levels, which have remained stable for two years. The IT department is relatively small and consists of the IT Manager and two other employees. Historically, Omicron has been heavily dependent on technology providers to help implement and maintain its information systems. The most senior managers in the organisation are the Chief Executive Officer (CEO), Chief Operations Officer (COO) and Chief Financial Officer (CFO).

Approximately 85 percent of Omicron's Australian sales are indirect, reaching end-users via a network of distributors. The distributors are independent organisations that sell to commercial and government customers around Australia. Distributors are geographically spread around the country to achieve adequate sales coverage across all markets in all States. Each one has its own independent business objectives: almost all sell products from competing manufacturers of cleaning equipment and they are not contractually obliged to sell Omicron equipment over other brands. Some of them are specialists in cleaning equipment and others sell cleaning equipment as part of a range of industrial products. Distributors do not do maintenance or servicing of Omicron equipment themselves, but many of them notify end-users when maintenance is due on specialised equipment they have purchased, and then arrange the servicing with Omicron on behalf of the end-user. Omicron's distributor database contains

approximately 900 organisations, but most of the business goes through about 180 of these. Omicron has three large distributors that collectively account for approximately 30 percent of indirect-sales turnover, but the bulk of its distributors are small businesses (collectively accounting for 70 percent of indirect-sales turnover).

Omicron sells directly to only a few very large organisations in the public sector. These buy equipment in very large volumes and unit prices must be reduced to a bare minimum to win these contracts, leaving no room for a distributor margin. Approximately 15 percent of sales are made directly to end-users of Omicron's cleaning equipment.

Omicron also offers fee-based maintenance services on the specialised items of equipment it sells. Omicron provides these services both via its distributors, to help them support their customers, and directly to end-user organisations. Equipment is returned to Omicron for servicing where it is checked over and refurbished before being sent back to the customer.

6.3 History of the eIOS

The origins of the eIOS can be traced back to 1998. The dot-com boom was well in its ascendancy, and exploring Internet-driven opportunities was a prominent aspect of business thinking in every industry sector. Omicron was no different, and senior managers in the company were acutely aware that e-commerce could either give Omicron a competitive advantage, or hurt Omicron if its competitors managed to move first.

In 1998, Omicron's distributors sent the bulk of their orders in by fax or by telephone. A small proportion of orders also came in as hand-written entries made in the order books carried by Omicron sales representatives as they moved about visiting distributors. All of these orders were then keyed into Omicron's computer systems by hand. Omicron began its first steps to move transactions with customers (distributors of its cleaning equipment) away from fax and telephone-based processes to more highly automated Internet-based channels in the fourth quarter of 1998. This move was initiated by Omicron Australia without any involvement from the parent company in the United States.

The CFO was the first champion of this move, and was motivated by the opportunity he saw in harnessing new technology to improve the efficiency, and thus the profitability, of Omicron's operations. The event or catalyst that made him act on these beliefs was a lunch he attended with a friend that worked in the IT industry, where e-commerce developments in other industries were discussed in some depth. Shortly after this event, the CFO briefed Omicron's CEO on his ideas and the CEO became a supporter. They selected as their initial objectives improving the inbound ordering process at Omicron. Getting orders in electronically was seen as a way to produce significant savings by cutting down the manual workload (especially keying-in of orders received by fax and telephone) of Omicron staff. As the CFO described it:

The real issue for me wasn't getting stuff out of this place, it was getting the orders in, and that was where I was going to have the biggest saving in this particular organisation—getting the orders in here electronically.

Having decided on this course, the CFO began to look for packaged software that might be suitable for Omicron's purposes and initiated discussions with an IT company (E-Shop). The E-Shop solution looked promising and provided strong capabilities around online sales functions. Based on E-Shop's recommendations, Omicron decided to combine some of its marketing and ordering functions online, and the first system Omicron tried was effectively a collection of Web pages set up for its distributors in a single online shopping mall for cleaning equipment. Omicron distributors could advertise products at their own retail prices on the individual Web pages within the mall, and could take orders online from end-users (companies buying cleaning equipment from Omicron's distributors). The orders taken via the Web would then flow electronically back to Omicron's systems, eliminating the need to manually key-in orders. Omicron developed a pilot system along these lines (henceforth named in this discussion as OM-0) in late 1998.

Distributors were then invited to participate in OM-0, but all that were invited rejected the concept. What had seemed attractive to Omicron was in fact unappealing to its distributors. The primary issue was that Omicron's distributors also distributed products supplied by other cleaning equipment manufacturers and wanted to sell these through the same shop front. On the one hand Omicron did not want its site used for selling equipment from competitors, but on the other hand distributors saw no advantage in

having to maintain one site for their Omicron product sales, and other sites for other brands. As one respondent recalled:

[Distributor] wanted to sell gear from [Competitor] as well as ours, as we said “shit, if we put you up in an online shop, we don’t want you advertising [Competitor]” but he says “Its part of my business and it’s bigger than yours!”

At the same time that OM-0 was shown to distributors it was also canvassed with purchasing officers for end-user organisations. They did not express any enthusiasm either, indicating that they did not see much benefit in navigating their way to many distributor Web pages in an online mall to do their buying of Omicron products. The OM-0 concept was consequently dropped as unworkable in early 1999.

Discussions were then held between Omicron management and EBI Services, an e-commerce software development company. EBI Services was known to Omicron because it had some years previously (before moving its focus to e-commerce software) undertaken minor software development work for the customer service department. A number of concepts were reviewed before the decision was taken to implement an e-commerce software module named in this discussion as OM-1. OM-1 was designed to be installed at the distributor site to route orders electronically between distributors and Omicron’s financial systems. Omicron’s initial approaches with OM-1 were to its very large distributors because they each conducted high volumes of business and they were seen by the CEO as strategic. As one respondent said:

Our CEO got stuck into it and said “Hey, our biggest customer is [Company], so we want to do it with [Company].

OM-1 was installed with one of these distributors in the first quarter of 2002. The installation process took more time and money than expected because OM-1 had to be customised to accommodate the requirements of the distributor, but it was eventually completed and the distributor purchasing staff were using it by the third quarter of 2002.

In the same quarter, Omicron began implementing OM-1 with a second large distributor. On this occasion a more significant effort had to be made to accommodate the distributor, where the management wanted to preserve existing procedures within their organisation as much as possible. This initiative turned out to be much more difficult than anticipated, requiring even more extensive customisation of OM-1. This

began to get very expensive and in late 2002 it was suspended until such time as system modifications could be introduced at acceptable cost to accommodate the distributor's specific requirements. It was never restarted and no more development was ever put into OM-1. Looking back on it, a respondent commented that:

It was too complex and it really was to our detriment, it really was. Eventually we weren't prepared to put any more resources into it to fix it. [EBI Services] were getting run off their feet. So we let it go for a while and then we just closed it down and went back to getting orders the old way.

In mid-2003, Omicron's e-commerce efforts were redirected to small distributors. Part of the rationale for this was that, collectively, small distributors accounted for the bulk of indirect sales, so if a large enough slice of these transactions could be automated it could produce a cumulative benefit at least as significant as securing a few large distributors. The main catalyst for the switch, however, was the demonstration of a prototype e-commerce solution (OM-2) that EBI Services had been working on for some time before it established a relationship with Omicron. OM-2 was a software module designed to be installed at the trading partner site to facilitate many of the functions of OM-1, but promised to be of much lower cost and complexity to install, enhancing its suitability for installation in smaller organisations. One respondent described his reaction to a demonstration of OM-2

They had designed something called OM-2, which to me, I reckon was just the 'Ants Pants'. I loved it. It was an eye popper.

A new customer service manager started at Omicron in July 2003, and shortly afterwards, because of his strong technical and business skills, and also the personal interest he had shown in the project, he was asked by the CFO to take overall responsibility for progressing e-business developments and getting more distributors on board. Although the project was still progressing before he was hired, respondents would later look back on his arrival as an important factor in its overall success, because of the energy and commitment he brought to the project.

In mid-2003, work on an export documentation system was completed. This had been undertaken independently of the work on OM-1 and OM-2. Omicron had asked EBI Services to develop this enhancement so export documentation could be printed

automatically. Existing manual processes had been overloading staff and producing too many errors. A particularly common error was a mismatch between which part of the shipment was packed in which boxes, with the consequence that recipients would become confused when labels did not match up with the contents of boxes.

The enhancement allowed Omicron to change the responsibilities for a staff member from full time administering of the production of export shipping documents to doing this part time and taking on new service responsibilities handling export-related queries. Labelling errors were reduced significantly and the four-day delay associated with most export orders was replaced by same day shipments for 98 percent of export orders. These positive outcomes reinforced the enthusiasm of Omicron management for pursuing its e-commerce agenda:

[Manager] says that we were able to handle about six times the number of export orders with about a quarter of the man-hours. It really was brilliant.

The OM-2 software module was completed by EBI Services, and launched to Omicron distributors, in April 2004. It provided the user with current Omicron part numbers and price lists, which were updated each night and downloaded to the trading partner when they next logged on. Users entered their orders into OM-2 and these were transmitted electronically into Omicron's financial systems.

Only three distributors agreed to take up OM-2, far fewer than anticipated. A fundamental objection of distributor purchasing officers was they had to enter their orders twice: once into their own financial system and a second time into OM-2 itself. For distributors that did not take up OM-2, this need to re-key orders was the main reason. For those that did take it up, the need to re-key orders led them to use it freely for receiving parts and pricing information, but to limit their use of it for placing orders.

An enhancement was then developed which provided connectivity between OM-2 and the distributor financial system. Orders entered into OM-2 would be sent electronically to the financial system to avoid re-keying. Omicron offered to pay for this connection to be built for each distributor to make things as easy as possible for its trading partners.

The connectivity to financial software was well received by distributors, but take-up was still slow. Distributor purchasing officers had now found the solution to the re-keying issue to be unsatisfactory. Ideally, they wanted the purchase order to be

generated by their own financial system first, and transmission of the purchase order into OM-2 to happen second, not the other way around as implemented now. This was important to them because other internal accounting procedures depended on all purchase order numbers being of a consistent format and sequence. As an Omicron respondent summarised:

We said to them, 'we're going to send you OM-2' and we did...but the customers weren't using it because they still needed to generate a purchase order in their system, and it wouldn't generate a purchase order for their system...they wanted not to key the orders twice.

In December 2004, after spending time onsite with distributors to learn more about their procedural requirements, EBI Services and Omicron began development on an enhancement to OM-2 to address the problem in the way purchase order numbers were generated.

At about this time, there was a realisation that the project was also experiencing delays because IT management was not motivated to progress the system. The cause of this was traced back to resentment over previous decisions to outsource development of the system to EBI Services instead of building it in-house. A respondent described the effect:

There is resistance, there is "I don't want to do that because my personal agenda is not in line with the technology goal".

Attempts to move the project up the list of priorities for IT department were unsuccessful.

In 2005, at the request of the CFO and customer service manager, the CEO began to take a more direct role in the project and began personally reinforcing the status and importance of the project to all managers at Omicron. As a consequence, the IT department became more responsive to change requests from other departments. At this time a change of strategy was also tried with the customer service manager accompanying sales representative on their visits to distributors to demonstrate the system. Sales representatives were not spending time learning how to promote the system and were often unable to answer questions put to them by distributor personnel. The accompanied visits had a positive effect on take-up.

[Name] understands how they work and is very good with them. And he started selling it. He started doing visits to our customers and all of a sudden our customers started saying “well, hell, where is this coming from?”

During this time OM-2 was also improved to provide electronic purchase order acknowledgements, advanced shipping notices, backorder and inventory information.

By April 2005, approximately 10 distributors were using OM-2. Several of these had begun taking the backorder status information they now had access to from Omicron and providing it to their own customers as a way to enhance their own service. This was soon followed by the provision of Omicron inventory information to customers as well.

In May 2005, an enhanced version of OM-2 was completed that addressed the way in which purchase order numbers were generated. The OM-2 module could now connect to the distributor’s financial software package such that, when an order was placed, it was routed first into the distributor’s financial system. The purchase order number subsequently generated by the financial system was then collected and routed back into OM-2 so as to preserve numbering consistency. OM-2 was now renamed OM-3 to differentiate the enhanced module from previous versions. At this time, Omicron had 12 of its distributors using OM-2 and was receiving 7 percent of all orders electronically an outcome that was already producing tangible benefits to Omicron through reduced call loads at the Customer Service Centre.

In June 2005, within a week of going out to distributors to promote OM-3, 9 more distributors indicated they would adopt the system. This was a dramatic improvement in engagement. Following these successes, development work was approved for a new series of enhancements that had been proposed by various staff working in different departments. The proposals included adapting existing software for tracking equipment returned to Omicron for maintenance so it could generate electronic service quotes and work-orders when equipment fell due for maintenance; electronic procedures for returning goods and generating credit notes; electronic transmission of export control numbers to the Australian Customs Service; and the ability to reflect special pricing deals negotiated by individual distributors with their Omicron sales representatives.

Omicron management were now seeing e-commerce as providing benefits of a more strategic nature than just efficient processes. As one respondent put it:

We believe that the easier we make it for customers to buy off us, the more likely they are to stay with us.

Similarly, distributors were beginning to see deeper benefits as well, especially in the form of enhanced electronic services that they could now offer to their own customers. As one distributor respondent noted:

It benefits us being able to delve into their [Omicron's] store and say, well we are not going to get that. We are putting in processes at the present time where we can go back to our customers and say "you are not going to get those safety spectacles or those gloves", or whatever the case might be.

The addition of a feature that would enable distributors to access a cleaning equipment knowledge base through OM-3 was also considered. Preliminary investigations were begun into content management solutions and the practicalities of maintaining richer information (audio and video media clips, detailed usage and use-scenario instructions, lookup tables for what filters should be used with what hazardous chemicals, etc) on Omicron's product portfolio. A decision was then taken to postpone development until more comprehensive content management strategy could be developed at Omicron's US head office, where it was found that much of this information was generated.

In July 2005, Omicron was able to re-allocate one of its customer service team to making outbound calls to distributors to discuss backorder issues, to suggest options and alternatives when stock was unavailable, and to provide information on new products and price deals. This was made possible by a reduction in ordering errors and inbound calls from distributors for querying and error reporting. Less time was being expended by Omicron customer service staff on corrections or returns when the wrong items were shipped, and on credit notes when the wrong prices were charged. Other staff responsibilities in the department were also altered so more of their time was allocated to outbound, higher value activities.

Also at this time, some of Omicron's distributors began approaching other manufacturers of cleaning equipment asking them to consider altering their trading procedures to work through OM-3. They valued the faster ordering, richer information

and reduction in errors that OM-3 delivered to them and now wanted other manufacturers to offer the same services electronically.

In October 2005, it had been announced by the parent company that all Omicron subsidiaries would be moving to a new enterprise resource planning software package, ERP-2 in February 2007. ERP-1, the system currently in use, had now been in place for 13 years and was being stretched to the limits of its capabilities because of Omicron's growth over this period. Additionally, the company that supplied ERP-1 was in decline and no longer providing adequate levels of support and development for its product. The ERP-2 package was known to also include an equipment servicing module, so Omicron Australia stopped work on the service module it was developing lest it duplicate something it would be getting by default.

By November 2005, 30 distributors had taken up OM-3.

During the first quarter of 2006, the warehouse manager and CFO proposed that OM-3 be used to help reduce excess inventory in the warehouse. Omicron carried approximately \$20 million worth of inventory at any given time, and the CFO estimated that this was probably \$6 million more than necessary, due to the amount of 'dead product lines' (i.e. lines that were no longer selling) that were kept in stock. They proposed a modification to OM-3 so that distributor purchasing officers would be prompted with daily special clearance promotions every time they logged on. EBI Services confirmed that the modification could readily be made, but Omicron's product managers refused to provide assistance because clearance promotions (which would necessarily involve sharply reduced prices) threatened to make it harder for them to meet their immediate revenue targets. An approach was made to the Marketing Manager but was met with a similar lack of support, for the same reason. The warehouse manager and CFO decided it would be too hard to push through the proposed enhancement and dropped it for the time being.

In April 2006, head office announced that the ERP-2 system, which had been scheduled for roll-out in February 2007, would be postponed for an additional 6-12 months, with roll-outs to commence in the smallest subsidiaries first to iron out the problems. Omicron Australia could now expect to commence its rollout around June 2008. Separately, Omicron had conducted its own research into ERP-2 during the first quarter

of 2006 and found that did not offer all the functionality Omicron management wanted in the equipment servicing module. Based on these events, Omicron then recommenced work on the service module. Shortly afterwards it was decided to expand the module into a version that could be installed by very large customers that purchased directly from Omicron. The sales manager proposed this as a way to increase maintenance sales with users that purchased the biggest volumes of equipment.

In June 2006, the CFO presented the results of the Australian operation's e-business developments to the executive team in the US parent company. This received a great deal of interest because neither the parent nor any of the subsidiaries had pursued an e-business strategy beyond setting up simple websites with limited online ordering capabilities. In the same month, the service module was completed and deployed inside Omicron, with deployment to distributors and customers expected to follow within three months, once it had been thoroughly tested.

In July 2006, the US parent company indicated that it would investigate the feasibility of replicating the e-business project in other subsidiaries. The South African office was considered to be almost identical in size and structure to the Australian operation and headed the list of likely candidates. Other candidates were Omicron China and Omicron Brazil.

As at the end of July 2006 another 30 distributors had taken up OM-3, bringing the total to 60. This had resulted in approximately 25 percent of orders coming in electronically. Omicron management believed this outcome had been directly responsible for Omicron growing its business without increasing total headcount. At this time, the customer service manager was asked to plan a trip around the country to visit as many distributors as possible to promote further take-up of OM-3.

Separately at this time, EBI Services reported that it was planning, late in 2006, to begin a complete ground-up rebuild of OM-3 using a software-as-a-service approach, where distributors could access the software via an Internet browser rather than installing software on their own machines. This development had been prompted by EBI looking for further simplifications to reduce the "invasiveness" of technology as a way to promote take-up, and by observations that broader developments in Internet technology

had introduced new toolsets and Web-based standards to the market that made software-as-a-service models easier to build.

The final interviews for this study were conducted at the end of July 2006. At this time the transition to e-commerce based trading had been underway for eight years and it was still considered an ongoing project.

6.4 Coevolutionary interpretation

This section describes my coevolutionary interpretation of developments in the history of the Omicron eIOS. I have laid it out in an order that closely reflects the path I followed in my own thinking. My objective in doing this was to help the reader follow my rationale and sequence as I made tentative interpretations and tested them against my understanding of the data, coevolutionary theory and e-commerce systems. Along the way I frequently modified my interpretations before settling on them, sometimes brought interpretations together as building blocks to describe more complex phenomena, and occasionally abandoned them altogether.

I began at the bottom, by considering what the most basic evolutionary units were at Omicron as well as how I could describe the variation, selection and retention processes, and who the people were that influenced events. In this way I started to build a picture of what constituted the lowest level of my 'hierarchy', using the component level of Rosenkopf & Nerkar's (1999) hierarchy as a template. I then considered the sorts of forces powering developments at Omicron, and the roles of chance and intentionality. Following this, I worked my way upwards, shifting my attention to consider the evolutionary entities and processes in other levels in my hierarchy. The outcomes were unsatisfactory the first time around, prompting me to revisit my ideas about components, and to take a fresh look at the hierarchy from the bottom up. Once I had finished building up the evolutionary hierarchy, I moved on to considerations of coevolutionary effects, first within, and then between levels. These are dealt with in the second half of the interpretation. Two broader considerations that I made, of coevolutionary effects between Omicron and other systems, and the rate of evolution for the Omicron system, are discussed towards the end.

Components and communities

I began my interpretive process by considering the notion of technological components, the most granular unit of analysis in the Rosenkopf & Nerkar (1999) hierarchy. What were the basic units of an eIOS?

Applying the notion of systemic technologies being constructed from multiple components linked via interfaces (Rosenkopf & Tushman 1998) I found it straightforward to view the Omicron IOS as a technological system composed of a series of separate technological components. These components included the various custom-developed software modules such as OM-1, OM-2 and OM-3, the product and pricing databases, the financial software packages used by distributors and by Omicron, the hardware systems that these packages ran on, other software packages in use within these organisations, and the interfaces between each of these parts. The Internet itself was a component.

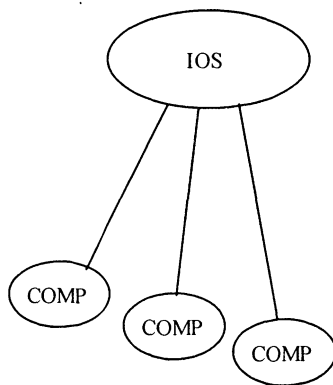


Figure 5: IOS comprised of technical components

I then considered the way in which individual components had developed over time. The OM-2 module, for example, was the culmination of a very long list of previous experiments and adaptations that had begun well before EBI Services had even begun its association with Omicron. EBI Services had been progressively fine-tuning its e-commerce software for years because EBI's management believed a key reason for many e-commerce systems failing to get traction lay with the connecting software that was available: all of it suitable for large companies but too expensive and complex to be readily implemented by small business trading partners, so its strategy had been to try building successively smaller, simpler and more affordable software modules, eventually culminating in OM-2. A long sequence of further adaptations followed as OM-2 became OM-3, as demonstrated by this remark from an Omicron manager:

For twelve months we have had re-developments and re-working and we have only just finished developing and testing the direct linkage with the [distributor] finance software.

These developments could readily be interpreted in terms of evolutionary trajectories with variation and selection processes driven by actors associated with each component. Here, my interpretation of selection and retention followed Aldrich & Ruef (2006, p-17) as, respectively, where the “differential elimination of certain types of variations” occurred, and where “selected variations are preserved, duplicated, or otherwise reproduced.”

I then turned my attention to the people involved in the evolution of components. Everywhere in the Omicron case, I could trace variation and selection processes back to decisions made by people, as the following quotes demonstrate:

Management has decided to get this out to other sales people.

...I just said “yes, let’s put it on and see how it goes” and that is how we initiated it.

With large organisations, you have to run it through the board first, and get a yes or no.

I found that respondents sometimes referred to organisations as if they were selection entities when they spoke, for example, of “distributors” accepting and rejecting new concepts, but when discussing decisions in detail their descriptions zeroed in on individual people, such as purchasing officers. Similarly, casual references made to decisions made by “departments” (e.g. the IT Department, the Sales Department) were also, when discussed in detail, related back to individuals within the department (e.g. the IT Manager, sales representatives).

In OM-2’s case, I could identify a group of people, each with their own goals and ideas, that had a strong influence on development, as demonstrated by this comment from an Omicron manager relating to the first version of OM-2 released:

They [the developers at EBI Services] had their idea of what they wanted to do, I had what we as a business should be doing, not necessarily doing it just at this present time, we are still developing it, but what we should be doing. We came to a solution.

Later, other parties became involved in driving variation and selection of developments with OM-2, most notably the purchasing officers working for Omicron distributors.

Similar groups could be identified for every component. The notion of communities used by Rosenkopf & Nerkar (1999), therefore, was retained as a highly appropriate way to describe groups of people associated with applying selection forces through their decisions.

Different groups of people could be identified influencing development for different components. In the case of the service module, for example, the group included the manager responsible for equipment maintenance, the sales manager, the CFO and developers at EBI Services, but it did not include any staff from distributors. Some people influenced developments relating to more than one component. The customer service manager, for example, played a role in shaping the evolution of a variety of components. People could therefore be members of more than one group, just as Rosenkopf & Nerkar (1999) found actors could be involved in many component communities in their technological framework.

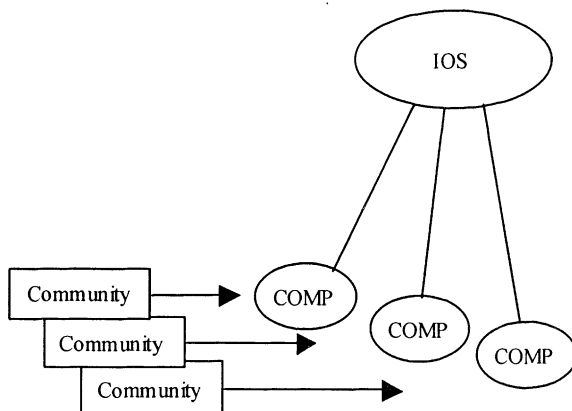


Figure 6: Component-specific communities

The history of the equipment service module can be used to illustrate component evolution and a component community. Many of the adaptations could be described, after Meyer (1994) and Shapira (1994), as being driven internally by managers and workers, in response to cues within the system. The first conception of a service module could be traced back to an initial decision to develop a better internal solution for tracking equipment that had already been returned for maintenance, so that this information could be made visible to sales and customer service personnel and thus

ensure everyone knew where equipment was and when the maintenance was due to be completed. An early interview illustrates how it had developed up to this point:

We've got a service module. We are using it in-house only. We're keying in the data when the goods come in, so we can keep track. One of the biggest things that we had problems with was keeping track of customer's product when it came here onto our site.

After seeing the service module used successfully inside Omicron, the customer service manager saw the potential to enhance it so that it could automatically send electronic service quotes to distributors, and generate work-orders for Omicron's service department, on top of its normal functions maintaining progress status and pick-up date information for all parties.

The plan is to use the service module to generate a service work order. We will send back to the customer a standard estimated quote, until we look at the product. We'll tell him to send the product in and we will give him a tag number. Comes in here, the guys receive it, they look at it and we give a quote back to him straight away.

Almost a year later, as these enhancements were being completed, the sales manager then observed that this service module could easily be adapted for use outside the distributor network to send quotes directly to large end-user customers, and that this had the potential to increase maintenance sales with end-users that purchased big volumes of equipment directly from Omicron or deployed in this way.

Well, what is now going to happen is the customer is going to become a part of this, so if customers want to send bits back for servicing or maintenance they can.

In the final set of interviews, the CFO vividly described how the service module functionality had emerged in its present form through a long series of adaptations:

It actually developed from something in-house, and grew out of that. We needed to be able to track customer product within our organisation. And that's what it grew from. And then somebody said 'why can't we do this?' and then somebody else asked the question 'well, why can't we do this?' and

then somebody else said ‘well, jeez it would be nice to be able to do this’. And all the time the guys from [EBI Services] are saying ‘yeah we can do that, we can do that, we can do that’.

In a similar fashion, each of the finance/ERP software packages used by the various trading partners followed their own evolutionary path as updates and upgrades were applied, and each was subject to its own component-specific community. For each package, the component specific community included the supplier of that software as well as the global community of users lobbying for bug-fixes and new features. At Omicron, the evaluation of the ERP-2 system foreshadowed another major step on the evolutionary path for that technology component.

Ideas and trials at Omicron stimulated further ideas and new developments. The number of development paths being pursued simultaneously grew over time, leading to enhancements such as the service module extensions, electronic procedures for returned goods, electronic credit notes and electronic transmission of export control orders to the Australian Customs Service. A wider group of people also became involved over time, including distributor personnel and workers across Omicron’s various departments. As an Omicron manager described it:

A lot of ideas started coming out of different places at [Omicron]. So the idea for credit notes, the idea for adding service capabilities, came out of the customer service area, other ideas came from the warehouse, and from storemen. So one of the interesting observations from this project is that it is developing, and it keeps developing and growing because now there is input from all over the organisation that has taken on a life of its own.

The way in which new variations were driven by those preceding them supported the notion that component developments exhibited a strong sense of history dependence (Lewin & Volberda 1999).

Forces

I now moved my attention to consider what forces were powering evolution. Aldrich & Ruef (2006, p-21) observed that selection in organisations can be “set through the operation of market forces, competitive pressures, the logic of internal organisational

restructuring, conformity to institutionalized norms, and other forces” and I observed a similarly complex mixture of forces influencing the way in which communities and individual actors drove evolutionary processes. Both business and personal goals entered into the picture. The Omicron CFO and CEO, for example, saw e-business as a way to trade more efficiently and thus lower the cost of trading for Omicron. Other managers were motivated by more specific business goals, such as minimising the number of credits:

We have to make sales and stop credits coming back, because once we have the sale we want to keep the money, not give it back. That is the end game for me.

Or reducing the number of phone calls coming into a department:

We want to free up as many mundane phone calls or reduce the need to have those phone calls coming in. Every one of the staff should be making proactive value-based phone calls, not reactive administrative phone calls, error correcting phone calls. And that is our goal. That is my goal.

Distributor principals and purchasing officers also made decisions about proposed changes based on both business goals such as efficiency and increased sales, and also personal goals such as saving time and working less on weekends. The following comment from a distributor principal was typical:

I have been doing this for twenty-five years and I accept change when it makes my job easier. I don't accept it [or] I dump it when it makes it harder.

The motivations and behaviours of many of these actors could be characterised, using the terminology of March (1991), as leaning more towards ‘exploit’ than ‘explore’.

Some of the forces worked to stifle and eliminate new variations. Omicron sales representatives were so focused on their sales targets that they resisted changes that would have them promote the technology and worked to maintain existing routines. As an Omicron manager noted:

Some of them [sales people] thought “what am I getting out of it?” I think if we'd paid a commission on it, I think it would have gone a lot better.

The rejection of OM-0 occurred because distributor principals considered that it would take too much of their time and effort to maintain duplicate websites for sales of Omicron equipment and sales of cleaning products from competing manufacturers. Similarly, Omicron's large distributors forced development of OM-1 in a direction that suited them, but not necessarily Omicron, eventually leading to a dead end when this work was discontinued. The forces in this last case were described in economic terms (as a desire to minimise the cost of change) and also in political terms (distributors using their power in the relationship to shape developments to suit themselves). One respondent described the latter issue in sharp terms:

That's the way big business works. Big business does that. It goes its own way, then says to everybody else, work with us or piss off, basically.

Some forces, such as the delaying tactics applied by the IT Manager, appeared to act to slow down the pace of evolution generally, without acting to differentially select variations. Respondents described the IT Manager as slowing the pace of development because he was motivated by a desire to maintain personal power and prestige in the organisation. His strong personal relationship with the CEO was described as having enabled him to play this negative role for some years without risking his position. I revisited this example again when I interpreted coevolutionary effects between levels in the Omicron system (the discussion is found later in this Chapter).

Chance and intentionality

At this stage I considered whether variations in the Omicron case could be interpreted as predominantly blind, in the tradition of Donald Campbell (Baum & McKelvey 1999), or whether intentional variations were necessary to describe events.

The data left me in no doubt that blind variations played an important role in influencing developments. The announcement from head office that Omicron would have to move to ERP-2, for example, was unforeseen by local managers and had immediate consequences in the discontinuation of work on service module adaptations. Chance events sometimes played a role in distributors deciding to trial OM-2 as well:

The other day we ran out of order books. Well I thought it would be a great opportunity to generate the orders with the computer and do it that way.

The employment of the new customer service manager at Omicron was another example. His hiring had been prompted by the unexpected departure of the previous manager. The depth of his technical knowledge and his enthusiasm for e-commerce subsequently made him an active force in the e-business project where he had an important influence on the direction of evolution.

A similar variation might be introduced again from the environment outside Omicron, because the customer service manager indicated that if he was offered a job elsewhere in 2007 he would probably take it. He expected to finish his masters of business management and would be ready for a promotion, but promotional prospects within Omicron were thin, and depended on someone leaving above him.

Chance also played an important role in the evolution of exports. As the following comment vividly illustrates, the CFO and another Omicron manager discovered entirely by accident what was causing a major bottleneck:

“We didn’t know it, and we walked in the room when we heard the clacking of a typewriter. I didn’t even know we had a typewriter in the building, and [the export clerk] had this typewriter behind her and she’d put the forms in and she’d turn around and she’d have all the written stuff...and my God, we still had a service contract on that typewriter...I absolutely didn’t believe it. Everything else is happening at the speed of light and the goods are sitting there for four days while the paper work catches up.”

The evolutionary story for Omicron, therefore, contained many developments that could be interpreted as examples of blind variation based on Aldrich & Ruef’s (1996, p-17) description of blind variation as that which “occurs independently of conscious planning” with the examples of “mistakes, misunderstandings, surprises and idle curiosity.”

The data, however, also showed intentionality playing a strong role. The early development of OM-2 could only be conceptualised as stemming from deliberate decisions generated by managers working for EBI Services as they intentionally worked towards a goal of producing a cost-effective module for small businesses. Many of the changes to both technologies and routines were introduced by individual managers during the course of the project and could only be interpreted as deliberate decisions

with specific aims, examples being the switch to small distributors to get away from having to customise every installation, the decision to develop OM-3 to solve the problem of where purchase order numbers were generated, and the decision by the customer service manager to take on the role of demonstrating and promoting electronic trading as a way of overcoming the inability of the sales force to do so.

Furthermore, a long list of variations came at the specific request of distributor principals, and purchasing managers working for distributors, who asked for them to solve specific problems. Distributor respondents frequently described enhancement requests that they had passed back to Omicron, including: changing the way in which pricelist data was transmitted; resolving technical conflicts; enhancing electronic ordering to take account of credit limits; and the addition of messaging capabilities in the OM-2 module. All of these variations might be interpreted as having an element of ‘blindness’ to the extent that there was never total certainty of the outcome when they were introduced. OM-1, for example, looked like a good solution but ended up failing. OM-2 appeared ‘good enough’ but subsequently had to be redeveloped on several occasions. Referring back to Aldrich & Ruef’s (2006, p-17) descriptions of evolutionary processes, however, intentional variation “occurs when people actively attempt to generate alternatives and seek solutions to problems” and there could be no doubt that this was happening all through the Omicron system.

I thus included both intentional and blind variations in the interpretation, following Nelson & Winter (1982) and Aldrich & Ruef (2006).

Interpreting retention

At this point it is worth discussing some of the problems I encountered in interpreting retention, and how I resolved them. Initially I found it difficult to draw a line between selection and retention when describing some events. Was the “adoption” of OM-2 by distributors, for example, a selection or a retention event? Sometimes decisions to adopt appeared to be gradual and spread out while at other times they appeared to happen in an instant, as these three contrasting statements from distributor respondents illustrate:

When [Omicron] came through and gave us the opportunity to get on board and try this out we thought, yeah we’ll give it a go...I did a trial period on it

for about two or three weeks, I thought, yeah this seems pretty viable, so yeah I went with it from then on.

I make the decisions, I am the Managing Director of the company, so I just said “yes, let’s put it on and see how it goes” and that is how we initiated it. I wasn’t going to criticise it until I used it.

I just made a split decision and said I want it!

To make sense of this in an evolutionary framework, the Omicron case introduced a need to conceptualise evolution from a finer or coarser grained perspective to suit the interpretation. Van De Ven & Garud (1994, p-440) found that, in order to make evolutionary theory “operationally useful” for their study of the cochlear implant industry, they needed to adopt:

A more fine-grained view of social evolution than has been used in the past by defining the concepts of variation, selection, and retention as micro- or individual events rather than as macrostages of evolution.

I interpreted distributor adoption of OM-2, therefore, as being made up of multiple sub-events. When an individual distributor adopted OM-2 this could now be said to involve a series of selection events (e.g. a decision to trial OM-2 by the purchasing officer and a approval for this by the principal) plus a collection of many small events where, by repeatedly following new routines, purchasing officers and others gradually cemented the changes into operational norms and standard procedures (retention). Here, my interpretation once again followed the Aldrich & Ruef (2006, p-16) definition of retention as when selected variations are:

Preserved, duplicated or otherwise reproduced so that the activities are repeated in future...via mechanisms such as specialisation, role standardisation and the acquisition of habits by individuals.

Another influence here was the description of successfully IS strategies by Peter Heng & Vet (2002) in terms of processes and procedures being retained in organisational norms and standard procedures.

A conceptual break down of events into more granular components was also required to describe the early use of OM-2 by some distributors for price lookups but not ordering:

[Distributor] took it on board, but he never placed orders through to us, because of the double keying, it was [only] used as a centre to get all the information...they still fax their orders through.

This could now be broken down into parts and explained as differential selection of those component adaptations relating to electronic distribution of pricing (e.g. database changes, price routine changes and software components enabling electronic transfer of price information) and rejection of the component adaptations relating to the ordering service (e.g. ordering routine changes, software components enabling electronic transfer of orders).

Associating components with subsystems

I now referred back to the hierarchy developed by Rosenkopf & Nerkar (1999) to compare my interpretation as it had developed so far. In my case Omicron had been conceptualised as a simple 2-level hierarchy comprising a component level and a system level (Figure 7), with the system (the eIOS) interpreted as the collective bundled 'product' of all the component technologies. The Rosenkopf & Nerkar (1999) hierarchy, however, had three levels (Figure 3). A middle level existed for the 'products' of component technologies—where they had been grouped together to make optical disc players. At this stage it seemed to me that whether a hierarchy had two or three levels probably did not matter, and that this point of difference might easily be a product of differences between the contexts, but the Rosenkopf & Nerkar (1999) notion of products prompted me to consider whether, in my context, there was any similarly logical grouping of components and, if there was, whether this generated a better description of events in the Omicron IOS.

Certainly, a 2-level hierarchy was not how the actors themselves saw things at Omicron. While respondents repeatedly referred to 'the e-business project' as if it was a single entity, they never referred to it as a single technological system. When discussing progress with the project they invariably talked about multiple systems as quite separate entities. The system for facilitating the transmission of online orders from distributors, for example, was discussed as an entirely distinct system from the one that produced export documents in electronic form. The following comments serve to illustrate:

When we started we just had an ordering system.

We've got the sales module or the order module. We've got the service module.

The export documentation system was working.

The Omicron IOS appeared to be conceptualised by the actors within it, therefore, in a manner best described as a collection of many sub-systems. Sub-systems, therefore, were tentatively included in the interpretation as aggregations of technical components into a technology 'product' that supported a specific trading operation. Earlier, when I had looked at the applicability of Rosenkopf & Nerkar's (1999) ideas I had noted that their notion of products could be generalised as logical assemblies of technological components, and these assemblies might take many forms (see Section 5.7), so in this sense my sub-systems were simply another form of assembly.

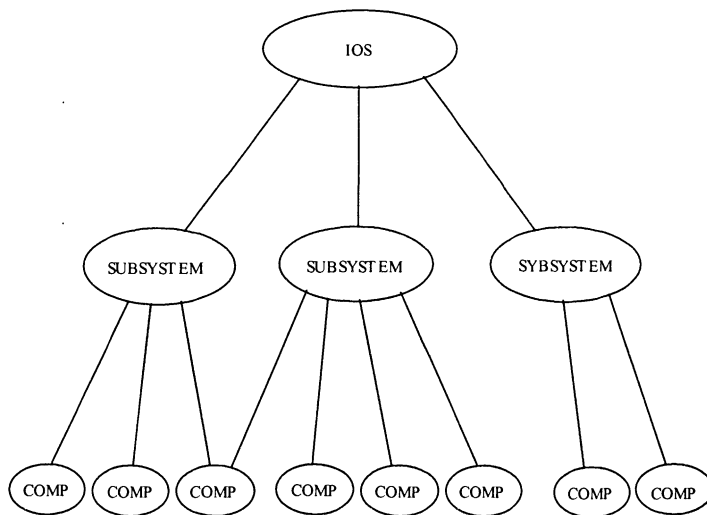


Figure 7: First interpretation of IOS hierarchy

As a consequence of all this, my interpretation now took the form of a three level hierarchy (see Figure 7) that looked somewhat similar to the Rosenkopf & Nerkar (1990) hierarchy I was using as a template. Sub-systems in my case, however, did not stand entirely apart from one another, as some components were shared between them. The finance software packages used by distributors and by Omicron, for example, were connected via interfaces into many sub-systems and I thus interpreted them as shared components

Later, I would abandon this notion of subsystems entirely, and at the same time revise my ideas about what constituted an eIOS. This would happen when I found that it was necessary to incorporate routines into the interpretation.

Incorporating routines as components

At this stage, following the hermeneutic process, I stepped back from a close consideration of technical components to a broader consideration of the system and its history. In doing this I found that the interpretation as it stood was inadequate, because technological components were clearly only one important part of the history of the Omicron IOS.

When discussing events, all respondents talked about many other types of adaptations that related to people and which did not describe changes to technological entities. They constantly referenced such things as changes to procedures, the reallocation of people to different jobs, and the restructuring of individual job roles, in their discussion of what constituted progress. This comment from a distributor purchasing officer in reference to changed procedures was typical:

Writing on a bit of paper and faxing it through was just a pain. Then you had to ring up and find out “is this in stock?” or “how long is it going to be?” and “when is it getting shipped?” Now, everything goes through [OM-3]...it is so much easier, being able to get backorders and knowing when they dispatch. I know where it is, I have got a dispatch note.

Indeed, for every technical enhancement that was proposed, procedures or routines could be identified that would also need to change as a direct consequence. When Omicron moved to electronic production of export documentation, for example, it created an immediate need to rationalise the many different routines being used across the various shippers. As an Omicron respondent described it:

We had to develop a standard schema for all export documentations. The shippers letter we had, we actually sent off to all the different shippers and we had generic ones for all of them. In other words, they were all just slightly different. So we took all their documents, put them together in one,

containing all the little bits and pieces and said “would you be happy to receive this?” And they said “yes, as long as all our details are on it.”

Interdependencies between routines and components were also an important consideration because they sometimes prevented change. The ‘clearance promotion’ adaptation to OM-3, for example, was discontinued due to lack of support from product managers in the marketing department. The proposed technical enhancement did not go ahead because product managers were tied to their routines in the form of short-term incentive programs: the way their performance agreements were structured meant that such a move would result in a short term reduction in their bonuses because of the price write-downs.

On top of these challenges, I began to ask myself another question about the interpretation I had made: if only technological components were considered, how would it be possible to fully describe the evolution of a situation where a trading process that was conducted entirely manually, with no technological components at all, evolved into one that was fully or partially automated?

I decided that the interpretation needed to account for adaptations to social components to resolve these issues. Previous evolutionary literature (e.g. Levitt & March 1988; Pentland 1992; Aldrich & Ruef 2006) suggested to me routines as a logical unit of analysis. Kay & Cecez-Kecmanovic (2001) had also previously found it necessary to include social, socio-technical and technological components to describe IS-organisational coevolution. Aldrich & Ruef (2006 p-4) went further to suggest that technologies could also be considered as a form of organisational routine alongside forms, rules, procedures, conventions and strategies, but I noted that the actors in the Omicron system never thought of technologies this way, and thought it important to preserve the distinction for technical components to keep the resulting framework relevant to practitioners.

I thus incorporated routines as social components in the interpretation, alongside technological components. Here, the hermeneutic process had moved through a cycle, in the manner described by Klein & Myers (1999), of a precursory understanding of the basic building blocks of the IOS to a broader consideration of the whole context and back to refine my understanding of the parts (components and routines).

Routines constituted such things as procedures within departments and work practices associated with jobs. Following March & Simon (1958), Miner (1994) and Howard (1994), routines were interpreted as interdependent with cognitive schemata and so were not necessarily written down or formally recorded within any of the organisations involved with the system. When routines prevented change I saw them as sources of inertia, after Shapira (1994).

An examination of the Omicron data revealed routines could also be readily interpreted as evolving through many incremental adaptations. The role of the customer service manager, for example, progressively took on a series of new responsibilities relating to price database maintenance, monitoring distributor feedback on system performance, acting as a conduit for technical enhancement requests, and working to stimulate take-up of electronic trading. Specific routines used by distributor purchasing officers changed as they began looking up prices using OM-2 instead of referencing price books, and began entering orders electronically instead of printing and faxing them to Omicron. One purchasing officer described the transition:

We were happy to stop the paperwork, because you get messy and you lose it and all that sort of stuff. On the computer system I just click on it and look it up. It makes life easier.

At Omicron, routines underwent substantial changes within the customer service department, as a comment from the manager of that department illustrates:

Until this time we haven't had the resources available here to make the phone calls back and say "hey it's on backorder by the way, do you want to take something else"...I have now delegated a staff member to call customers to actually pre-empt the customer call and offer them alternatives.

Similarly, routines for Omicron sales personnel in the field changed as their focus shifted away from facilitating processes related to ordering to spending more time on relationship management, negotiation and the provision of richer information on Omicron products.

I conceived routines, therefore, to have their own evolutionary trajectories in the same way as technical components, and component variations to be retained not only in the installation of new technical components, such as new software enhancements, but also

in the acceptance of new skills, roles and procedures as they became a persistent element in the everyday actions of relevant personnel.

Abandoning subsystems for trading operations

I had now expanded my interpretation of the basic units of analysis in the Omicron system to include both technological components and social components in the form of routines. I returned again to my earlier interpretations to test these new ideas against them. While the inclusion of social as well as technical components tallied with the way in which the actors themselves freely intermixed their descriptions of changes to both technologies and routines, this iteration in the interpretive cycle immediately brought into question the notion of subsystems as bundles of technological components designed to support a specific trading function. I was compelled to ask myself the question: what type of subsystem, if any, did a combination of technologies and routines now make in the Omicron system?

Pondering this led me to abandon my initial concept of technological subsystems analogous to Rosenkopf & Nerkar's (1999) technological 'products', and consideration of a socio-technical alternative. I found that any given routine or technological component could be readily associated with at least one commercial function that it was designed to support, such as distributing pricing information, placing orders, processing exports, and returning equipment for maintenance. A tentative notion was thus developed of collections of routines and technologies enabling the conduct of a commercial operation between trading partners. Placing orders, for example, was a product of routines in Omicron's sales department, routines within the purchasing departments of distributor organisations, the OM-2 and OM-3 software modules, the configuration of financial software packages used by distributors, and the Omicron master pricing database. The label 'trading operation' was subsequently applied to this concept.

My thinking here was driven primarily by consideration of how the actors themselves described commerce. Regardless of individual perspective, department or organisation, managers at both Omicron and its distributors could all talk about changes to the way 'ordering' was done, 'exporting' was done, how 'pricing' had changed, or the new way that 'backorders' were handled and would all be referring to the same thing.

Furthermore, when respondents spoke of the impact of new technology components or changes to routines and job roles, it was almost always related to the impact on a trading operation. The following passage, where a manager related the role of an e-business server to specific trading operations, was typical:

There were three main parts to it, and there will be a fourth one and a fifth one. The first one is pricing, which is updated every day when they do a send and receive. The second one is purchase orders outbound, with an archive for a library for the customer's purchase orders, and lastly is sorting out backorders, advices, advanced shipping notices.

I had taken an important step in my thinking here, from interpreting the technology as something that supported a trading operation but was distinct and separate from it, to an interpretation of the technology as being, along with routines, part of the trading operation (see Figure 8). Here, trading operations paralleled the idea of 'activity systems' (Nelson & Winter 1982) as bundles of routines, albeit with the specific inclusion of technical elements in those bundles too.

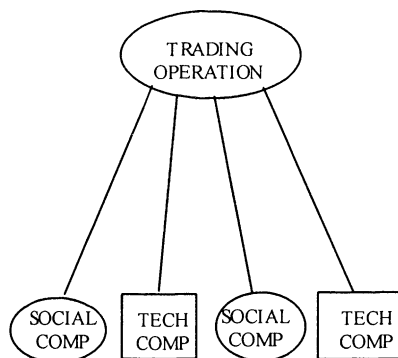


Figure 8: Trading operations comprised of social components (routines) and technical components

The hierarchy defined by Rosenkopf & Nerkar (1999) remained valid, in the sense that the logical aggregation of the component building blocks was important to explain events. I had found, however, that their specific conception of products was not meaningful in the eIOS context. The Rosenkopf & Nerkar (1999) product was a self-contained unit that made sense as something that could be manufactured even before it was given to people that could use it. It could exist as a purely technological entity. In the eIOS context, however, a trading operation only made sense as something already in

use. Routines, in other words, were just as necessary as technological components if I wanted to describe trading operations properly.

I should note here that the actors within the Omicron system never used a collective term like 'trading operation', referring only to specific operations, such as 'ordering' or 'quoting', on an individual basis. As described by Orlikowski & Baroudi (2002), this was an occasion where I, as the observer, needed to overlay my own interpretations to make sense of the perspectives of all the actors in the system.

My terminology also changed as the interpretation developed. I initially used the name 'trading service' because the word service contrasted neatly with Rosenkopf & Nerkar's (1999) use of the word 'product' for their purely technological framework 'product'. 'Product' was also considered, especially given that Ingram & Roberts (1999) had conceptualised products (pharmaceuticals) as manifestations of organisational productive routines, but the term did not seem appropriate for the combination of social and technical components for the conduct of interorganisational trade. Kay & Cecez-Kecmanovic (forthcoming) used a combined term 'product-services' to describe socio-technical outcomes provided to clients of an organisation. Reflecting back on the objective of the research to produce a framework more relevant to practitioners, however, the term 'trading operation' was selected as one more likely to be understood and associated with ordering, invoicing and pricing operations by managers in the field. At this stage, my notion of trading operations had displaced subsystems as the middle-level entity in my framework.

Reinterpreting the IOS

Having incorporated both social and technical components in my interpretation, and defined trading operations using these elements, my next iteration of the interpretive cycle was to take a broader perspective again, to re-examine what constituted an eIOS. So far, I had only attempted to interpret this in purely technological terms.

It was clear to me that the actors within the system themselves maintained some sense of a collective whole, as exemplified by their frequent references to 'the e-business project' to describe the overall effort to transform the way trade was conducted with distributors and customers. The term 'e-businesses project', however, did not equate to the notion of a single technological system. As discussed earlier, the data suggested that

actors in Omicron’s case did not perceive technical developments to be embodied in one system but many systems. The e-commerce system could never be interpreted as a single independent entity such as a piece of software running on a server.

I discovered a more appropriate way of looking at the system by considering trading operations in aggregate (see Figure 9). If the concept of an IOS was reinterpreted as the collection of all trading operations in play between a group of trading partners, then this allowed the top level of the hierarchy to be described using similar language to Rosenkopf & Nerkar (1999, p-171) as the “coordination” of trading operations into “systems of use”. Reinterpreting things this way also had the effect of making the definition of a system independent of technology characteristics. As with my earlier interpretation of trading operations, the system could now be described in a consistent way regardless of its technological status: its evolution could be described before, during and after the point at which Internet-based technologies were introduced (i.e. the point at which an eIOS came into existence) using the same framework.

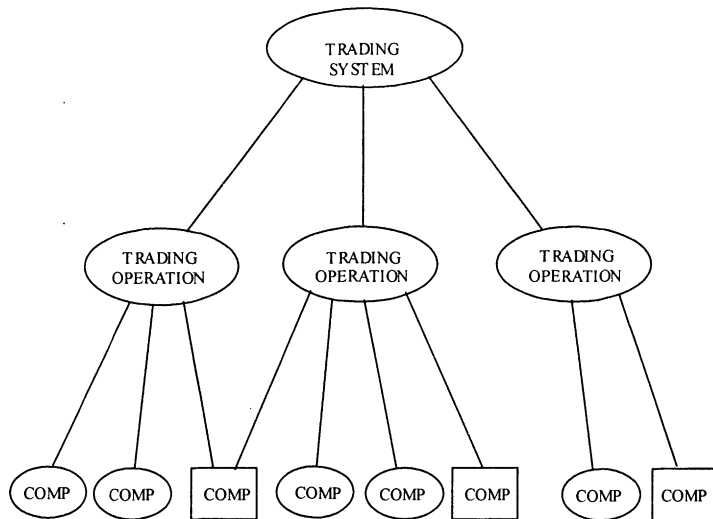


Figure 9: Second interpretation of IOS hierarchy

The goal of the ‘e-business project’ was now interpreted as changing the way in which business was conducted in a trading system, and the history of ‘the e-business project’ was not a history of technological development, but a history of the evolution of the trading system from a state when it was conducted without use of the Internet, to a state where it made extensive use of e-commerce.

As before, I was no longer seeing technology as playing a supporting role but rather it was an intrinsic part of things. Events, therefore, could no longer be conceived as the overlaying of a separate technological system onto a group of organisations that traded together. Instead, I interpreted events in terms of an existing socio-technical trading system that was evolving through adaptations to trading operations within it.

Evolution of trading operations

Having established a logical hierarchy for describing components, trading operations and the trading system, I then turned my attention to whether the evolutionary concepts of variation, selection and retention applied at the higher levels. Could trading operations be described as evolving? I considered this question first by re-looking at descriptions found in the data. Respondents frequently spoke of how purchasing and pricelist distribution had changed, and made references to the ‘before’ (“before the e-business project we used to do it by...”, “it didn’t work well back then”) and the ‘after’ (“this is how it is done now”, “everything is much faster”, etc). The following passage describes some of the changes in backordering:

When we started off initially we just had a system where you bashed your order through. It has progressed since then, where they [distributor purchasing officers] got the acknowledgement saying ‘thanks very much for your order, it is in the queue for being dispatched’, and then the next thing he started getting was ‘this is your backorder report’. Whereas the backorder report first showed a date of when we received the order, well he [the purchasing officer] didn’t like that. Over a period of time and much head-butting against a brick wall that date was progressively changed from when we received the order to when the next shipment is due in. So he started being happy with that.

Here, the trading operation had become progressively richer, enabled by multiple adaptations to the technology and routines that defined it. Backorder reporting, previously an ad-hoc, over the phone operation, had been made proactive for the first time, then adapted to provide more useful information relating to shipment dates. Later, the richness of the trading operation was improved even further so that updated backorder reports would be sent to distributors when importers changed the due date

supplied to Omicron. Once again, this was underpinned by adaptations to technical components (additional technical integration between Omicron and its importers) and routines (sending multiple reports rather than just one report).

Looking to the Aldrich & Ruef (2006, p-16) definition of retention between organisations, variations to trading operations could now be interpreted as being retained by the ‘institutionalisation of practices’ between trading partner organisations. In this case variations were being retained in the institutionalisation of new trading practices.

Providing pricing information, for example, evolved from a trading operation built around manual price books, phone calls and onsite visits, into an operation based on electronic downloads and updates via the Internet. Purchasing evolved from being a trading operation built around printing documents, faxing them to Omicron and manually entering the order information, to an operation built around the transmission of orders via a software module and the Internet.

This interpretation highlighted to me the notion that selection and retention processes for trading operations spanned multiple organisations at the same time. When new export procedures were successfully introduced, for example, it represented an adaptation of exporting to both Omicron and its shippers.

I also found evidence that adaptations had been retained in trading operations in the remarks of senior executives pointing out that there was “no going back” to the way things were before. A Managing Director of a distributor described, for example, how new expectations from his customers cemented the new trading arrangements with Omicron in place:

Oh I don’t really even want to think about it [going back to the way trading was done before] because of the impact on my customers. My customers are now expecting something different and better and won’t accept it now I have given them something else.

The question I considered next was whether the actors that influenced evolution of trading operations were unique in some way, or were simply the sum of all actors influencing their underlying components.

For each trading operation it was not difficult to identify the main influencers in terms of making the decisions that counted with respect to variations, although the data did not allow every single influencer to be definitely identified. These people appeared to form unique communities, with a different membership to those associated with driving evolution for the specific underlying components. The key actors in the community associated with the price distribution trading operation, for example, were Omicron product managers and distributor purchasing officers, but did not include developers at EBI Services or members of Omicron's IT department – actors that played important roles in generating enhancements to an underlying component: OM-2.

The case of clearance promotions provides another example. Here, EBI Services was part of the component community for OM-3 when it confirmed the feasibility of the proposed variation, but it was not a member of the trading operation-level community that rejected it. Marketing managers, by contrast, were not members of the component community, but were key members of the community deciding if and how clearance promotions could be conducted.

Developers and IT personnel, while especially important members of many of the component communities, did not seem to ever play a selection role at the trading operation level, where selection was primarily driven by people imbedded in, and directly affected by, the operation on a daily basis.

Just as Rosenkopf & Tushman (1988) found in their analysis of coevolution in the flight simulator industry, I found that actors sometimes moved into and out of communities in the Omicron case. When the short-term/promotional discount capability was proposed and subsequently implemented, for example, many more sales representatives became temporarily engaged in shaping price distribution.

Trading operations were, therefore, readily interpreted as evolving, with variations interpreted as being retained in the institutionalisation of new trading operation practices between organisations. Trading operation-level communities were interpreted as distinct from communities influencing components and being comprised principally of people imbedded in, and directly affected by, the operation on a daily basis. Membership of communities was fluid, and an individual could be simultaneously a member of both trading operation and component communities.

Evolution of the trading system

I now moved my attention from individual trading operations to consider more closely the evolution of the system as a whole.

Given the reinterpretation of the IOS as the collection of trading operations in play between Omicron and the organisations distributing Omicron equipment, I first attempted to interpret evolution in collective terms as well. The system was conceived as having progressed in an identifiable direction through the adaptation of the trading operations from fax, telephone and manual trading, to more highly automated, Internet-intermediated trading operations. A similar idea of adapted trading processes underpinning evolution of a greater combined system was put forward by Holland (1995, p-132) who suggested that:

The close linking of business processes between individual organisations based on shared IOSs leads to the emergence of an integrated supply chain that behaves as a single strategic entity.

My interpretive process was assisted by considering the people involved. A unique group of people could be identified as key influencers and decision-makers for the direction of trading (see Figure 10, below). These included senior managers at both Omicron and its distributors. Omicron members included the CEO, CFO and COO. It appeared likely that other members of the management team (such as the sales manager) might also enter into this system-level group from time to time when, for example, they were asked to formulate a recommendation to the CEO on a strategic issue. There were no data collected, however, to definitely confirm or refute this. At Omicron's small business distributors, the important decisions about who they traded with and how it was done were undertaken by the business owners, or principals, sometimes in collaboration with business partners or spouses. At larger distributors, strategic decisions relating to trade were made by groups of senior managers.

I thus interpreted evolution at the system level as being driven by its own system-level community, as done by both Rosenkopf & Nerkar (1999) and Kay & Cecez-Kecmanovic (forthcoming), and this group was comprised of executives deciding the overall direction of trade. Members of this group were sometimes also members of communities influencing the evolution of trading operations and components, a

prominent example being small business distributors where principals often had a hand in making decisions at every level.

This interpretation left me with the question of what milestones or markers, if any, could be used to describe when system-level evolution had occurred. Rosenkopf & Nerkar (1999) pointed out that standards such as CD and DVD were convenient markers for system level evolution in the optical disc industry, prompting a consideration of whether similar indicators might be found to mark the occurrence of evolution in the IOS context. I initially examined the role played by technical standards in e-commerce, as discussed by Reimers (2001) and Chen, LeBrie & Shao (2003), as a candidate. I dismissed it, however, on two counts. First, technical standards did not rate a single mention in any of the interviews associated with the Omicron case, so as far as the participants were concerned they weren't an especially important element in the history of this system. Second, the interpretation of the IOS was now both social and technical, and technical standards alone could not be used to account for evolution where routines had changed but not technologies.

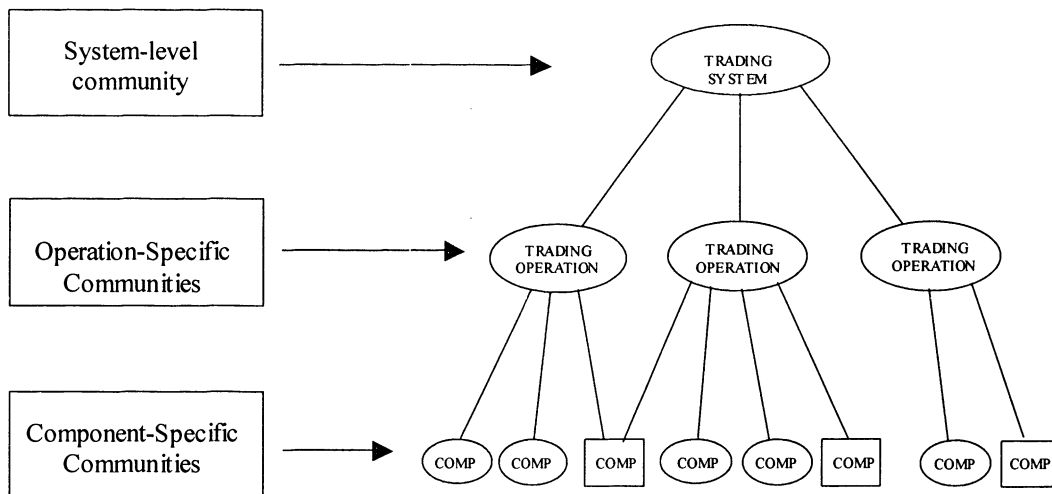


Figure 10: Selection entities and hierarchy for IOS evolution

I then moved my interpretation to a broader consideration of standards as the “standardisation of roles” within organisations and the “institutionalisation of practices in cultural beliefs and values” between organisations after Aldrich & Ruef (2006, p-16), but a challenge remained in identifying what evidence could be used to indicate when standardisation or institutionalisation had occurred. Management decisions and

directives, while potentially well documented, were poor markers, because a management decision mandating use of a new routine or trading practice is no guarantee that this will happen. Cooperation does not necessarily have to follow. Kay & Cecez-Kecmanovic (forthcoming, p-20), for example, discussed how the Head Office in an investment banking company had decreed that everybody should use the new Omega information system only to have regional offices and analysts rebel against the decree and resist using Omega. Because of this, I selected actual use of new trading operations as the best evidence of system-level evolution.

This led to a new question: how much actual use was enough to say that a trading system has evolved? Universal use was too restrictive. Omicron management aspired to have a sufficiently large proportion of distributors working electronically to make it viable to ‘switch off’ the equivalent offline trading operations (i.e. only trade with distributors that had made the transition) because Omicron could then further simplify its own procedures, job roles and costs. That point, however, looked to be a long way away, and would perhaps never happen, because some distributors were clearly uninterested in using new technology of any kind, as the following comments illustrate:

We’ve got one distributor who has been in the industry for fifty or sixty years, and all his business is face to face, who says “you want my business, your rep will come and see me once a week or once every two days to get a manual order.”

Another customer just does not like technology. All his orders are on order books, he hand writes them out.

Furthermore, based on the history, where OM-3 had been introduced after only a small number of all distributors had taken up OM-2, it appeared highly probable that changes would continue ‘overlapping’ so that at no point in time could all trading partners be described as using the same practices at the same time. There would always be at least a small number of trading partners who insisted on using older practices, as well as, at the other end of the spectrum, some trading partners that adopted the next wave of new practices ahead of the majority of their peers. The same observation held for the nine other systems I had examined in my earlier research, where widespread use had sometimes been achieved, but never universal use.

I found a more appropriate interpretation of standardisation and institutionalisation by embracing the notion of dominance rather than universality as the criteria for evolution, borrowing from the notion of ‘dominant design’ used by Anderson & Tushman (1990), Rosenkopf & Tushman (1994) and Suarez & Utterback (1995). Suarez & Utterback (1995) noted the closeness between dominant design and standard where the latter notion is defined on the basis of accepted current use, custom or general consent, and Rosenkopf & Tushman (1994, p-418) noted that:

While dominant designs are characterized by a package of technological features, they are achieved via consensus building at the community level. Standardisation may be driven by organizations explicitly designated for this purpose, but it may also occur via the actions of various actors in the community.

In the coevolutionary interpretation for eIOS development, therefore, I interpreted evolution of the trading system as occurring when new trading practices became dominant between trading partners in that system. This then raised a new question about what constituted dominance. Here I drew on the definition used by Suarez & Utterback (1995) in the context of dominant designs in industries. They defined the occurrence of a dominant design on the basis of the knowledge of industry experts. A dominant design was what the experts identified, among all competing design paths, as dominant in their industry. In the e-commerce context, I similarly interpreted dominant trading practices as those identified by the ‘experts’ in the Omicron system as the most dominant among the various trading practices in use.

This meant that dominant practice was not defined by some arbitrary quantitative milestone decided by me, but was what the actors within the system understood it to be, an interpretation I considered well suited to the overall objective of applying the interpretation to help practitioners. From my external perspective, I might guess that system-level evolution of the Omicron trading system to Internet-based practices had not yet occurred because, at the time of final interviews, only a relatively small proportion of Omicron’s distributors had moved to electronic trading operations (60 out of a possible 180 substantial traders and 800 traders in total), so the dominant trading practices *appeared* to be manual and fax based. But as an outsider, would I ever be in a position to call out when evolution occurred? If, for example, those 60 distributors

accounted for 80 percent of transactions now or sometime soon, then Omicron staff might very well consider this dominant practice, but this would be invisible to me—unless I asked. I hypothesised, therefore, that dominant practice, would be readily identified by the experts at the centre of the system, such as the customer service manager and CFO.

The picture emerging from all of this was of an evolutionary process defined by relatively fewer events at the higher level, and many small evolutionary events at lower levels of the hierarchy, in the manner suggested by Van De Ven & Grazman (1999).

Within-level effects

I now turned my attention to looking more closely at interdependencies in the Omicron case. Especially important codependencies, from the perspective of engaging Omicron's distributors, existed between technical enhancements proposed by Omicron and adaptations made to the routines of distributor purchasing officers. Here, new technological components spurred adaptations to routines, and the changed routines in turn spurred more adaptations to the components. The introduction of OM-2, for example, initiated variations in distributor ordering routines for early adopters.

We said to them, 'we're going to send you OM-2' and we did...but the customers weren't using it because they still needed to generate a purchase order in their system, and it wouldn't generate a purchase order for their system...they wanted not to key the orders twice.

This led to new changes on the Omicron side. After distributors had adapted their purchasing routines to incorporate the use of OM-2 it had become clear that re-keying data twice was undesirable. Omicron then integrated OM-2 with the small business financial software in an attempt to address the double-keying issue.

But the subsequent alterations to purchasing routines as the new version of OM-2 was tried led to yet another realisation: that purchase order number consistency was critical to distributors and purchase order numbers needed to be generated by their financial software. OM-3 was then developed to address this by allowing purchase order numbers to be picked up from financial software packages.

Now we have arrived at entering it into their system only and it will extract all the way through to OM-3 without them having to key it twice.

The notion of within-level coevolution, used by Rosenkopf & Nerkar (1999) to describe the way product innovations spurred developments in one another, could be applied to describe these events too, with the key difference being the recognition of interdependencies between both technical and social components. Here, technical components spurred developments in routines, which spurred further developments in the technical components. Progress involved many cycles of learning and adjustment, reminiscent of Doz (1996) observations of positive event sequences in the building of alliances. These events were characterised by recurring, self-reinforcing effects building one upon another over time, and could be interpreted as a positive feedback loop (see Figure 11) after Baum & Singh (1994) and Lewin & Volberda (1999).

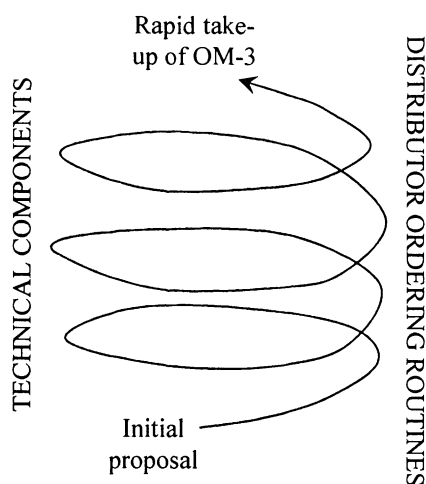


Figure 11: OM-2 / OM-3 development interpreted as a positive feedback loop

While the chain of events described above was particularly critical in the journey towards e-commerce enabled trading in the Omicron IOS, another codependent sequence between the evolution of both technical components and routines was described by respondents in the resolution of technical problems. One distributor experienced a software conflict at an early stage, a conflict that was only identified after

routines had been adapted to use OM-2 for occasional purchases. The problem was described by the principal:

Now, we have some teething problems with OM-2. We have a lass that does our purchasing, and she experienced a problem. We run an accounting system called A-1 and we can't run OM-2 on the server whilst she has A-1 in operation. So there is a conflict there somewhere.

When the problem was fixed with a software update to OM-2, increased usage of OM-2 led to the discovery of a new problem, as related by the purchasing officer in a later interview:

We have a credit limit, and what happens once you get to that credit limit, if I fax an order down, they override it. But when you do it in [OM-2], you send it down, it goes into limbo. And we had an order, wondering where the heck it was, and it was in this 'limbo land' because [OM-2] doesn't know to adjust things.

When Omicron made technical modifications to include credit limit alerts, the purchasing officer began putting all her orders through electronically. Performance related problems were then discovered, however, that stopped the distributor principal from adapting to it completely:

I have noticed that there are a lot of the times I don't use it...I will wait until a Saturday morning and even then it sometimes takes way too long. To put it bluntly, it is annoying. I am not getting order acknowledgements and backorder reports out of it. Very seldom I'll get a shipping report out of it.

Similarly, the adaptation of various technical components underpinning changes to pricelist distribution (such as Omicron's master product database) led to distributor purchasing officers changing their routines so they no longer used printed catalogues and took pricing information from their computer screens instead. This subsequently led to dissatisfaction with the new routines because they did not cater for the special one-off deals that distributors negotiated from time to time. Special deals were still documented manually, in a letter from the relevant Omicron sales representative, and this temporary pricing was not visible to distributors electronically. Consequently, distributors had to place electronic orders at the regular price and trust Omicron to

manually apply the discount at their end. Disliking this arrangement, purchasing officers pressured Omicron to make further adaptations to technical components so that special deal prices would appear as an option on their computer screens for the period that the special deal was valid. This sequence of events was somewhat reminiscent of the idea of equipping the customer to act as the innovator and leader in designing products (e.g. Thomke & Von Hippel 2002).

Coevolutionary effects also played an important role in failure. In the early attempts to move to electronic trading with large distributors, the constraints and controlled direction of adaptation for routines inside one of Omicron's large distributors had driven new adaptations to OM-1 in a direction that progressively added complexity. The following sequence, drawing together remarks made by three different respondents, paints a vivid picture of the repeating cycle of events that eventually led to the termination of OM-1:

So that's the direction we started to head, and EBI Services developed that [OM-1] for us -- a package that would do what we wanted.

We put OM-1 in as the middleware solution for [Distributor]. And we had what we thought was a really natty little solution, and it wasn't. [Distributor] had a very specific idea of what they wanted, they wanted to change ordering, and all that sort of thing, that EBI Services had developed for us.

So it wasn't the right solution. Our second install attempt was vastly different in concept due to the demands and constraints placed on us by the customer.

The [second version of OM-1] didn't work well. We could not resolve the errors, we had major problems...because they wanted to order their part number, they wanted to order their units of measure, and all of this.

We would no sooner fix it to match [Distributor's] requirements than something else would not work. So we would fix it and [Distributor] would have a problem...we redeveloped the entire system for [Distributor] because they don't use our part numbers and we had to have it auto resolve to our part numbers to go through to our warehouse for picking.

[The next iteration of OM-1] was good for them, from their end. It was a nightmare for us. It didn't work as well as what the theory would predict.

It was too complex and it really was to our detriment, it really was. Eventually we weren't prepared to put any more resources into it to fix it. [EBI Services] were getting run off their feet. So we let it go for a while and then we just closed it down and went back to getting orders the old way.

The cycle of coevolutionary events had made OM-1 more and more complex, impractical and expensive for Omicron, until it was ultimately abandoned in the manner of a negative feedback loop (Baum & Singh 1994; Lewin & Volberda 1999). Interdependent entities had become locked into a sequence of coevolutionary events leading to failure (see Figure 12), in a similar manner to what Arino & de la Torre (1998) described in the failure of joint ventures, and Doz (1996) described in failing alliance projects.

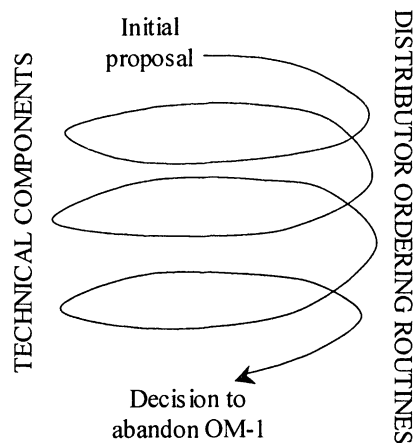


Figure 12: OM-1 development interpreted as a negative feedback loop

Trading operations also exhibited interdependencies where enhancements to one trading operation led to changes in others. When export operations were updated, for example, the export clerk was freed up and began taking on responsibilities previously handled by officers in the marketing department:

“She’s also doing queries and chase ups, and she’s doing a lot more work that she wasn’t doing before that was [previously] being handled by product managers, and the product managers no longer do it, she just handles it all.”

An outcome of this was that the product managers could focus more directly on their principal responsibilities, which included the management and quality control of information underpinning operations for distributing pricing to trading partners. Examples such as this showed the non-linear nature of some dependencies in the system, with changes at one point capable of producing surprising effects elsewhere, in the manner suggested by Lewin & Volberda (1999).

In a second example, the reduction in order placement and order processing errors, due to the enhanced ordering operations, led to a significant reduction in in-bound phone calls to the customer service department. The customer service manager described the knock on effects to routines in his department:

The guys have time to concentrate more on their job, stop making mistakes, stop making errors, stop the credits coming back [and can] be proactive in their deals. Our Customer Service is becoming more efficient, more proficient. They can start doing their knowledge development in specifications of products rather than being reactive and chasing the product manager for information...

In this case, enhancements to the ordering operation led to adaptation of routines for dealing with errors and in-bound calls. This had, in turn, enabled adaptations to other routines that improved pricing, ordering and backorder trading operations.

Cross-level effects

Having looked at within-level effects, I now examined the interdependencies and coevolutionary effects between levels. Here, I observed that the directions set by members of the system-level community filtered downwards to other managers, influencing the direction of ideas and adaptations as they sought to develop trading operations, technical components and routines. This phenomena could be seen in the frequent references made by Omicron respondents to the CEO’s interest in the e-business project. When the manual export procedures were discovered by chance, for

example, the subsequent adaptations to software components and to warehouse and dispatch procedures were initiated immediately, because of pressure from the top down to improve upon the four-day delays for processing export orders and to reduce the number of re-orders caused by errors. As one respondent noted, it was well understood by everyone how the MD felt about these developments:

He was very 'gung-ho'. He loved the developments in export documentation, he loved OM-2 and he loved the idea of the service module.

This process, in which directions set at the system-level played a role in evolution at the lower levels, could be described in evolutionary terms as downwards causation, after Campbell's description of this phenomena as when:

The laws of the higher level selective system determine in part the distribution of lower level events and substances. (Campbell 1990 p-4, in Rosenkopf & Nerkar 1999)

I have described the contrary process, of lower-level evolutionary effects leading to changes at higher-levels, earlier in this Chapter, but it is worth noting again here that these effects could be quite pronounced. I found that alterations to the direction of the trading system as a whole could sometimes be traced back to changes to a single component. The shift from large to small distributors, for example, was driven by the development of OM-2. Another example was the change about to be made in trade by having end-user customers purchase maintenance directly, bypassing distributors. This change could be traced directly back to development of the service module. The new capabilities for electronic quotes and work orders had led to new strategic thinking. Management had come to the conclusion that deploying the new service module to these organisations would have greatest effect in boosting equipment maintenance sales. It would still be offered to distributors, but Omicron would now focus its efforts on servicing big end-users directly, including those that bought equipment via distributors. This was a shift in the system-level strategy, with Omicron choosing to expand trading with end-users at the expense of distributors, and the catalyst had been the evolution of a single component.

Pronounced cross-level effects, therefore, occurred in both upwards and downwards directions. Evolution driven by a combination of component evolutionary trajectories

and top-down pressure was also described by Kay & Cecez-Kecmanovic (forthcoming) in their interpretation of IS/Organisation evolution. No formal plan for achieving a specific end result in e-commerce ever existed at Omicron. Instead, the project was allowed to develop and took on “a life of its own” with new ideas initiated based on the outcomes of previous developments. As an Omicron manager described it, it would not have been possible to follow a plan and arrive at a good outcome:

This project grew and grew. There was no way you could have planned it. If you had planned it, then by the time you had it you would have something you didn't need anymore, or it wouldn't work.

And another manager, when describing how Omicron had arrived at its current situation with respect to e-commerce:

We progressively build on and build on until what we have now.

I thus interpreted the overall system-level direction as coevolving with lower levels of the hierarchy, as suggested by Yetton, Johnston & Craig (1994) and Peters, Heng & Vet (2002). Transformation emerged through a combination of encouragement from top management to look for efficiency through electronic trading, and from a long chain of tactical selection decisions taken at lower levels (see Figure 13).

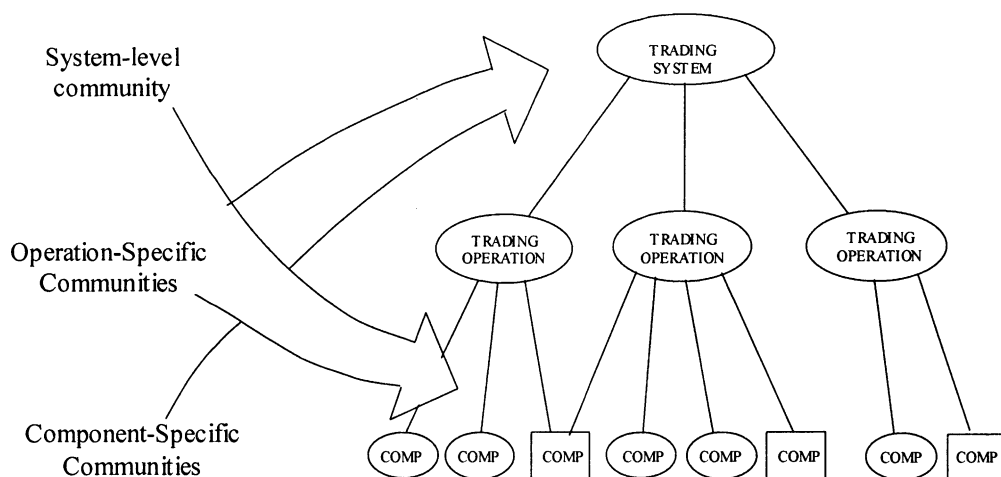


Figure 13: Cross-level effects

Just as the combination of downward causation effects from the system-level and upwards effects from evolving components could mutually reinforce one another, I could also observe cross-level effects clashing with one another.

The inability to get sales representatives to promote electronic trading was one example. Sales representatives did not invest the time necessary to learn how to promote the system properly, and were consistently unable to answer even basic questions from customers about the client software. This was in spite of the fact that senior management at Omicron considered the project strategic and had asked sales representatives to promote it, and in spite of the fact that electronic operations promised to free up time spent by sales representatives collecting orders manually. This behaviour appeared to be driven by the desire to focus on existing routines in pursuit of sales targets. Eventually, alternative mechanisms had to be created (changes to the job role of the customer service manager and the creation of packaged 'demonstration kits' on CD-ROM) to promote the system to the extent desired by Omicron management.

Similarly, comments from distributor purchasing officers suggested that immediate personal goals and priorities sometimes outweighed trialling OM-2 or OM-3, despite distributor principals having asked them to do so:

I don't have time to sit around and learn the whole intricacies of any program, whether it be [Omicron's] or anybody else's.

The abandonment of the proposed 'clearance promotion' enhancement to OM-3 could also be interpreted as a product of a struggle between the desire to maximise system-level efficiency through reducing dead stock inventory, and members of the marketing department seeking to maximise personal benefits under the incentive programs in place. Winding down dead stock would clearly improve the efficiency of the trading system as a whole and would benefit Omicron. The warehouse was constrained by a \$20 million ceiling on the stock that could be kept on hand, so the move would produce much more capacity for the faster moving, in-demand products. By resisting changes to dependent components in order to preserve their existing routines, the product managers were undermining these important system-level goals. Using the terminology of March (1991), the product managers might also be described as pursuing exploitation at the expense of exploration.

Events of a more destructive nature were encountered in the undermining by Omicron's IT Department. Here, the IT Manager was openly described as having promoted his own interests in conflict with those of other departments, and to the detriment of

outcomes as a whole. An Omicron manager confirmed the serious overall effect this had:

We had an internal brick wall...you can't assume that because theoretically the benefit is there, and the benefit is there, that people will support it, that is a wrong assumption to make... There is resistance, there is "I don't want to do that because my personal agenda is not in line with the technology goal". It really hamstrung us when we went off getting the resources here that we needed to do the things that needed to be done, to get this up and running. And that was causing us a lot of problems. I think we could have done a lot better in getting this out to our customers on a more timely basis and been 18 months further down the track...if we hadn't been 'sandbagged.'

Under the evolutionary metaphor, the IT Manager could be described as trying to preserve his routines, in the form of existing project priorities and his traditional role as owner of new software developments in the organisation. This resistance manifested itself in frequent delays in responding to requests, refusals to provide resources and attempts to undermine EBI Services as a provider of outsourced software development. I was thus interpreting routines as both sources of variation, after Feldman & Pentland (2003), and sources of inertia, after Shapira (1994), depending on the circumstances.

I could thus describe many of the difficulties and failures experienced along the way at Omicron as outcomes of whole-part coevolutionary competition (Campbell 1994, Baum 1999) where coevolutionary forces at lower levels pushed developments in directions that were not beneficial to the system as a whole. Relationships between levels in the hierarchy could become both positive and negative, as Van De Ven & Grazman (1999) suggested was a general characteristic of nested hierarchies.

Between-system effects

I now moved to two broader considerations in my interpretation, the coevolutionary effects between Omicron and other systems, and the rate of evolution for the Omicron system.

With respect to coevolutionary effects between systems, the data showed that changes to the Omicron trading system were also impacting trading systems between the

distributors and their customers (the organisations that ultimately used Omicron's industrial cleaning equipment in the field). Distributor-customer trading operations were being adapted to take advantage of outcomes associated with changes in Omicron-distributor trading operations. A respondent from one distributor described how the Omicron system had provided the direct inspiration for building up new electronic services between the distributor organisation and its customers:

We are in fact now putting in similar systems where we will now electronically forward our invoices and our statements to our customers and we are encouraging our suppliers to electronically lodge documents with us.

Another described how his organisation had commenced a similar project to provide new backorder and inventory status information to customers in electronic form:

It benefits us being able to delve into their [Omicron's] store and say, well we are not going to get that. We are putting in processes at the present time where we can go back to our customers and say "you are not going to get those safety spectacles or those gloves", or whatever the case might be.

I could see evidence that these trading operations had been retained in frequent remarks made by these respondents about how they had become "part of the business" and how going back to the old procedures "would be a backwards step".

The distributors were building adaptations to downstream trading operations with customers that depended on the newly enhanced trading operations with their supplier (Omicron). At Omicron, managers subsequently recognised the importance of providing more data that could enhance distributor-customer systems, and this was in turn shaping their thinking about new developments:

They really get excited about information—quality of information, much quicker, much more timely—for them to service their customers. What matters to them? Their customer!

The systems were influencing each other in ways that would make them more interdependent over time.

I found that distributor-customer systems also played a role in determining the evolutionary path of the Omicron system in other ways. In one case a distributor has

elected not to use electronic ordering because it grouped products together differently (in cases of ten items, for example, instead of allowing any number of items to be ordered) and would have required changes to the distributor's sales procedures relating to the order quantities normally on-sold to customers, In another case a distributor cited a primary consideration for going ahead with electronic ordering as being that it could be implemented without requiring significant changes to their own sales procedures:

It hasn't changed our [sales] procedures too much; we can still do things the same way. If you sell it you reorder it, and things like that.

The Omicron trading system was not only impacting distributor-customer systems, but was also influencing trading systems between distributors and other, competing manufacturers of cleaning equipment (see Figure 14). Distributors had encouraged Omicron's competitors to adapt trading operations along the same lines as Omicron's, going so far as to suggest they integrate their ordering systems with the OM-3 software module. The principal of one distributor described his efforts:

I have tried to get other companies to talk to this system, because I would like to have one platform...this company has a different platform to this one, and so on and so on, so I made recommendations to other companies, have a look at it...if I can get another three or four or five companies on the same platform, then that has got to be advantageous then for [our company].

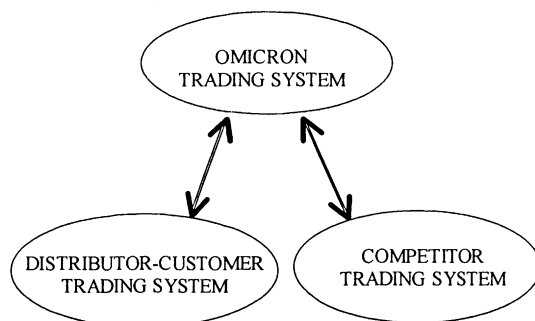


Figure 14: Between-system effects

Similarly, other systems between Omicron competitors and the distributors were having some effect on the Omicron system, as illustrated by the following remarks. The first was made by an Omicron manager having difficulties convincing a distributor to use OM-3:

They are umming and ahing. Their IT Manager has a relationship with another e-business system manager [from another supplier]. They want him to go that way, which stopped [Distributor] from coming to us.

The second remark was made by a distributor principal in reference to the need to consider competing systems when adapting to Omicron's:

I believe that we must go forward and persist with e-business strategies, not only of Omicron, but of all systems.

Potentially, if mutual interdependencies led evolution in a direction towards a 'single platform' as suggested by the distributor principal above, then the reinforcing effect might propel developments to a greater extent than if they were developing in competitive isolation, as observed by Barnett & Hansen (1996) in the banking industry and Barnett & Burgelman (1996) in the semiconductor industry, and this might lead to greater entrenchment of electronic trading operations between all distributors and suppliers involved. There were no data suggesting that competitive system effects had yet translated into any actual adaptations to the Omicron system, however, so this possibility remained speculative on my part.

Rate of evolution

With respect to the rate of evolution, I first interpreted the Omicron trading system as evolving in a manner described by punctuated equilibrium (Tushman & Romanelli 1985; Tushman, Newman & Romanelli, 1986; Van De Ven & Garud 1994) where periods of relatively incremental change are punctuated by periods of very rapid change. According to Omicron management, the same fax, telephone and paper based trading operations had been in place for a long period prior to the introduction of Internet-based technologies (the timeframe for this period could not, however, be specified). An explicit management decision had been taken to move to more highly automated electronic channels in 1998, after which the data painted a picture of accelerating evolution. The early stages were characterised by variations that achieved more 'misses' than hits (e.g. OM-0, OM-1) but the period following the introduction of OM-2 saw the number of adaptations increase rapidly and the apparent success rate with it. A second round of major enhancements then brought many diverse and parallel adaptations,

prompting the description by an Omicron manager of the project as having “taken on a life of its own”.

I could now interpret the acceleration as partly a result of the mutually reinforcing effects between the levels. Pressure to change was initiated at the system level by the CEO. Subsequent developments in reshaping some trading operations led to improved business outcomes. This then reinforced top-level enthusiasm and pressure to continue advancement of electronic trading. Efforts to accommodate distributor requests and further adapt first generation technical components were energised, and many new lower-level adaptations that had now been proposed by staff, across a variety of departments, were trialled. Work on this second round of initiatives resulted in enhancements to a range of trading operations.

While this acceleration was strongly evident from the relatively higher rate of change compared to pre-1998, there was insufficient data to suggest that any definite peak had been reached, or that the rate of adaptations had fallen off, or that they had definitely become more incremental in character. Adaptations to OM-3, for example, appeared to me to have slowed to a trickle, only for a respondent from EBI Services to make the comment, in the final round of interviews, that his organisation was considering redeveloping OM-3 “from the ground up” later in 2006. I thus interpreted the evolution of components and trading operations at Omicron as having accelerated over time, but whether or not it followed a path described by punctuated equilibrium was yet to be determined.

6.5 Summary of the framework

In this section I discuss the overall outcome of my interpretation, bringing together the key elements in my framework and comparing it with the Rosenkopf & Nerkar (1999) framework.

The interpretation established that the events that take place in the creation, acceptance and take-up of an eIOS can indeed be interpreted in coevolutionary terms. The Omicron case was interpreted using a three level coevolutionary hierarchy comprised of, in ascending order, a component level (technical components and routines) a trading operation level and a trading system level. These levels are represented graphically in Figure 10. Community based selection processes are prominent, as they are for Rosenkopf & Tushman (1998). Component-, operation- and system-level communities apply selection forces. Community membership can change and an individual can be simultaneously a member of more than one community. The framework takes an ecological evolutionary approach (Baum & Singh 1994) in seeking to understand the dynamic interactions within and among ecological entities, in this case technical components, routines, trading operations and trading systems that exist within and between organisations. It seeks to accommodate both the process and the context of the change, after Barnett & Carroll (1995).

Components are the most granular unit of analysis. Social components are routines such as job roles, procedures and work practices. Technological components are software modules, databases, interfaces and the like. Component variations are intentionally generated by actors, and also come about through chance. They are selected by component specific communities. Variations are retained in the installation and acceptance of new technical components such as software enhancements and in the acceptance of new skills, roles and procedures as they become a persistent element in the everyday actions of relevant personnel. Component evolution is characterised by strong history dependence.

Trading operations are collections of routines and technologies in commercial processes between trading partners, such as pricing, ordering and exporting. Variations to trading operations are retained in the institutionalisation of new trading practices between organisations. Selection and retention spans multiple organisations simultaneously, and

is undertaken by operation-level communities, comprised principally of people imbedded in, and directly affected by, operations on a daily basis.

The system is the collection of trading operations in play between a group of trading partners, organised into a coordinated system of use. System-level evolution occurs when trading practices are established as dominant practice between trading partners participating in that system. The overall direction of the system is determined by a combination of top-down strategy (set by a system-level community of senior executives in the various trading partners) and the evolutionary trajectories of trading operations at lower levels.

A complex mixture of social, political, economic and market forces powers evolutionary processes. In the evolutionary tradition suggested by Aldrich & Ruef (2006), these are accepted as driving variation, selection and retention but the exact nature of these forces varies from case to case and does not need to be specified. Forces can work to promote variations and to stifle and eliminate them, and they often conflict with one another.

Interdependency effects act within and across levels. Interdependencies between the adaptation of routines and technical components factor strongly in determining the ultimate selection or elimination of variations relating to e-commerce, especially when routines act as sources of inertia. Successful developments are characterised by recurring, self-reinforcing effects building one upon another as positive feedback loops. Unsuccessful developments are characterised by negative feedback loops, where developments become progressively less acceptable to one party until selected out of the system, or by whole-part coevolutionary competition where actors or communities work to local goals that conflict with directions that can benefit the system as a whole.

The framework includes both teleological and dialectic elements (Van de Ven & Poole 1995). Teleologically, the business goals of Omicron and its trading partners help drive generation of new variations and the selection of those variations. Dialectically, actors and communities associated with the various operations and components struggle with one another (within and between levels) over different goals and requirements, also driving selection.

Table 8 compares the induced coevolutionary hierarchy with the template hierarchy from Rosenkopf & Nerkar (1999). The most significant difference lies in the inclusion of routines as social components and the resulting conceptualisation of trading operations in socio-technical terms, as opposed to conceiving them in ‘product’ terms, as aggregations of technology components.

	Evolution of optical disc industry (Rosenkopf & Nerkar 1999)	Evolution of eIOS
Level 1	SYSTEM	SYSTEM
	<ul style="list-style-type: none"> • <i>Systems</i> are composed of multiple coordinated products and solutions. • <i>System-level community</i> is the selection entity. Selection is accomplished through coordinated activity of a broad community of actors. • <i>Standards</i> are markers of system level evolution 	<ul style="list-style-type: none"> • <i>Trading system</i> is the combination of trading operations in play between a set of trading partners. • <i>System-level community</i> of senior executives from the trading partners is the selection entity. • <i>Dominant trading practices</i> are markers of system level evolution
Level 2	PRODUCT	TRADING OPERATION
	<ul style="list-style-type: none"> • <i>Product</i> is a system of technological components. • <i>Firms</i> are selection entities. Product-level variations occur when individual firms decide how they select and bundle components. 	<ul style="list-style-type: none"> • <i>Trading operations</i> are collections of routines and technologies for conducting commercial operations between trading partners. • <i>Operation specific communities</i> are the selection entities. Evolution is driven by community selection, downward pressure and evolution of components.
Level 3	COMPONENT	COMPONENT
	<ul style="list-style-type: none"> • <i>Components</i> are discrete technologies that can be combined into products. • <i>Component-specific communities</i> are selection entities. Evolution is diffused, with variations & selections occurring across multiple communities. 	<ul style="list-style-type: none"> • <i>Components</i> are both discrete technologies (e.g. software modules, databases) and routines (job roles, procedures, work practices). • <i>Component-specific communities</i> are selection entities. Evolution is diffused and driven by both community innovation and top down pressure.

Table 8: Comparison of hierarchies

(Rosenkopf & Nerkar framework for technological evolution versus framework for the evolution of an eIOS)

Having demonstrated that the creation, acceptance and take-up of an eIOS can be explained in coevolutionary terms, I now return to the question posed at the very beginning of this research: “What new enabling strategies for practitioners could help facilitate the successful engagement of trading partners in interorganisational e-

commerce systems?” What, in other words, does all this mean for managers? In the next Chapter I present my answers to the research question by using the coevolutionary framework I have arrived at to suggest a series of new strategies.

7. Conclusions and implications

I begin this Chapter with a short review of the decisions, discoveries and events that marked the course of this thesis. I then move on to the main contribution of this research with a discussion on the implications of the coevolutionary framework for practitioner strategies. The largest part of the Chapter is dedicated to this. Afterwards, I describe the theoretical contributions and a methodological contribution that I have made. In the latter part of the chapter I discuss new questions that have been raised and the avenues that have been opened for further research.

7.1 The journey

I started this journey with the principal goal of producing new insights for practitioners to help them engage trading partners in e-commerce systems. My research began with a review of relevant literature to search for more information on why trading partners are successfully or unsuccessfully engaged. The results of this review were far from satisfying. I found that the empirical studies circled back over the same broad adoption factors, frequently contradicted one another, and tended to offer little in the way of practical new strategies for managers charged with implementing eIOSs. I also found that the existing theoretical models were complex and had limited application—obtaining all the data to populate them (such as the internal costs of businesses for trading partners, or measures of interorganisational trust) would be difficult or impossible in practice. The majority were strongly biased towards initial conditions and offered little insight on engagement processes once an initiative is underway: they could help the practitioner decide if to pursue a proposed project but not how to pursue it. Each social, economic or technical model analysed part of a complex picture where many forces shaped the development and deployment of an eIOS. Practitioners, on the other hand, cannot afford to focus on economics at the exclusion of power and trust, nor can they look at institutional forces without considering economic factors. While all of the theoretical perspectives could be said to be relevant in some way, none supplied the practitioner with a framework that accounted for many forces, extended beyond initial decisions and could be usefully applied to a variety of eIOS contexts.

I collected data across ten eIOS cases in search of simplifying themes relating to the successful engagement of trading partners in eIOSs. From this I identified a series of characteristics—long histories of change and adaptation, interdependent changes across multiple organisations and the critical importance of feedback channels—that suggested coevolution as a promising theoretical approach. A review of the literature reinforced the potential of coevolution to produce a meaningful model for the engagement of trading partners in interorganisational e-commerce systems. It offered advantages in getting past the focus on initial conditions, extending to engagement beyond initial adoption decisions, accommodating intentional and chance-based events, and accounting for social and economic forces together. Furthermore, it had already proved a useful lens for understanding organisational adoption of technological innovations and the formation of alliances. During the review, I identified the Rosenkopf & Nerkar (1999) framework as a promising lens through which to try reinterpreting an eIOS case in coevolutionary terms. I then conducted a second data collection exercise to build up a detailed history of the Omicron case. The interpretation of events in the Omicron eIOS project was undertaken using a hermeneutic cycle, moving iteratively between descriptions made by actors in the Omicron system and my conception of the system as a whole, and reflecting back to the ideas of Rosenkopf & Nerkar (1999), other coevolutionary literature, and the eIOS literature more generally. The outcome is a new coevolutionary framework for conceptualising the development of an eIOS.

7.2 Implications for practice

The coevolutionary framework provides practitioners with a different way of thinking about eIOS initiatives and suggests a series of new strategies to maximise the chances of successfully engaging trading partners. These strategies apply to the preparation, initiation and ongoing management of eIOS developments. They are discussed in full in the following pages, and I have also presented them in summary form in Table 9, below.

1. Assume that a complex eIOS initiative cannot be designed, planned and controlled at the outset.
2. Work iteratively, through successive cycles of change, trial, analysis and change, until new dominant practices are established.
3. Rethink the system in socio-technical terms. Identify the relevant trading operations and the components underpinning them, taking particular care to consider social components such as routines, procedures, competencies and job roles.
4. Identify the communities that will influence developments through proposing, selecting and retaining changes. Do this for individual components and trading operations, as well as for the system as a whole.
5. Consider the desired end states for components and, for every change, identify interdependencies by considering what other components will be affected.
6. Emphasise a smooth and positive sequence of developments over absolute rate of progress, especially in the early phases of the implementation.
7. Foster adaptability by building technical components that are easy to modify.
8. Prioritise initial work based on adaptability and responsiveness of individual communities, rather than organisational characteristics of trading partners.
9. Select easily changed routines and technical components for early work.
10. Foster effective, regular communications within and between communities.
11. Create communication channels to receive feedback from trading partners, and procedures to ensure feedback, suggestions and problems are acted on promptly by the system initiator.
12. Direct additional resources/support to developments where changes are spurring new adaptations and enhancements in positive, mutually reinforcing cycles.
13. Promptly intervene in cycles of negative development, where events are heading towards an outcome that will be rejected by one or more communities.
14. Head off whole/part coevolutionary competition by adapting performance measures or introducing new incentives where possible.
15. Create opportunities to bring trading partner personnel and managers together at regular intervals to discuss developments and exchange ideas.
16. Begin new trading partner relationships using new e-commerce operations and practices from the outset.
17. Brief new managers on new routines before they have a chance to learn the old, established routines.
18. Time new adaptations, where possible, to coincide with disruptive events such as new products, trading contracts, government regulations or market conditions.
19. When few components and routines can be directly influenced, emphasise rapid reaction through those that can.

Table 9: Strategies for engaging trading partners

Working through iterative cycles of change

At a high level, the framework challenges the notion that a fixed path of development can be imposed upon complex e-commerce initiatives, and thus helps the practitioner

get away from assumptions that they should design, plan, and attempt to impose control on such initiatives from the outset. These ideas may be seen as following those of Truex, Baskerville & Klein (1999, p-118), who encouraged practitioners to consider their organisations as “emergent” and “in a continuous state of adjustment” and so should abandon rigorous, lengthy up-front analysis and design activities that presume organisations hold still. The multi-organisational context of eIOSs makes change even more inevitable, and such presumptions even less relevant, than for intraorganisational contexts.

The coevolutionary framework provides a way of understanding the problems of control and complexity that Naeem, Rabhi, Benatallah & Ray (2005, p-41) described:

Controlling the applications and systems that need to be integrated may be difficult, because they usually span several organisations. Moreover, the applications are often heterogeneous, made up of a mixture of databases, enterprise resource planning (ERP) systems, legacy systems, and custom applications.

By viewing interorganisational e-commerce systems in terms of coevolving social and technical components, practitioners can better appreciate how many of these components lie beyond their direct control, especially in the case of the routines and technologies used by trading partners.

At the same time, the framework moves the practitioner beyond the application of traditional intraorganisational strategies, and suggests more suitable strategies when the practitioner cannot directly influence all the components in the system. A realistic approach to engaging trading partners does not lie in attempting to push them en masse to new trading practices, nor in taking the traditional IS planning approach of developing a system and then ‘extending’ it to other organisations (Finnegan, Galliers & Powell 2003), but in working iteratively, through many successive enhancements to components and trading operations, until new dominant practices are established. Managers are thus steered towards the role of guiding developments into a positive development path, based on a better understanding of interdependencies between components and levels. Two of the strategies suggested by Truex, Baskerville & Klein (1999)—pursuing smaller but ongoing cycles of analysis and implementation, and

building technical components that are easy to modify—are especially relevant. Practitioners are encouraged to follow the lead of Sage & Cuppan (2001, p-343) who, based on their conceptualisation of modern information systems as systems of systems, recommended seeking:

...to adapt and cope, abandoning myths of ‘total control’, to attain sustainable, ecologically-balanced, effectiveness in systems engineering and management.

Moore (1993) similarly argued that fostering coevolution helped modern business ecosystems to thrive, whereas tightly controlled ecosystems did not build the same opportunities or harness as much capital and talent from participating companies.

The framework also provides a reminder, after Aldrich & Ruef (2006), that selection events do not always improve fitness, alerting the practitioner to the possibility of adaptations being embraced by one community when they may not be good for others, or for the system as a whole.

Preparation for engagement

Although the practitioner should abandon the idea that initiatives can be planned from the outset, this does not imply that no preliminary work should be done. On the contrary, preparation will still be very helpful. First and foremost, plenty of up-front work can be done to help rethink their eIOS in coevolutionary terms and to alert themselves to what this implies. Traditional technical views of eIOSs will need to be adapted to the socio-technical concepts of routines, technical components, trading operations, communities, forces, and interdependencies. Adner (2006) provides inspiration here in his suggestion that managers can benefit from mapping innovation ecosystems. The first step in the mapping process, he suggested, was to identify all the intermediaries that must adopt an innovation before it reaches the consumer, and the second step was to identify all the other innovations needed for a particular innovation to succeed. Here, Adner (2006) emphasised a deliberate, pre-emptive approach, in strong contrast to the emergent process I advocate, and I question his presumption that all of this information can be known in advance, but his ideas serve as a reminder that useful work can be done before commencing an initiative.

In the eIOS context, a useful first step for the practitioner will be to identify key elements within their evolutionary hierarchy. This might be most easily undertaken from the top down, with a description of their trading system (e.g. trading between our organisation and suppliers of raw materials) and system-level goals, followed by descriptions of the trading operations of interest and the desired end state for each. The practitioner would then move downwards to identify the key components underpinning each of these trading operations, and their desired end states. Most importantly, he or she would take the time to consider all the social components (including routines, procedures, competencies and job roles) as well as the technical components.

Next, the practitioner will identify the communities acting at component, trading operation and system levels. This goes back to the need, discussed by Premkumar, Ramamurthy & Nilakanta (1994, p-181), “to satisfy the needs of many constituents—top management, internal users in the functional areas, external users (customers/suppliers), and IS personnel.” The practitioner should seek to identify all actors likely to exert a meaningful influence on developments through proposing, selecting and retaining changes, constantly asking themselves the question “who really decides the outcome here?” All of this would be considered without regard to departmental or organisational boundaries.

Here, the practitioner should be especially careful to think about the levels at which selection and retention decisions are taken. Acceptance of new routines or software modules by component-level communities does not necessarily translate to acceptance of the associated trading operation changes by operation-level communities. Nor does mandated change from the top necessarily translate into accepted adaptations at lower-level communities. The better the understanding of the social levels at which various selection and retention decisions are actually made, the more likely that time and resources will be applied to best effect later.

Finally, the practitioner will consider interdependencies between components. Whenever they come across a routine or technical component that will have to change (even if they do not yet know exactly how it will change) they should be asking themselves the question “what other components will be affected?”

There will inevitably be many gaps the practitioner cannot fill. It may, for example, be very difficult to establish all the actors that will exert an influence on a given component. If, however, a few questions here and there are all it takes to eliminate some unknowns, and to establish what relationships and dependencies are most important, then these investigations will be very valuable in producing an understanding of who and what will matter most in achieving successful engagement.

The practitioner will then be better positioned to single out technical components, routines, people, and dependencies that are especially critical, and to prioritise at least the very first stages of the implementation. Reflecting on what I observed earlier across the ten case studies, practitioners often think in insufficiently granular terms when they prioritise their early engagement efforts based on organisation types or characteristics (prioritising the engagement strategy based on categories of trading partner organisations was an important theme). A more effective strategy will instead be found in setting priorities based on the character of component and trading operation communities.

Adner (2006) suggested that, after mapping an innovation ecosystem, a manager could estimate the cumulative delays in innovation development and adoption based on the identified interdependencies, and then should consider changes to strategy if initial expectations seemed unrealistic. In the eIOS context, quantitative estimates of timeframes for component adaptations will not be practical, but the preliminary work I suggest here will at least give the practitioner a better qualitative appreciation of how difficult their project is going to be, and whether it is realistic.

These recommendations raise a practical question about the selection of boundaries: how much should a practitioner incorporate in their considerations and what should be left out? Theoretically, of course, an enormous number of interpersonal connections, relationships and technical elements (including all the technologies underpinning the evolution of the Internet itself), exert influence on any complex system, even if the influences are small. Some limit, therefore, must be set in practice. Practitioners should set that limit based on their own subjective assessment of the importance of the phenomena in question and the practical limits of their knowledge and capacity to investigate. What the practitioner leaves out, in other words, will be what hardly matters, what they don't know, and what they cannot find out.

Having reconceptualised an eIOS implementation in coevolutionary terms, and used this to prioritise their first steps, the next step will be managing the implementation once underway. Broadly speaking, the coevolutionary framework tells the practitioner to pursue strategies that foster adaptability, help variation/selection/retention sequences proceed more smoothly and reinforce positive feedback effects within and between levels.

Making the first steps count

The way that the practitioner begins engaging trading partners will be of particular importance. Here, the practitioner should emphasise a smooth and positive sequence of developments over absolute rate of progress (Doz 1996; Arino & de la Torre 1998). Easily changeable components can be selected for early work and special care can be taken to foster effective and regular communications between members of communities. The practitioner must also ensure that procedures are in place to ensure all feedback, suggestions and problems are acted upon promptly. The Omicron interpretation and coevolutionary literature provides guidance on the types of communities for initial engagement. At Omicron, very large trading partners were characterised by inertia and slow adaptation, while managers in small distributors made more rapid selection decisions, suggesting that early component variations should be tried with these communities. Similarly, the greater adaptability of new firms to innovations (Henderson & Clark 1990), and increased inertia in organisations as procedures become more entrenched over time (Hannan & Freeman 1984) suggest that, in the early stages of an implementation, the practitioner should target newer communities preferentially over older, more entrenched communities, and focus on recently created routines to facilitate ‘quick wins’ to foster positive coevolution from the beginning.

Nurturing positive feedback loops

The framework highlights the importance of feedback loops across organisational and hierarchical boundaries, and the practitioner should look to facilitate effective feedback channels within and between levels to power cycles of variation and selection. Identifying and strengthening feedback loops was also suggested as a strategy by Baum & Singh (1994) and Lewin & Volberda (1999), and creating effective communication channels to receive and act upon feedback from trading partners was a prominent theme

in the ten case studies I conducted. The practitioner should try to nurture positive, self-reinforcing feedback loops by diverting additional resources and attention to these developments when they are identified. Conversely, the practitioner should aim for prompt intervention in cycles of negative development, to minimise the impact in wasted time and resources for the effected communities. Similarly, effects characterised as whole/part coevolutionary competition will need to be dealt with promptly. Based on the experiences of actors in the Omicron system these effects can be very difficult to address if left for too long, and the most promising approach probably lies in anticipating this type of conflict at an early stage based on a good understanding of the goals and motivations of the various communities (e.g. the sales team and the product managers at Omicron). Baum (1999) suggested adapting performance measures, restructuring and/or decentralising as potential strategies. Of these, adapting performance measures is likely to be the easiest to implement in practice (in the Omicron case this would likely have been very valuable if applied to members of the sales team and to Omicron's product managers). Adapting performance measures for personnel working in trading partner organisations will be more difficult, but it is by no means impossible. Here, strategies can be built around the tying of additional incentives, such as discounts or rebates, to requests to trial and/or provide feedback on new components. This is analogous to Levinthal & March's (1993) suggestion that learning processes can be enhanced through the use of specific incentives for the pursuit of exploratory behaviour.

Another strategy to mitigate against whole-part coevolutionary competition lies in bringing managers together, at regular intervals, to discuss and debate developments in the eIOS implementation. Doz (1996) found that managers need more time and space to learn, engage in joint sense making with their counterparts and to experiment. Deliberately creating learning time and space for members of key communities associated with the eIOS is likely to be valuable. Opportunities to bring managers together from a large number of trading partners could be created, for example, by scheduling workshops at trading partner conferences and/or industry events. Such mechanisms would ideally generate an exchange of ideas even before the very first component variations are proposed.

Exploiting windows of opportunity

Evolutionary and coevolutionary literature suggests other strategies to help ‘free up’ evolutionary processes. Levinthal & March (1993) suggested slowing the socialisation of new system participants to established practices (i.e. the old practices that you intend to change). In the eIOS context, practitioners might brief newly hired managers on the objectives of the system, and how the manager can contribute towards achieving the objectives, before they get a chance to learn the established routines of their department. Similarly, practitioners can ensure that when new trading partner relationships are formed, relevant trading partner personnel are introduced to e-commerce based operations from the outset, rather than beginning the commercial relationship using the existing trading operations.

Practitioners may also find useful strategies in exploiting, or perhaps even introducing, events that temporarily heighten adaptability in the system, especially with respect to the inertia of routines. At the community level, Rosenkopf & Tushman (1988, p-24) suggested that technological discontinuities generate “windows of strategic opportunity for firms to participate in shaping emerging standards during eras of ferment.” According to Tyre & Orlikowski (1994) the same principles apply at the organisational level, and strategies can be directed at stimulating adaptation as close as possible to ‘disruptive events’ on the basis that adaptation to new technological innovations falls away rapidly with time after a short introduction period. They described this period as a finite window of opportunity during which users found it relatively easy to make changes to work practices to accommodate new technologies, after which adaptive efforts dropped off. Tyre & Orlikowski (1994) also found that spurts of adaptive activity could be initiated by disruptive events such as management actions, the introduction of new procedures, or the arrival of new personnel. In the eIOS context, practitioners can try timing the introduction of new components and adaptations to coincide with disruptive events either of their own making (new services, products, software upgrades, trading contracts) or imposed from the outside environment (new government regulations, market conditions, mergers and acquisitions).

Action versus reaction

The practitioner's strategy will be shaped by how much variation is blind and how much is intentional. When random effects play a relatively greater part then the practitioner will be better served by monitoring developments closely and concentrating on rapid reaction through the few components and routines that can be directly influenced. If intentional effects play a relatively greater role, then it will be worthwhile to invest more time working with actors in key communities to influence communication, decision-making and selection processes. Experience and good judgement will be helpful here, as variations that appear to be direct consequences of intentional action can be much more random than appearances suggest, making it difficult to establish how much of a role is played by purely random effects (Shapira 1994).

A new way of looking at the eIOS

For the practitioner, this research has produced a new way of looking at the development of an eIOS. It highlights the necessity of considering routines, such as job roles, procedures and work practices, as social components alongside the technological components in a system. It makes clear the limitations of considering an e-commerce subsystem as a product or aggregation of technology components, and provides a more valuable conceptualisation of the trading operation as the collection of routines and technologies that form a commercial process between trading partners. The purely technological view of an eIOS has been displaced by a socio-technical one. All of this allows the critical role of routines, and routine adaptation, to be properly accounted for, which is essential to successfully engage trading partners.

The interpretation has highlighted the limited influence of the practitioner as they attempt to promote adoption of an eIOS. He is only one actor in the complex system involving many communities that span multiple organisations. Abundant potential exists for forces and interdependencies to produce conflict and lead events down a path to failure. Attempting to impress a fixed design on this complex system is a high-risk strategy that—unless the practitioner switches to a more flexible development path—is doomed to fail. For most systems, the only real chance the practitioner has of successfully engaging many trading partners is to embrace iterative strategies of change

and trial, encouraging continuous enhancements until new dominant practices are established.

The framework I have produced offers practitioners a new way of thinking and discussing things, in the same spirit described by Adner (2006, p-106):

The value of most frameworks lies not in changing a manager's intuition but in clarifying the issues that arise when managers with different instincts try to debate the right course of action. A structured framework can transform the debate from a battle of guts, ultimately resolved on the basis of reputation, power and eloquence...into a comparison of assumptions being made about a given situation's fundamental structure. A framework presents elements and relationships that provide a grammar for the debate.

When managers debate the right course of action in the eIOS context, the coevolutionary framework will help them get beyond arguing strategy based on narrow economic, political or technical perspectives, and provide a grammar for considering many forces operating simultaneously, and the many interdependencies that exist between social and technical components in these systems.

7.3 Theoretical contributions

I have also made two theoretical contributions. Firstly, by building on the ideas of Rosenkopf & Nerkar (1999) and many other scholars, and inducing a coevolutionary framework for describing events in the engagement of trading partners in an eIOS, I have extended coevolutionary theory into a context where it has not been applied before. Secondly, the new framework fills an important gap in the e-commerce and interorganisational systems literature.

A new organisation-level coevolutionary framework has been induced based on multilevelness, multidirectional causalities, positive feedback loops, nonlinearity and path and history dependence, the essential properties of coevolution (Lewin & Volberda 1999). The framework takes an ecological evolutionary approach (Baum & Singh 1994), accommodates both the process and the context of the change (Barnett & Carroll 1995), and is characterised by community based selection processes (Rosenkopf & Tushman 1988; Rosenkopf & Nerkar 1999). Routines and competencies have been used as organisation-level units of analysis, after Levitt & March (1988) and Aldrich & Ruef

(2006), but have, uniquely, been extended to a phenomenon spanning multiple organisational boundaries. Similarly, the notion of dominant design (Anderson & Tushman 1990; Rosenkopf & Tushman 1994; Suarez & Utterback 1995) has been uniquely extended to the conceptualisation of dominant trading practices as an evolutionary marker for the eIOS context.

The framework builds on the Rosenkopf & Nerkar (1999) framework for technological coevolution, and complements other attempts to apply coevolution to information systems strategy (Peters, Heng & Vet 2002; Kay & Cecez-Kecmanovic, forthcoming) by offering a new organisation-level coevolutionary framework for a specific, complex type of information system—the eIOS. Other researchers may look to adapt this framework further and use it to interpret other types of interorganisational system or other information systems phenomena characterised by complex social and technical interdependencies. My framework has also served to reinforce a series of considerations available to scholars seeking to adapt the ideas of Rosenkopf & Nerkar (1999) to any context: that the basic building blocks of coevolutionary frameworks can be a combination of technologies and routines, that socio-technical aggregations can sensibly substitute for products in evolutionary hierarchies, that selection communities are capable overlapping and changing over time, and that dominant trading practices can serve as a marker for system level evolution.

A theoretical contribution has been made by bringing a new perspective to the interorganisational systems literature as well. Having taken an interpretive philosophical approach, and used coevolution as a lens to describe phenomena within the eIOS, I have demonstrated that coevolution provides a powerful description of events. I have used coevolutionary theory as a “sensitising device to view the world in a certain way” (Klein & Myer’s 1999, p-75). Roughgarden (1983, p-34) described coevolutionary models as a “small, but growing, collection of models that have proved useful to people” and, like models in physics which assume frictionless pulleys and surfaces when modelling mechanical advantage, “these simplified and idealized models are useful guides to understanding processes”. My coevolutionary framework makes a contribution in the same spirit, providing a new guide to understanding the processes of developing, and engaging trading partners in, eIOSs. From the positivist perspective, my contribution is a metaphor serving as a precursor to theory development to “assist

the theorist in deriving specific propositions and/or hypotheses about the phenomenon being studied” (Bacharach 1989, p-497).

The framework offers a new way of looking at eIOSs in terms of routines, components, forces, variation / selection / retention sequences and within-level and between-level coevolutionary effects. At the lowest level in the hierarchy, adaptations to technical components and routines can now be viewed as variations that are either rejected, or retained and accepted by becoming a persistent element in the everyday actions of personnel. Variations to trading operations can, in turn, be viewed as retained in their institutionalisation between organisations, and systems can be seen as evolving as new trading operations become dominant practice in a community of trading partners. Interdependencies between routines and technical components are critical in determining the ultimate selection or elimination of variations within the eIOS, especially when routines act as sources of inertia. In marked contrast to the existing literature, social, political, economic and market forces can all be included as powering the differential elimination of variations, and these forces can be seen to sometimes power conflicting developments that undermine evolution of the system as a whole.

Under this interpretation, interdependencies and coevolutionary effects, both between components and between levels, lie at the heart of understanding why trading partners are successfully or unsuccessfully engaged in e-commerce. When trading partners are successfully engaged, evolutionary developments are characterised by recurring, self-reinforcing effects building one upon another via positive feedback loops. When system initiators fail to engage trading partners, evolutionary developments are either characterised by negative feedback loops (where developments become progressively less acceptable to some actors, until they are selected out of the system) or whole-part coevolutionary competition (where actors or communities work to local goals, to the detriment of the system as a whole).

The interpretation can now account for the complex mixture of factors that apply as trading partners are engaged in these systems, while at the same time remaining relatively simple. A common foundation has been created for interpreting many phenomena in various eIOS scenarios. Interdependence and coevolutionary effects, for example, describe why process innovation and technological innovation go hand in hand in successful EDI implementations (Clark & Stoddard 1996), why reengineering

trading processes in trading partners has a big impact on benefits realised by system initiators (Riggins & Mukhopadhyay 1994), and why improvisation and the inclusion of boundary-crossing individuals in workgroups is helpful (Ibbott & O'Keefe 2004). Concepts such as routine inertia and whole-part coevolutionary competition provide a way of describing why process reengineering is often far more difficult than implementing the technology itself (Yen & Ng 2002). History dependency and bottom-up evolutionary trajectories provide a description of how IOS implementations themselves lead to new, totally unforeseen enhancements down the track (Li & Williams 1999). In none of this is the practitioner asked to quantify trust, power or transaction costs. Nor are they bound to one economic, social or technological view of the world at the exclusion of others. Instead, the framework offers a ready way to map relationships and dependencies based on qualitative estimates of all these forces.

For scholars studying the eIOS context, one of the strongest messages to come out of my research is the necessity of considering social components. Routines are critical in determining the ultimate success of a system, and the notion of defining an e-commerce system by technical elements alone—hardware, software, data standards and information transactions—is inadequate for describing what it takes for a system to be successful. Here, the framework directly addresses the need for organisational and technological change in IOSs to be considered interdependent (Li & Williams 1999).

A theoretical contribution has also been made by constructing a coevolutionary framework that spans multiple organisations but makes no use of organisations as a unit of analysis. Evolutionary theory includes expansion or contraction of organisational boundaries as a form of organisational evolution (Aldrich & Ruef 2006) and interorganisational information systems are traditionally seen as expanding and spanning organisation boundaries (Bakos & Treacy, 1986; Johnston & Vitale 1988; Konsynski & McFarlan 1990). Following their ideas, the Omicron case could perhaps have been interpreted as an expansion and overlapping of the boundaries of the involved organisations (as depicted graphically in Figure 15), but it hasn't actually been necessary: trading operations and systems have been conceived as spanning organisational boundaries but no definition is required of where those boundaries lie, nor how many organisations are involved. The boundaries that are important in the eIOS case are those of the system, not the organisations.

This is undoubtedly one of the features that gives the framework its power in the eIOS context, because it forces practitioners to think about components similarly, regardless of whether they reside in trading partner organisations or at home. It breaks the pattern of thinking of an eIOS as something owned and controlled by the initiator organisation, and it also helps make the framework equally applicable when different organisational configurations are encountered in e-commerce (e.g. Choudhury 1997; Grieger 2003). For practitioners, understanding what the key components are and who influences them is what matters, not where they reside.

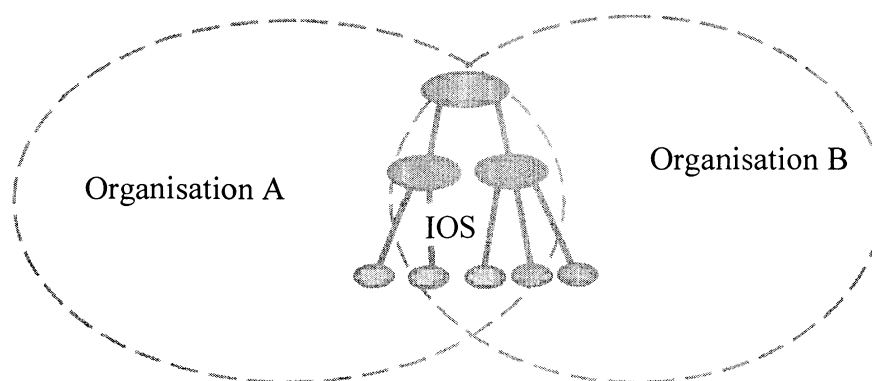


Figure 15: eIOS as expanding organisational boundaries

The Rosenkopf & Nerkar (1999) framework, it should be noted, also did not use organisations as a unit of analysis, but their context was purely technological (a hierarchy of components, products and systems). My hierarchy is unique in the coevolutionary literature because it incorporates social elements within organisations (routines) and spans multiple organisations without requiring organisations as a unit of analysis.

7.4 Methodological contribution

In addition to the contributions to practice and theory, I have made a minor methodological contribution by applying a hermeneutic process to the interpretation of phenomena relating to the engagement of trading partners in eIOSs. Although hermeneutics have been applied to information systems studies (e.g. Lee 1994 and Boland 2002) they have not previously been applied to this context. I was able to

produce satisfactory results by reflecting and moving between many levels: the actor descriptions within an eIOS, my conceptions of the system as a whole, my interpretation of the themes across ten case studies, and my interpretation of the e-commerce, IOS and coevolutionary literature more broadly. The hermeneutic process was particularly valuable because of the variability of the systems being studied (no two systems were exactly alike) and their complexity (events were shaped by a very large number of factors, forces, people and interactions). Collecting data via case studies and following a hermeneutic process made it possible to dig deeper into the nature of these systems, and to produce a more descriptive, complete interpretation of what was going on within them. Many previous scholars have used surveys to study this context, but my journey proved the complete inadequacy of these methods for understanding such complex and variable systems.

7.5 Further research

Testing the framework in the field

A most important avenue for further investigation, given the original inspiration for conducting this research, is testing the framework in the field. “How useable is the framework?” is a question that remains unanswered. It is not certain that the framework will be easy to use in practice. Perhaps managers used to thinking in technical or economic terms will struggle to reconceptualise an eIOS as a system of coevolving components. Or perhaps difficulties will be raised by the fluidity of communities because actors can be members of multiple communities and community membership can change over time. Asking a manager to identify the communities and components in a particularly large-scale project may prove to be extremely onerous. On the other hand, perhaps the relative difficulty of such an exercise will prove a useful benchmark for when proposed initiatives are too complex and risky (if the person responsible for a project cannot even name all the influences and influencers, after all, then the risks must be greater than when these are clear). Finally, identifying positive and negative feedback loops, and acting on them in a timely fashion (i.e. well before they reach a success/failure outcome) may be challenging in practice. Action research methodologies (Lewin 1951; Baskerville & Wood-Harper 2002) might be especially useful here, allowing the framework to be introduced to practitioners dealing with real world IOS

implementations, and subject to all the constraints, demands and time pressures associated with those implementations, then conducting evaluations of the results.

Mechanisms that promote feedback effects

Each of the strategies I have suggested also generates new lines of enquiry for future researchers. Finding new mechanisms to promote feedback effects provides an example. Initiators in two of the ten cases I studied (see Theme 12 in Appendix C), successfully employed intermediaries to promote trust and reduce trading partner concerns over lock-in, as demonstrated in the following comment by a respondent:

I think that the fact that we had a third party provider, that it was available to everybody, regardless of where they fit in the supply chain...it is not us trying to get a competitive advantage. I think that has been tremendous.

Brown & Lockett (2004) made similar observations. Perhaps, then, different structural arrangements observed in eIOSs (Choudhury 1997; Grieger 2003) can also produce beneficial feedback effects. Future research might employ a longitudinal case-study approach to examine how the introduction of an intermediary changes the evolutionary dynamics of a system. Similar studies could be conducted to explore the feedback effects when initiators try other mechanisms to promote interaction, such as workshops at trading partner conferences.

The role of resource scarcity

Coevolutionary theory also suggests resource scarcity as a possible consideration in the overall timing of eIOS initiatives. Van De Ven & Grazman (1999) found that resource scarcity tightened the interconnectedness between levels in their study of health care organisations. If resource scarcity had a similar effect in the eIOS context then this would challenge the conventional thinking that major initiatives are best undertaken in business environments of relative prosperity (when organisations have more time and money to spend re-engineering their software). Perhaps e-commerce projects initiated during relatively more difficult business environments can instead benefit from greater adaptability in a trading system. As an example, perhaps an eIOS aimed at the automation of transactions between underwriters and brokers in the insurance industry might be accepted more rapidly in an environment where insurance margins are

declining and brokers need to find new efficiencies to survive. Scholars might be able to investigate this by researching eIOS contexts in industries where trading partners are dealing with significant new regulatory or market-driven changes.

Inter-system effects and extending the framework

Another avenue for future research is a more extensive exploration of inter-system effects. In the Omicron interpretation, my discussion of IOS-to-IOS coevolution was limited because my data collection effort had been focussed on intra-system events. The question remains open as to the importance of inter-system effects in determining adoption and take-up of an eIOS. How, in other words, do competing eIOSs interact with one another over a longer timeframe? How important are these effects on determining adoption by trading partners? To answer these questions, future researchers might seek to extend the framework to accommodate a population-level (Barnett 1990; Tushman & Anderson 1986; Rosenkopf & Tushman 1988) and/or community level (Baum & Korn 1994), with the caveat that systems should remain a fundamental unit of analysis in these extensions, not organisations as has been traditional in other applications of coevolution. If researchers are able to obtain access to data on a larger population of interrelated trading systems, then they could combine multiple levels of analysis, as suggested by Shapira (1994). Triangulating the qualitative case study approach with sophisticated event history and computer modelling, as suggested by Lewin & Koza (2001), might offer a useful methodological approach.

Broadening or extending the framework in this way could also be useful where initiatives exist that try to promote e-commerce across entire industry sectors.¹⁰ Although no industry bodies or government organisations featured in the Omicron case, in some contexts they might play a significant role in setting the overall direction of

¹⁰ Examples of initiatives facilitating e-commerce across Australian industry sectors include the Australian Steel Institute (www.steel.org.au), the National E-Health Transition Authority (www.nehta.gov.au), Lending Industry XML Initiative (www.lixi.org.au), National Electricity Market Management Company (www.nemmco.com.au) and the Superannuation, Wealth and Investment Management Electronic Commerce initiative (www.swimec.com.au).

evolution, especially where many initiators are promoting different and conflicting systems within an industry. The role of an industry body in technological evolution has been analysed before from a coevolutionary perspective by Van de Ven & Garud (1994) in the context of cochlear implant technologies, and Anderson & Tushman (1990, p-627) described the closing on an industry standard as “an inherently political and organisational phenomenon constrained by technical possibilities” which seems an apt description of the work of e-commerce standards committees too. To accommodate those circumstances the framework needs to be extended, because in its present form it stops at the system-level. A logical step might be to incorporate a social level for selection decisions made by the ‘industry-community’—industry leaders, government policy makers and the representatives on industry committees. It could be useful here to build on the notion of dominant practice used in the current framework, by borrowing from the work of Van de Ven & Garud (1994, p-441) who described technological evolution in terms of periods dominated by variations, rule-making events and rule-following events. Perhaps e-commerce at an industry level can be interpreted as evolving when industry policy/standards selection events are displaced by usage events.

Global initiatives to promote e-commerce¹¹ mean that the hierarchy could potentially be extended even further to include a global level, accommodating the selection decisions of a ‘global community’—e-commerce leaders and lobbyists in organisations such as the United Nations and World Trade Organisation.

However it is done, extending the framework will help paint a richer picture of inter-level effects and how trading operations coevolve in a large pool of variations introduced by many competing initiators. It might, in other words, help conceptualise the vastly greater evolutionary challenges faced by practitioners when many of their peers are trying to do similar things at the same time.

¹¹ Examples of initiatives facilitating e-commerce across global industry sectors include UN/CEFACT (<http://www.unce.org/cefact/>), the World Customs Organisation (www.wcoomd.org), the Organisation for the Advancement of Structured Information Standards (www.oasis-open.org), World Wide Web Consortium (www.w3c.org) and the International Organisation for Standardization (www.iso.org).

Choosing different boundaries

Another question is whether choosing different boundaries for the research would produce other interesting insights. Aldrich & Ruef (2006, p-242) recognised that choosing boundaries was a general question when applying evolutionary theory to organisations:

The geographic scope of a community is an empirical question. A community may well encompass an entire regional, national, or global economic system, depending on the core chosen. The extent of interdependence between social actors is also ultimately an empirical question, and investigators must make informed choices in setting boundaries around a set of interdependent activities.

But at the same time, Midgley (2000 p-135) has pointed out, in his discussion of intervention in systems, that:

If the boundaries of analysis are crucial to the generation of knowledge, then a capacity to reflect on different possible boundaries is essential if we are not to simply take for granted assumptions flowing into intervention.

To learn more about the application of coevolution to eIOSs and to surface other phenomena, therefore, it may be valuable for future researchers to try exploring this context using entirely different boundaries from the ones that I thought were important, as well as extending their research to consider different levels.

7.6 Summing up

Writing this thesis represents the culmination of an interpretive journey that took me through many twists and turns and more than a few surprises along the way. I learned a lot about the complexity and depth of these systems and the inadequacy of survey-based methods for producing a useful understanding of the phenomena within them. I also learned a great deal about the simplicity and power of coevolutionary theory, and the potential for applying biological metaphors to organisational and information systems contexts. By the end I saw not only the value of applying a coevolutionary perspective to e-commerce interorganisational systems, but the enormous potential—still

untapped—to apply this theoretical perspective to other types of complex, distributed information systems phenomena.

My conversations with so many people working in initiator and trading partner organisations gave me an even deeper appreciation for the challenges involved in successfully implementing eIOSs. All those that I interviewed gave their time to me not just out of goodwill to assist a researcher (and I found plenty of that) but because they genuinely felt that implementing these systems was hard and not enough was understood about it. Everywhere I went, my conversations reinforced to me the importance of learning more about these systems and how to do a better job of engaging trading partners.

My principal goal was to suggest new strategies for managers deploying eIOS systems. In this I have been successful. The coevolutionary framework, and the resultant implications and strategies, make an entirely fresh contribution to the field—a contribution that is, I believe, worthwhile. At the same time, however, I can see countless opportunities to extend, test and refine the framework. In this sense, my application of coevolution to the eIOS context is only a beginning, and I hope that other researchers also explore some of the avenues I have opened up.

It is fitting to end by reflecting on how the interpretive journey led me to an altogether different way of understanding what the act of “engaging trading partners in e-commerce” is really about. Along the way, the notion of imposing a separate, Internet-based technological system onto a group of organisations was abandoned completely. By the end I saw organisations, their routines, and their technologies as intrinsic elements of a living, continuously evolving, socio-technical trading ecosystem. To my mind now, these elements are interdependent and already engaged. It is not engagement, therefore, that the practitioner seeks, but rather the coaxing of an ecosystem along a trajectory where trading operations become progressively more integrated.

8. References

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Appendix A: Ethical considerations

Possible risks for participants included emotional stress or feelings of failure if they are forced to confront errors of judgement or poor decisions during the interview process. A risk of reduced credibility and/or reduced personal standing in the organisation also existed if errors of judgement or poor decisions were made known to other respondents within the organisation or to respondents from trading partners associated with that organisation. A possible risk (embarrassment, reduced credibility) existed if interview content was made accessible to other individuals associated with the organisation or its trading partners.

The following practices were followed to minimise these risks. These were documented in the ethics application submitted to, and approved by, The University of Technology, Sydney (UTS reference: HREC 2004-111A):

- Participants were provided with an information sheet documenting the purpose of the research, the impact on their time, and how their information would be used.
- These points were summarised verbally at the beginning of each interview, and participants were given the option to end the process and withdraw from the interview at any time, with no negative ramifications for themselves or their organisation.
- Confidentiality and anonymity was preserved. Tapes, raw interview transcripts and respondent identities were stored in a secure location and were not disclosed to any parties other than the researcher and supervisory panel.
- The identity of individual respondents, and individual trading partner organisations, was removed from written materials and coded appropriately.

Appendix B: Format of semi-structured interviews in Phase I

Interviews were conducted in a semi-structured manner. The initial explanation and opening question was the same for all respondents, but the other questions were used only if deemed necessary by the interviewer. In some interviews respondents provided very rich narratives almost unprompted, while in others the prompts were used regularly. The prompts were not used in any particular order, but were employed selectively, based on the flow of the conversation.

This sheet reflects the wording of interviews with trading partner respondents. The wording was amended (e.g. “take-up by your organisation” became “take-up by your trading partners”) for respondents from system initiator organisations.

Purpose and timeframe reviewed with respondent:

The purpose of this research is to improve our understanding of how e-commerce systems are deployed between trading partners, and from this to identify ways to improve the way businesses engage in e-commerce. The outcomes are intended to help other businesses as they try to deploy similar systems.

The expected time to complete this interview is 45 minutes to one hour. Please note that this interview is voluntary and you can withdraw at any time.

Questions:

1. Please take me through the history of your organisation’s involvement with <system_name>, including how the system, your organisation and your use of the system has progressed and changed over time.
2. Were there any key turning points in your take-up/use of the system?
 - a. Prompt: What happened, and when?
 - b. Prompt: Why was this important?
3. What factors played an important role in helping/inhibiting take-up of <system_name>.
 - a. Prompt: What happened, and when?

- b. Prompt: Why was this important?
- 4. Was there a definite point when your organisation decided to use/not use <system_name>? /
 - a. Prompt: What happened, and when?
 - b. Prompt: Why was this important?

Identification of other respondent candidates:

Who else should I interview to understand the history of your organisation's involvement with <system_name>?

Close interview

That completes the interview. Thank you very much for taking the time to answer my questions and for contributing to the success of this study.

Appendix C: Thematic analysis for ten e-commerce interorganisational systems

This section contains the output of the thematic analysis conducted on the Phase I data set. The themes are described in their raw form as they were first interpreted from the analysis and before any attempt had been made to relate them back to the existing literature. The order in which they are listed roughly reflects the relative prominence of each theme across the sample: the strongest themes are listed at the beginning and weakest at the end. Note that some of the themes considered relatively weak for the entire sample were still extremely important to the individual cases or small number of trading partners to which they applied. An example of this was meeting initial and ongoing system performance expectations, which was a major theme mentioned by every respondent interviewed in one case, but did not rate in the rest of the sample.

Each subsection describes the theme, supports the description with selected examples and quotes from individual cases, and ends with a short conclusion about the implications for practitioners. All themes are summarised and presented in table form in the main body of the thesis (see Table 5 on page 57). The implications for practitioners were also used to build the checklist found in Appendix D.

Theme 1: Acting to achieve a fair distribution of benefits and costs

Perceived benefits were a strong theme in every one of the cases. Almost every respondent discussed the engagement process in terms of what the system did for their organisation or would do for them when it was implemented. Trading partners that had taken up a system were more likely to see substantial benefits for their organisation, and initiators of systems that had achieved more traction were more likely to articulate substantial benefits for their trading partners as well as for their own organisations.

That tangible benefits are important is unsurprising and does not in itself provide new insight for the practitioner. The data did, however, produce deeper insights into this factor: a strong sub-theme, surfacing in interviews in eight of the ten systems, was the importance of distributing benefits and costs fairly between initiators and trading partners. Trading partner respondents frequently mentioned adjusting the distribution of

benefits as a mechanism that accelerated engagement, or would speed up engagement if it was addressed.

[Initiator] has gone door knocking so to speak, coming around to us and saying “hey we want to do e-business” and now we are at the stage where [our company] has to ask itself what do we get out of it? [Initiator] must be getting some benefit by us dealing with them electronically, so if we can accommodate them good, but my personal opinion is that we should be receiving more.

Central to this theme was the issue of perceived fairness. Fairness did not necessarily mean equal distribution of benefits and costs. In seven of the cases I estimated that the initiator received significantly greater benefit from a system than any one of its trading partners, but trading partner respondents did not have a problem with this, tending to the view that initiators deserved some additional reward for their innovation. A difference in benefits significant enough to be perceived as unfair was what slowed engagement.

Where initiators were expected to reap greater benefits, their trading partners also expected them to bear a greater part of the associated costs. If trading partners felt they were being asked to bear an unfair part of the cost it also a major factor in slowing engagement.

The costs for them are actually relatively low [but] it is a major investment on our part. If they really wanted us to jump on board they should have been here with their cheques.

The distribution of risk, which can be viewed as a function of both the potential cost if things go wrong and the probability of things going wrong, was part of this thought process. For one trading partner it was the critical issue:

I said to them right up front “if you can make this easy and risk free for us we will do it” and they couldn’t do it. Simple as that...everyone is sort of saying “look if you want to do this, you are going to have to take the risk” [but] neither [initiator A] nor [initiator B] were prepared to carry, or even partially carry some of the risk.

Costs were not restricted to just those relating to the initial implementation. They could also relate to operations after the system was in place. In two cases respondents reported dissatisfaction in the ongoing overheads borne by their organisation when compared to those borne by the system initiator, and in both cases take-up had slowed as a result.

The uploading process is an enormous headache, from [our] point of view. They don't really care about it because we are the ones having to feed this machine...it adds a big load on us and it has probably cost us...

Generally speaking, initiator respondents were well aware of the need to distribute benefits and costs fairly. The following comment on the importance of a strong value proposition for trading partners was typical:

A focus for management would be that there is a saving in it for them, as opposed to a saving in it for us...I don't know that any amount of selling the capabilities is going to work unless you've got a very strong story about what is in it for them.

But awareness of the issue did not translate into sensitivity to actual trading partner concerns. In four cases where trading partners explicitly identified unequal distribution of benefits as a key problem, slowing their engagement, only one of the initiator respondents saw it as a factor that had to be addressed.

The attitude in the SMEs is, correctly so, "it's all in it for you guys. You are trying to cut your costs, but what's in it for me?" And the answer is, truthfully, there is not a lot in it for them. Unless we [change] they are not going to be interested.

For the practitioner, a very important link exists between the way benefits and costs are distributed and successful trading partner engagement. A degree of asymmetry sufficient to be seen as unfair is to be avoided as it will impede both initial take-up and ongoing use of an e-commerce system. Benefits and costs need not be distributed equally to be considered fair. Imbalances should, however, take careful account of what trading partners will perceive as fair. Initiators frequently promote e-commerce systems on the basis of mutually beneficial outcomes. The findings suggest that, to maximise the chances of successful engagement, they need to ensure that the actual distribution of benefits and costs matches the expectations they set.

Theme 2: Avoiding the duplication of existing business processes / seeking to rationalise already duplicated business processes

A very strong theme, with references by respondents in nine of the ten cases, was that of duplicated processes. The most frequent example cited was where trading partners had to enter the same data twice, in both an internal system (finance, project management, customer, etc) and in the new e-commerce system.

The link between duplication of business processes and successful engagement of trading partners was demonstrated in two different ways:

1. Trading partners were less likely to be engaged when a system duplicated existing business processes instead of altering or replacing them.
2. Trading partners were more likely to be engaged when they could see that the system helped them avoid duplicating processes, or helped reduce existing duplication of business processes.

The first point could also be related to the theme of minimising required organisational change, discussed later.

A typical comment from a trading partner respondent concerned about additional processes was.

We had reservations because then we would virtually be double handling, having to enter into our database and then into the on-line system.

And from an initiator respondent on the challenges his organisation faced trying to engage its smaller trading partners.

I don't think we'd ever have much support from a group like that, that's got their own in-house system and having to also interact with [the e-commerce system] simultaneously. For them it becomes a bit of doubling of resources.

In three cases, engagement of trading partners was helped by reducing duplication because the e-commerce system displaced two or more alternative systems. Managers within trading partner companies had become very aware of the inefficiencies of using different systems with different trading partners, each attempting to achieve the same thing but each with its own unique procedures. The disadvantages of going down the

multiple system path had hitherto limited engagement and commitment, and seeing a concept that rationalised or consolidated such systems had been a key enabler. A trading partner respondent described this thinking succinctly.

I went “no way! If I am dealing with three companies I am not doing this three different ways, let’s talk standards” and they all said “yes, that’s a great idea”, so that is how it happened.

And in another case.

What I was focusing on really was, and one of the reasons I went with [system] is, it provided me with one single gateway to a number of [trading partners].

The system initiator in this case had an identical view.

And if they have five different systems they have to do the project five times...and so you end up with an economic item that doesn’t really stack up as well as [our system].

In four cases systems produced duplication of existing processes but had still been accepted. Increased process duplication does not, therefore, necessarily eliminate the chances of successful engagement. In each of these, however, duplication was described by trading partners as a negative that reduced their motivation to further use and develop the system. In one case this was only offset by a high degree of coercion from the system initiator (see the theme on coercion, discussed below).

One trading partner respondent had found it impractical to rationalise duplicated processes because it had already made a significant investment in its internal systems and it was unwilling to become too dependent on a system owned by another organisation. The respondent described the situation in the following terms.

We still have our own internal process and everybody is trying to maintain two systems. We found it better just to try and corral the pain of jumping between two systems to only a few people...it has probably cost us a lot of money in terms of just having to employ people almost full time just for doing that.

The same respondent was aware that the e-commerce system had been a much bigger success in another similar company that had not faced these constraints and had been able to eliminate duplicated processes.

They were able to effectively have everything go through the one door...and they thought that was fantastic, and it really was.

System initiators were often aware of process duplication and the desirability of avoiding it, but tended to greatly underestimate how much of an issue it really was with their trading partners. One initiator respondent seemed to be right in the middle of realising that it was a more substantial factor than he initially thought in accounting for poor engagement of a particular group of trading partners.

It is a very cheap solution. It is fairly labour intensive of course, because it means they may have to enter the documents once into their own internal systems and then again the same data into [the e-commerce system]...maybe that is what it is, and perhaps in thinking about it, it is something we have not followed up that hard because we have been focused on the bigger [trading partners].

In another case the initiator described the tradeoffs between adding new benefits and duplicating procedures for its targeted trading partners.

And so that's why they just looked at it and said "hate it, don't want to do it" because straight away they could see..."we are going to have to re-key everything that was just keyed into our CRM" so they weren't too happy, but like I said, once they used it and saw the advantages, then even though it did impact their processes and did require them to spend a little bit more time keying in stuff twice, the benefit at the end of it far outweighed the extra few minutes that it took.

One of the two trading partner respondents interviewed in this case corroborated the view that, on balance, the benefits did outweigh the additional workload costs, but process duplication was an issue that, if removed, would very significantly contribute to their willingness to make further use of the system. The other respondent was unsure if there was enough benefit to outweigh the additional workload costs.

There is a relationship between this theme and that of asymmetric costs and benefits, discussed earlier. While the e-commerce systems often resulted in process duplication, and therefore additional workload costs, in targeted trading partners, they almost never did so in the initiator organisation, where they were designed to integrate with, streamline, or eliminate internal processes altogether. These outcomes were typically part of the motivation for system initiators undertaking the projects in the first place.

There was also a link between this issue and the size of trading partner organisations, in that systems were more likely to produce duplicated processes in smaller trading partners. This appeared to be partly because larger trading partners have more resources to undertake systems integration and partly because system initiators were more willing to be flexible and to fit in with established processes and internal systems used by their larger and more important trading partners. In the words of one initiator respondent:

You have basically got to find those [trading partners] where the transactions are a significant enough volume to make it worthwhile to make the extra investment.

This contrasts, of course, with the apparent capacity for smaller organisations to absorb process duplication. In the case of very small businesses with only a few employees there might easily be no capacity at all to duplicate processes and continue operating effectively, so the chance for successful engagement might be eliminated altogether.

A common approach when engaging a large number of small business trading partners is to build a Web-based portal and to ask them to undertake their transactions through that portal (see the later theme on segmenting the engagement strategy). This, however, almost always duplicates processes because the small business operator must still separately record the transactions somewhere internally. In three cases this approach had been tried and produced disappointing results for the initiator.

They are happy to key it into their spreadsheet, but not happy to go onto the website [as well].

For practitioners, the strong link between process duplication and engagement suggests a number of implications. First and foremost, offering a system that streamlines or eliminates processes in trading partners will be a strong enabler. Similarly, where multiple systems are being considered, any initiative that promises to rationalise them

into one is likely to be well received. Creating duplicated processes will make engagement more difficult, although it will not necessarily preclude engagement if trading partner benefits are strong enough. Practitioners need to maintain an especially keen awareness of this when dealing with smaller trading partners, where the issue is less likely to be addressed properly and more likely to be a critical factor.

Theme 3: Creating effective communication channels to receive and act upon feedback from trading partners

A theme spanning all ten cases was the need to solicit feedback from trading partners and to act upon it by adjusting the system and/or the way engagement was undertaken. Respondents from trading partners that had engaged in systems very frequently cited the availability of a feedback channel, and the willingness of the initiator to listen and act upon it, as having been a critical factor.

They consulted us before they released it and they have consulted us ever since. They have taken all our issues on board and generally have been able to improve the system with our suggestions.

In all cases feedback mechanisms included informal channels such as receiving feedback via account managers or trainers, ensuring that trading partners had good access to the project team to e-mail or telephone through any concerns, and reviewing problems reported through technical support.

In three cases feedback mechanisms had been developed in the form of user groups that met at regular intervals. In one case initiator respondents considered the user groups had actually slowed the rate of take-up because members not serious about the system had consistently wasted the group's time discussing minor technical issues. For the other two there was no data to suggest user groups had made the engagement process any more or less successful.

Successful system initiators had systematically acted on feedback by implementing changes to systems (some had released five or more major revisions to their system) and adapting the way they engaged trading partners.

In two cases initiators had pursued an initial ‘pilot’ phase to engage a select few trading partners, incorporating their feedback into the system before engaging others. In both cases initiator respondents reported the strategy had been very valuable.

Start with a pilot because that way you can beg a bit of forgiveness if things are not quite as they should be, plus you use it as an opportunity to get feedback, to get a small release quickly out to deliver improvements.

A trading partner respondent reported, on the other hand, that with hindsight and given the challenges, they would have preferred not being part of the above pilot.

The frustration builds up. It did fall over quite a lot, they were doing a lot of patches...the system was being ironed out on us.

Most respondents made comments about feedback channels in the positive sense, but two trading partners also explicitly singled out the absence of adequate feedback channels an important factor in delaying their engagement.

These findings suggest it is critical for the practitioner to create easily accessible feedback channels for trading partners, and that they must be prepared to act on feedback and take an iterative approach in developing the e-commerce system and adapting their engagement strategy. Practitioners should assess the suitability of a pilot phase based on how helpful it will be in addressing any unknowns, and the availability of trading partners willing to be active participants.

Theme 4: Pre-packaging and removing complexity from the system, its implementation and the engagement process

Simplifying, pre-packaging and generally removing complexity was a theme in six cases. It applied to system design, information and communications relating to the system, demonstrations of the system and the implementation process for the system.

In three of these cases, the importance of pre-packaging communications and demonstrations was linked to how quickly trading partners grasped what the system did and the benefits it delivered, ensuring, as one respondent put it, that you did not leave trading partners ‘bewildered’.

One mistake has been to promote technology in excess of what they can get their minds around...we should have taken a simple message to them. If we had not worried about the cute stuff then we would have been much more successful [from the beginning].

In two cases there was a strong belief by initiator respondents that the specific act of reducing the number of available choices/options had helped lead trading partners to more rapid decisions.

The amount that we are configurable or the flexibility is a great differentiator; it's also the biggest pain...we are now in the process of putting together what we call 'standard packs'.

What we were expecting to do was go in and say "right, this is what the tool is and this is how you could use it. Now how do you want to use it?" And they had no idea, so we really had to focus on saying "right, this is what we recommend you use, start with that".

In neither of these cases did trading partner respondents express these same sentiments, but it appeared that they were unaware of the reduction in choices that had been undertaken by the initiator.

The pre-packaging theme was stronger where smaller trading partners were concerned. There appeared to be a relationship here between these observations and the way small businesses made decisions about engagement more rapidly than their larger counterparts (see the discussion of 'Other Themes', below). One respondent in an initiator organisation summarised what he had learned this way.

It is next to impossible to get the SME into the e-world without delivering it to them on a plate. You really need to demonstrate to them [that] the cost of getting there is not much...It must be an automatic process.

A successfully engaged small business trading partner vividly described the impact of a tightly packaged demonstration and overview of the system.

The thing that they did do well, that, you know, that basically sold it for me was to come to where I was and put it on the computer in front of me and say "look, this is all you have to do". In my position I don't have a lot of time to

go looking into things...and they came—didn't take very long—came in and said “look, this is it, this is how simple it can be, there you go!” and that pretty much sold me right there.

The importance of simplifying solutions and the implementation process did not exclude practices such as consultation with trading partners or involving them in the solution design. In both of the above cases, initiators had already been through several iterations of solution design and development that had been highly consultative (but had not themselves led to rapid take-up).

Attempts to hide complexity or exaggerate how easy it was to implement a system led to resentment and distrust. As one trading partner complained:

Simplicity is often overstated, timeframes are often understated, and costs are always understated.

This did nothing for the credibility of the initiator and made the trading partner much more cautious about evaluating new e-commerce initiatives.

The findings suggest that practitioners will greatly improve the chances of successfully engaging trading partners by simplifying and pre-packaging their proposed system wherever possible, especially when dealing with small trading partners. Practitioners may get better results from developing and piloting solutions with a limited number of trading partners before taking a more refined solution to the rest, and are advised to be realistic about the complexity of systems, seeking ways to simplify them instead of glossing over the challenges involved in implementation.

Theme 5: Minimising the organisational change required of trading partners

Minimising organisational change was a theme in five of the cases. It was an especially strong theme, singled out as an important enabler for successful engagement, in three of these. There was a relationship here to the preceding theme in that systems could be designed carefully to minimise the required change. An initiator respondent summed up the effect in one case:

The [trading partners] love it because they don't have to go and change anything!

Many references were made to the difficulty of changing processes that had been built around established financial systems. These related to both very large financial software systems and small business accounting packages, as the following comments illustrate.

When that happens [the ERP system needs to be changed] I've had to go around it or we just don't implement that part of their project.

So if, somehow, we are going to get this through, somehow it has to be developed as a tool off MYOB.

References were also directed at the difficulty of changing workplace practices more generally, and the need to fit in with existing business processes as much as possible rather than ask for unnecessary change.

They said "we've got a fantastic solution, why aren't you using it?" but they missed the point: the point was we didn't want to change our own internal processes.

This was a lesson that had been learned the hard way by respondents in initiator organisations, and they subsequently modified their engagement strategies with more success.

We don't go in there and say "right, we've got this system, now let's see how your processes have to change to use it." We go in there and say "right, let's see how we can match the system to your process." So I think that has made it easier to some extent for us to engage those sorts of companies.

Very quickly we realised that for [the system] to grow, we had to accommodate what the existing communication models of choice were. So instead of trying to revolutionise, basically evolutionise the process.

Breaking down the change process into manageable steps was a valuable strategy. In one case every respondent described breaking things down this way this way as a success factor. The strategy here had been to select and work with a subset of all the

transactions they hoped to make electronic and to progress to other transactions only when the first set was working smoothly. Respondents from the initiator organisation felt that had they not taken the approach they would never have gained the support necessary from trading partners to make it a success.

If we had come out and said well look...we've got to implement 10 different document types straight away, this would never have happened.

From the practitioner's perspective these findings tell us that decreasing the organisational and procedural changes asked of trading partners will increase the likelihood of successful engagement, and that potential strategies include customising the system to accommodate existing norms, and simplifying or breaking down the implementation so that only small changes are requested in the initial engagement.

The desire to minimise unnecessary organisational change must, however, be balanced against the need to ask for organisational changes that will benefit the trading partner and initiator. Leaving existing procedures untouched at the cost of introducing duplicate procedures is a tactic to be avoided altogether (see earlier discussion about avoiding the duplication of existing processes).

Theme 6: Targeting specific people / job roles within trading partners

The need to target the right people within trading partners was referenced by respondents in seven of the ten cases, and was strongly linked to successful take-up.

References were made to a range of specific job roles (examples included logistics managers, billing managers, project directors, purchasing officers, content managers and designers) depending on the specific industry and purpose of the system. The task was easier for very small trading partners where the business owner was generally the main target (albeit not always the only one).

A typical comment was made by a trading partner respondent when he described the importance of ensuring project directors supported the system, which was designed to manage documents for complex multi-organisational construction projects.

The success of the adoption of [system] was driven by the project directors saying “we are going to use this and not use anything else.”

Targeting the wrong job role was a sure way to impede engagement. In one system the initial effort had been directed at account managers working for its trading partners, where the existing relationships centred. Upon getting unsatisfactory results, the initiator organisation investigated and found that these personnel generally held no interest in process improvement and tended to dismiss the system as unimportant because it offered nothing in the way of new sales. Subsequent adjustment of the targeting to logistics managers and managers of back-office accounting functions yielded far better results.

In several cases there was a more general need to identify and engage people that could be project ‘champions’ and/or own the decision to go ahead with the system. These people could also occupy a range of job functions. In one case an initiator respondent described the transformation when a champion was appointed in a trading partner, midway through a long and so far unsuccessful engagement effort.

The one thing that changed the whole scenario there was when the guy who we were dealing with...he was given the right to make the final decision...all of a sudden they just said [to him] “You’re accountable!”

When the champion himself was interviewed he identified the same event as the key turning point.

It wasn’t until we put our hand up and said “well, [our department] will own this project. We will source it, we will find our way through the mire of IT, we’ll unearth that” that we started to get traction.

In another case an initiator respondent described the need to engage with the person, if there was one, that acted as the ‘e-business visionary’ within the trading partner. They considered that this person was most likely to grasp the potential for the system and move things forward.

In each of the seven cases where targeting the right people was discussed, IT management was not considered the primary target to achieve successful engagement. IT management was sometimes acknowledged as an important target, and in one case

the initial approach to trading partners was through the IT departments to recruit support before moving on to other parts of the organisation, but in every case IT managers were considered secondary to other managers in securing take-up of systems. A typical remark was:

I go out, or one of my team goes out, and its really about process management improvement, you don't have to talk about technology to start with. Usually the IT person from their business isn't even there.

In two cases IT managers were seen as creating serious roadblocks to engaging trading partners, even when chief executive officers and other senior managers were keen to progress take-up. In both cases the issue was described as having little to do with technology and much more to do with internal politics and/or a desire by IT managers to control projects they perceived lay within their domain. The outcome was a sharp application of the brakes to further progress. As one initiator respondent put it.

Any organisations where you've got the old-guard, where IT drives things...anywhere where you've got the IT department that has any sort of power, you can forget anything ever happening. It's their job, it's their baby—keep away!

A trading partner respondent in another case described how this issue delayed the engagement of his organisation.

I kept pushing back saying “well, hang on, you know it is not really an IT project, it is a business project, it is a partnership.” So anyway, with this to-ing and fro-ing, the project didn't go anywhere...

In both of these cases initiators developed tactics to reduce or avoid the involvement of IT management. For some trading partners, the only option had been to wait for the IT Manager to move on to another job.

Similar tactics were also employed when other (non-IT) personnel were identified as creating barriers to organisational change. One initiator respondent described the challenges associated with personnel in a particular job role.

A lot of [people in that job] are older guys [and] there is really a great deal of resistance to it. Strong resistance. They feel like they are giving away their intellectual property.

In this case the tactic was to go around them and recruit support from their immediate managers instead. When these outflanking tactics were employed, care and diplomacy was necessary to preserve existing relationships.

The findings indicate that practitioners will improve their engagement success by making an effort to identify key personnel and by developing separate procedures and tactics for each, and that there are often complexities associated with who should be targeted as the priority. The most critical targets will almost always be in business roles rather than IT roles, with IT managers sometimes playing a secondary role in the engagement process. Where it is practical to do so, packaging systems carefully enough so IT involvement in the decision-making process can be minimised, or eliminated altogether, will be a valuable strategy.

Theme 7: Using the most appropriate staff to engage trading partners

Identifying and selecting the right personnel to introduce and ‘sell’ the system to trading partners was an important enabler in six cases.

People with the right combination of personal qualities made a difference, just as particular qualities help make more effective sales people. Four trading partner respondents in three cases commented that their organisations had become much more engaged and moved forward with a system following the appointment of a new account manager or new project owner, for no other reason than they had better rapport with this person.

The job role itself could also be important. In one case using sales staff to promote the system was found to be a mistake as, in the absence of an explicit financial incentive, these personnel placed the system well down on their list of priorities. This mirrors the experience of targeting the sales personnel working for trading partners, as described earlier.

Appointing a specialist to own the engagement process and take the message to trading partners, with or without assistance from other staff, was mentioned as a valuable enabler in four cases. As well as being focussed on the task fulltime, one person could get an overall view of what was working and could better tune the message or modify the approach. Trading partner respondents liked this.

I am assuming he is like an e-business, I don't know what you'd call it, manager? Anyway, having him as a focal point for us is very good.

Better results were also achieved when people were used with the same professional background as personnel targeted within the trading partners. In one case, in the building and construction sector, this was an especially important factor mentioned by every one of the respondents interviewed.

A different perspective to this theme was the ineffectiveness of using technical people to introduce the system to business people. An initiator respondent, in a reference to the technologists that created his system, said:

I didn't have confidence in their being able to present it properly because they didn't have the [industry] background...I don't think I would let them go near our clients!

For practitioners, the findings suggest that it is worthwhile investing time and effort in the selection of personnel responsible for engaging trading partners. Important considerations will be congruence with their normal job goals and compatibility with the personnel they are targeting. Regular account managers will frequently not be the best choice. If practical, the appointment of a single owner for the engagement process is also likely to be a valuable strategy.

Theme 8: Using other organisations to assist in the engagement process

Related to the preceding theme was the impact when trading partners were introduced to a system, or heard about the merits of a system, through peers that were already using it. A positive assessment from a trusted peer with no axe to grind had considerable impact on trading partners in four of the cases.

A trading partner respondent described a typical scenario.

I then spoke to a couple of other [contacts] to just find out what their experience with taking on [the system] was like, and I got some pretty good reports.

Initiators were well aware of this process.

They [trading partners] will say “well, who else in the industry is doing it?” They just want to know who is doing it.

In two of these cases trading partner respondents described this in terms of not wanting to be ‘first movers’ because of the greater risks and costs. As one put it:

I am a great believer that critical mass is important in these things, and a ‘go it alone’ involved a hell of a lot of commercial risk and development.

An initiator respondent in the same case mirrored this observation.

They have to see that it has been successful elsewhere first, before they take the plunge.

Good results were achieved in one case by exploiting an initial ‘pilot phase’ with a very small group of trading partners acting as a proof of concept for others. In another case, the initiator found an enabler in identifying and going after the most influential members of the industry, then using their involvement to motivate others. This was described by an initiator respondent as securing ‘anchor’ trading partners. It was difficult to secure one of these organisations, but when successful, the effect on others was significant. In this case a competitive element was present in that trading partners were motivated by not wanting to be left behind when they saw their competitors beginning to take advantage of the system.

In one case an especially powerful enabler was when trading partners saw the system being used by peers when they worked together on joint projects.

Quite complex relationships were sometimes involved, with information about a system spreading through a group of trading partners and recommendations arriving from more than one source. The following description, of an organisation being approached both by the system initiator and one of its own trading partners, is a good example.

So [company A], once they had implemented with us two years ago, then turned around to [company B] and said let's implement what we have just done with you. And then we approached [company B] and said let's do the same with you as our customer.

This had a positive impact. A trading partner that had been impressed enough by a system to want to build a similar one to connect to its own customers represented a big endorsement.

Similarly, a respondent in a different case described how conversations with its materials suppliers, customers and logistics providers, all of whom were preparing quite similar e-commerce systems to meet their own objectives, had helped prepare the ground for deciding to move forward with a system.

Trading partners prepared to act as reference sites for an e-commerce system are powerful enablers. The findings suggest that practitioners should incorporate information about successful implementations into communications, and look for opportunities to promote dialog between those trading partners successfully engaged and those yet to take it up. Practitioners should also note that both positive and negative trading partner experiences will impact take-up when communicated to other trading partners.

Theme 9: Segmenting the engagement strategy for different categories of trading partner

A strong theme was the benefit of splitting the engagement strategy into two or more parts so that different priorities, and different methods, were applied to different types of trading partners. Engagement strategies that had been segmented in some way were evident in five of the ten cases, and in three other cases initiator respondents made general references to a need to customise the approach for different types of trading partner.

Respondents had learned the hard way that one blanket approach to all trading partners produced unsatisfactory results. A typical comment was:

I guess a milestone for us would have been the realisation that it wasn't 'one size fits all' and to have iterations of the solution that can fit small suppliers.

Segmenting engagement strategies in this way was undertaken using a variety of criteria, and usually more than one.

The technical capability of trading partners was the most common criteria for segmentation. Initiator respondents frequently mentioned the need to deal with trading partners differently if they did not have an IT department or had limited technical resources to integrate the e-commerce system with other internal systems. Segmenting purely on the basis of business size, without assessing technical capabilities, was not useful. Occasionally very big businesses, for example, were found to have extremely limited technical capabilities, on par with what might be expected from a small business. In one case an initiator created, as part of its engagement strategy, a specific procedure to assess the skill set and experience of the technical personnel working for each trading partner.

Segmenting on the basis of technical capabilities generally led to alterations to the engagement strategy that related to prepackaging, onsite technical assistance and subsidisation—all of which are discussed in other themes. In more than one case initiators also adopted the strategy of building portal based options to address trading partners with limited technical capability, but it should be noted that this produced highly undesirable consequences in introducing process duplication, discussed earlier.

In two cases the main criterion for segmentation was not technical capability but transaction volume, on the basis that where the largest numbers of transactions took place would be where trading partners would gain the most value (and also, naturally, where the initiator organisation would gain most value).

In one case the initiator had spent time categorising the different business models used by its trading partners and considered this had been valuable.

We actually identified that there were five models. One model was absolutely suited to online ordering because all they did was sell [service A] but then there were other models where [the system] is of no real value to them or their business.

In another case the initiator had decided to segment trading partners based on an estimate of the benefits and costs that would apply to each.

Segmenting by transaction volume, business model and cost/benefit estimate were used primarily to adjust the prioritisation and timing of engagement rather than to customise the tactics to be employed.

For practitioners, the findings suggest that an important strategy will be to use different tactics, timing and prioritisation to engage different logical groups of trading partners, but that in most cases it will be desirable to consider more than one criterion in this segmentation. Using business size alone should be eschewed in favour of a combination of factors. Technical capability is likely to be important, but other useful factors may include the volume of transactions expected to flow through the system, opportunity to benefit and cost differences. It may also be useful to consider e-business awareness and the disposition of management towards technologically-driven change (discussed in the section later dealing with minor themes) and competing priorities in trading partners (discussed below).

Theme 10: Identifying competing priorities in trading partner organisations

The timing of engagement with respect to competing priorities within the target organisation was a theme in four cases. In circumstances where other priorities dominated management thinking, any new e-business project, despite being recognised as valuable and viable, could not gain traction. The impact was always expressed as delayed engagement, rather than outright rejection of the system. Three respondents described how projects to upgrade financial and operations management systems postponed any involvement in the e-commerce initiative. The existing projects involved as much organisational and process change as the organisations could handle. The following comments, from different trading partner respondents, were typical.

When they first approached us we were in the middle of trying to make a decision about [an operations system] and that was a huge project for us, and we didn't really want to take on something else to distract us from the main event, so to speak.

Management aren't going to pay attention until they have to. Now I am getting attention because they are getting a focus on costs and are no longer distracted by the SAP rollout.

In another case all three respondents spoke at length about how multiple competing organisational priorities had kept the e-commerce initiative off the management agenda. In this case industry changes, competitive pressures and business initiatives that promised faster payback for less effort were the dominant factors. An initiator respondent described the thinking in these trading partners along the following lines.

“Why now? I can always find some other things that will generate more revenue tomorrow” or “I can always find some cost savings that I can pull out of the business in other ways that are probably easier to achieve”...ultimately it is not “should we do it or shouldn't we do it?” it is “when should we do it?”

Trading partner respondents used identical language in their interviews. One respondent, himself enthusiastic about the system, described the background to his organisation's delayed engagement in the following way.

They [senior management] had much higher priorities, and I respect that... the last thing you want to do is have to devote some time to something you don't see as important in the grand scheme of things. They were supportive of it, don't get me wrong, they were just working on much bigger issues.

In each of these cases initiators had attempted to change timing and move engagement up the priority list within trading partners, but had not been successful. Engagement was either yet to occur, or had occurred only when the natural course of events led to the trading partner being ready, with the initiator having no impact on this. The timing issues had been identified at an early stage in the project, and were equally visible to both initiator and trading partner.

The findings suggest that practitioners should be careful not to overestimate their influence over the organisational priorities of their trading partners. Serious conflicting priorities need to be identified quickly and early, and will generally be best accommodated by re-engaging the trading partner later, rather than wasting valuable resources trying to change those priorities.

Theme 11: Providing trading partners with implementation assistance and technical support

In three cases initiator organisations had taken the decision to provide proactive technical assistance to trading partners implementing the system, with experts capable of going out to the trading partner premises and doing some or all of the necessary work. In each of them this represented an adaptation to the strategy made to overcome early disappointments, and in each case it produced positive results by making engagement more successful. Comments from two respondents serve to illustrate.

Take-up has increased a lot in the last 12 months. We have in that period ramped up our services to go onsite and help implement, help them get this going.

It's one of the really important things I have found within the community to speed the process up and make sure things keep moving. You have got to be able to go in and fill the gap and help the new, confused user, fill the gaps of their capabilities. Otherwise it will grind to a halt.

Part of this theme was the provision of appropriate post-implementation technical support (e.g. a help desk facility). When systems were more complex or difficult to use, or had outstanding technical glitches, a lack of appropriate support in those circumstances greatly inhibited engagement.

Expectation setting was a factor here. In one case, where an initiator had gone to the trouble of nominating help desk staff as experts in the system, and had heavily promoted this as a service to its trading partners, a trading partner respondent had been frustrated by the difficulties of actually getting hold of one of these experts. The respondent reported that an expert had been available 'about 10 percent of the time' when they were sought. This had cost the initiator goodwill, and reduced interest in exploring further enhancements to the system or future e-commerce projects.

From the practitioner's standpoint, the provision of proactive onsite technical assistance during the engagement process is likely to be a valuable engagement strategy, but it will also be a relatively expensive exercise and the costs will need to be weighed against the outcomes achieved. Where it is possible, pre-packaging and simplifying the system

(see earlier discussion) and therefore reducing the need for technical assistance in the first place, is likely to be a better strategy.

Theme 12: Addressing trading partner concerns over independence and lock-in

Concerns about how the e-commerce system could increase dependence on a particular initiator, increase the initiator's market power and/or make it more difficult to dismantle a trading relationship should the need arise in future, were expressed by four trading partner respondents. Each was a participant in a different system, so it was not an especially strong theme in any one case. Nevertheless, for these organisations, the issue was important in delaying or slowing take-up. Typical comments were:

If it becomes a critical channel for communication, and they control it, they actually control a large amount of the value...it is hard to negotiate with suppliers like that...it's uncomfortable.

As a customer of [initiator], I want to leverage it as much as possible, but at the same time I'm very conscious not to hand over my key processes to a third party...at the end of the day if we needed to switch it off, we would need to be able to do so without any grief, and I think most businesses would think like that.

Reinforcing this, two initiator organisations had transferred their e-commerce systems to intermediary organisations that specialised in e-commerce hosting and connection services, for the specific reason of making it more open and independent and reducing trading partner concerns over lock-in. Both reported that take-up had increased following this step and it was an important success factor.

I think that the fact that we had a third party provider, that it was available to everybody, regardless of where they fit in the supply chain...it is not us trying to get a competitive advantage. I think that has been tremendous.

There is something of a contradiction here in that e-commerce systems are typically built to strengthen electronic linkages between two organisations, but at the same time they can produce concerns relating to dependency and lock-in. The existing level of commitment between organisations may be a factor here, with concerns over lock-in

more likely to surface when organisations do not have a longstanding relationship with reasonable trust between the parties.

In cases where lock-in concerns are a big factor among trading partners, the findings suggest that a valuable strategy likes in involving a third party intermediary and/or redesigning the system in such a way as to be more 'open' to future changes in trading partner relationships.

Theme 13: Coercion from system initiators

Coercion was a theme in three cases. In one of the three cases it was a strong theme referenced multiple times by each respondent. The data provided several insights about the nature of coercion as an enabler.

In the case where coercion was a stronger theme it clearly produced resentment among the trading partners. While it was certainly a key factor in initial take-up it also appeared to act as an inhibitor to further use of the system by the trading partners: they quickly accepted the necessity for using the system but were predisposed to keeping it at arms length in the organisation. They saw themselves as passive recipients rather than partners likely to look for opportunities to enhance or expand upon the system. When asked about how the system might progress and grow, one of these respondents said:

Not with [initiator], no...anyway we have to follow, we have no choice...if they put this away and give us something else...then we will have to follow it, no matter how un-user friendly it is.

This is despite the fact that each of the trading partners could articulate benefits that the system delivered to their own organisations and also had positive things to say about support that had been provided by the system initiator.

In another case, where coercion was a weak theme, one of the trading partner respondents referred to their usage of the system in the following terms.

We'll use it only on a project basis, we certainly don't use it internally...We have to use it. I suppose they [the system initiator] have got to have a system like this as it makes sense for them. We just didn't like it but what does it

matter? We're just the [junior partner]. We just have to try and limit our exposure to the effort of it really.

Once again the last sentence indicated that the trading partner was not interested in actively working with the initiator to expand the system and make it a success.

The coercion theme was revisited from a different perspective in the third case, where two initiator respondents discussed how they had explicitly decided not to use coercion because of the likelihood of negative consequences, even though the market power held by their organisation made coercive tactics an option.

We tried to avoid any sense of a stand-over, and I think that maybe [coercion] is a common practice. I don't know, it's the sort of thing that you hear from suppliers, that they feel a little bit bullied into it you know...I think if we tried to use sticks, then I think that the average [supplier] would just back off and say well, not really interested...It [the choice not to use coercion] has been a success.

That was key...we didn't want to be dictatorial, and I think they would feel the same way, because it doesn't do the relationship any good, so it had to be an agreeable thing...

Coercion was not a theme in the other cases studied (significant differences in market power did not exist in most of the other cases, so coercion may not have been an option). It is worth noting, however, that 'positive' strategies, such as fairly distributing benefits (see earlier discussion) were found to be very strong enablers.

The conclusion for practitioners is that they should be wary of coercion. It had the potential to produce inhibitive effects, especially in discouraging an active partnership to develop and progress e-commerce systems, which can offset some or all of the intended outcomes.

Theme 14: Direct subsidisation from system initiators

Direct subsidies were used extensively in one case and mentioned briefly by a single trading partner in another. In the case where this was a strong theme the initiator had pursued a strategy of establishing a 'development fund' and made access to the fund open to any partner that signed up by a certain time. The funding available was non-

trivial and could go a long way towards offsetting the partner's implementation costs. The results, however, were not clear-cut, and the initiator expressed doubts about the merits of the approach and the message it sent.

One of the learnings we have got is historically I think a lot of people will always say cash incentives don't really work because it sometimes is belittling the value proposition. If you've got to pay me to do this, then surely it should stand on its own.

There was also concern that subsidies would always be accepted regardless of whether they were necessary or not.

One of the trading partner respondents interviewed in this case did, in fact, nominate subsidies as a factor, describing them as a way to achieve a more equal distribution of costs and benefits between the two organisations. This was related closely to the fairness theme discussed earlier. It was not a primary consideration, however, and was described as a factor that would bring forward the timing of engagement rather than affect the decision to engage.

For the practitioner, the findings suggest that direct subsidies should be used with care and probably won't be effective for achieving engagement where other issues are wanting. Subsidies, in other words, won't be enough to engage trading partners if the systems offer no lasting value. Furthermore, if the number of trading partners is large then the cumulative cost of direct subsidies might easily make them financially unsustainable. The data suggest that direct subsidies can be employed to bring forward the engagement of trading partners already sold on the merits of a system by making the distribution of costs and benefits fairer. In these circumstances, however, simplifying and reducing the cost of implementation or finding ways to boost the lasting, ongoing benefits to trading partners might offer a better way to get results without sending the wrong message.

Theme 15: Meeting initial and ongoing system performance expectations

Performance of the e-commerce system was a strong theme in one case, where it was mentioned by five out of the six respondents. The actual response times for the system

appeared to be reasonable relative to the complexity of the system, but they had evidently not met expectations of trading partner respondents, and had resulted in frustration.

It was evident in this case that both performance expectations and actual system performance had changed over time. There was a feeling by initiator respondents that when end-users saw a new online system they expected it to be at least as fast and responsive as anything they had previously experienced. One wryly commented that “people now want everything instantaneously”.

At the same time, as this system was taken up by more trading partners, the increased usage had caused the performance to deteriorate. The initiator was aware of this issue and had taken steps to boost system performance through hardware and software upgrades.

Frustration with performance had not been a big enough problem to cause trading partners to disengage or reject the system after implementing it, but it had most definitely inhibited acceptance by personnel within trading partners. There was a general view that teething problems could be expected in new systems and were a fact of life, but respondents did not think it would be acceptable if the performance problems continued.

It has been very slow at times, as the project has grown and...it took [the system initiator] a while to appreciate the slowness of our system and respond to some of the capacity things, but that aside, I think the general reaction has been quite a good relationship.

In the other nine cases, the issue of performance was mentioned only once, by a trading partner respondent frustrated by system outages. Once again it had not stopped engagement altogether, but it has been an inhibitor to further exploiting the system within the business.

For practitioners, the findings suggest the need to not only ensure adequate initial performance, but to also ensure performance expectations continue to be met to sustain engagement. This might require a proactive effort to monitor performance and ensure it does not deteriorate as take-up progresses. With implementations that take place over

an extended period it may also be valuable to monitor whether the expectations of users change over time.

Theme 16: Adjusting to the value propositions that are important to different trading partners

Benefits for trading partners, and the reasons for engaging, varied greatly between cases. Sometimes they were quantified in direct financial terms (additional revenues or dollars saved) but most often they were expressed in qualitative terms. More rapid business processes, time savings for personnel, reduced errors, reduced workload, reallocating personnel to other tasks, better quality of information and deeper relationships between the organisations were all reported as benefits in multiple cases. Given the widely different nature of the systems included in the study, the variation in reported benefits between systems was expected.

More interestingly, however, the benefits and reasons for engaging very often varied between trading partners in the same case and engaging with the same system. Different organisations often engaged for quite different reasons depending on their circumstances and priorities. As one initiator respondent summarised:

No two [trading partners] have the same reason for using it. They are all different. Reasons change too—the reasons they use us now are not necessarily the same as the ones when they adopted.

From the practitioner's perspective these findings suggest they should be careful never to assume all their trading partners will be motivated by the same value proposition. The process of engaging trading partners will need to incorporate a degree of sensitivity to detect these differences, and a degree of flexibility to adjust communications, negotiations, and potentially even the systems themselves, accordingly.

Theme 17: Removing uncertainties from the trading partner business case

Although respondents frequently mentioned uncertainties about the exact quantitative value that a system delivered to their organisation, they were almost always able to express a definite view as to whether the system was, weighing up the costs and

benefits, a good thing for the organisation. In two cases, however, multiple respondents reported not being able to form a view and cited this as a reason they had not participated. In both, open-ended costs were described as the main problem. For one, the issue was an inability to put a ceiling on implementation costs and for the other it was an inability to confidently predict the operational costs once the system was in operation. In both cases the initiator was seen as not having done enough to address the problem.

In a third case the initiator was seen as having successfully engaged trading partners explicitly because of its efforts to remove cost/benefit uncertainty. In this case the initiator had dedicated time and personnel to developing individual business cases for each of the most important trading partners.

We often go out and work with them on the business case, then present [the business case] to their marketing management team to get agreement.

We can speculate that the efforts made by many initiators to simplify and pre-package aspects of the e-commerce system, discussed earlier, also contributed towards eliminating uncertainties in the business case.

For the practitioner, the findings suggest that care should be taken to eliminate uncertainties, to whatever extent is practical, from the business case as it will be seen from the perspective of trading partners. For more complex systems, or for especially important trading partners where engagement is especially critical, consideration should be given to actively working with the partner to develop and present the business case to management.

Theme 18: Support within the system initiator organisation

In three cases the engagement process was interrupted by interdepartmental conflicts within the organisation that initiated the system, a reminder that successfully implementing a collaborative e-commerce system is predicated on achieving organisational change in both initiator and trading partner. The success or otherwise of change at the initiator can directly affect whether a system is accepted by the trading partner.

In two cases conflicts were between the business unit committed to making the system a success and the IT department. Getting the necessary IT resources allocated to the task was an issue.

We have had a fair bit of ‘kick back’ on that...we were expected to believe they had been allowed to resource up, and that is proving still to be an issue. I don’t know whether we underestimated the expected impact on our IT section.

In another case lack of support by the IT department had caused significantly delays to the project.

We should be 18 months further down the track than we are. We had an internal ‘brick wall.’

In one case the internal conflicts within the initiator organisation had been highly visible to a trading partner respondent. This had led to concerns about the commitment of the initiator to the project, and future viability of the system. The respondent remained supportive but was likely to end his organisation’s involvement if the situation was not addressed reasonably quickly.

In discussing ways to overcome these barriers, respondents talked about the need to recruit support from the most senior management at the earliest stages, and making sure senior executives played a bigger role in promoting the system. One respondent pointed to the importance of communicating the achieved benefits of the system, many of which were not highly visible, back into the company to ensure ongoing support.

We haven’t sold it well internally...we haven’t broadcast the number of transactions we have moved off people’s desks [and that] my team remains the same size as it was when the business was one quarter the size and so we have seen genuine savings.

Another respondent described having to overcome fears in the customer service department where staff were worried about the impact the system would have on their jobs. A significant effort had to be made to involve them in all aspects of the project to ensure they were comfortable and would play their role in engaging trading partners.

In addition to examining organisational readiness for trading partners, these findings are a reminder that practitioners need to consider the readiness to change within their own

organisations, and the need to address any concerns or conflicts in business units and the IT department before commencing an external engagement strategy.

Theme 19: Providing training to trading partners

Training as a method of increasing take-up was tried in four cases. It took the form of pre-implementation seminars, post implementation workshops and, in one case, ongoing training services for new trading partner employees and for employees that needed to freshen their skills. In this last case, the re-training might also be viewed as an extension of the technical support provided to trading partners. I did not include short briefings or demonstrations of the system, without hands-on activity, in my definition of training.

In only one case did an initiator respondent express enthusiasm for training as an enabler (neither of the trading partner respondents mentioned it). In two of the other cases training was not associated with any outcomes relating to take-up and in the third, where a significant effort had been put into developing training courses, the initiator was disappointed with the results and thought they had been a waste of time, an observation supported by the trading partner respondents.

While training was not linked to positive engagement outcomes, frequent comments were made linking engagement success with how straightforward a system had been to explore and self learn.

For practitioners, these findings do not imply training is unnecessary, or that it should be ignored, but they do imply that training is not a strong enabler in its own right, and is a poor substitute compared with enablers such as pre-packaging and simplifying systems, especially when trying to engage trading partner managers with limited time to allocate to training.

Other minor themes

Some interesting additional observations can be made about the way initiators assessed the organisational readiness of their trading partners. As discussed earlier, assessing organisational readiness meant, for most initiators, having an appreciation for the technical resource capabilities of trading partners but many other factors were also considered.

Respondents in three cases mentioned that better results came from trading partners that had already experimented with building their own e-commerce initiatives, or that had already developed an e-business strategy of some description. These partners were better positioned to grasp the advantages of the system under consideration and to make a quicker decision. Three initiators also described a need to consider interest/lack of interest, by managers in targeted companies, in pursuing technologically driven change. This was directed both at small business initiators, where the attitude of one person would certainly play a strong role in determining overall likelihood of engagement, and also at managers in large businesses. The point was made by one respondent that managers within some of Australia's largest corporations sometimes had a strong aversion to technological change that had to be taken into account. General comments about the need for managers in trading partners to be reasonably up to speed with e-business developments to make a good candidate were also common. In a related observation, an initiator respondent noted that serious roadblocks were usually instigated by IT managers, and considered it useful to assess trading partners based on the power and influence of the IT department. In another case a key issue was the readiness of organisational data. Many targeted trading partners had poorly maintained data in their internal systems, a situation that adversely affected the business case for adopting the e-commerce system. For the practitioner, these findings emphasise the great many factors that will influence the ability or willingness for a trading partner to engage.

Another interesting observation related to the way in which small business trading partners tended to make more rapid engagement decisions. In some cases a decision had been made over whether a system was worthwhile or should be accepted within an hour of the first briefing (the decision was not necessarily made known to the initiator until much later). Conversely, large business trading partners almost always arrived at the engagement decision over a period of weeks or months, during which some form of cost/benefit analysis was attempted and a consensus sought across multiple managers. For practitioners this finding reinforces the vital importance of getting the message across effectively from the outset, and the value of a tightly defined and pre-packaged demonstration of their system, when dealing with their small business trading partners.

I also found it interesting that the notion of offering trial periods to trading partners (i.e. ‘try the system before you commit’) was hardly mentioned. It is possible that trials were undertaken, but the lack of references suggests they were not an important factor in promoting engagement. I tentatively concluded that one reason for this was that many of the systems were impractical to trial: i.e. business processes had to be changed and expensive software integration work had to be completed before they could be used at all, so a trial represented almost the same commitment as actually adopting the system. A comment by one respondent lent support to this view:

It’s not one of those things you can trial, you either do it or you don’t do it.
You’ve got to physically do the technical integration before you trial anything.

Based on this data, trial-based engagement strategies appear to be a poor option, reinforcing the importance of having trading partners see peers that are already using the system successfully, as discussed earlier.

Lastly, while I have used the term ‘engagement strategy’ loosely to describe the basket of activities and tactics employed by a system initiator when engaging trading partners, I noticed that an identifiable plan for engaging trading partners rarely existed (in the form, for example, of a document that managers, salespeople and technical personnel associated with the project could refer to). Some form of overall engagement plan existed in only two cases.

Appendix D: Practitioner checklist derived from thematic analysis

The following checklist was created for use by practitioners when preparing to engage trading partners in a new e-commerce system. It is presented in the form of a series of questions. The questions are grouped into four broad categories: considerations for within the organisation that initiates the system, system considerations, benefit / cost / risk considerations, trading partner considerations and engagement strategy considerations. For each one, an affirmative answer represents a better prospect of successful engagement. The checklist was developed out of the thematic analysis and is a subset of all issues a practitioner should consider: it was not intended to be comprehensive or exhaustive.

QUESTIONS 1-9 (CONSIDERATIONS WITHIN THE SYSTEM INITIATOR)

1. Has an assessment of organisational readiness been conducted for your own organisation?
2. Does the project have senior executive support within your own organisation?
3. Has sufficient support been secured for the project from the IT department?
4. Have steps been taken to identify and address any concerns in business units impacted by the system?
5. Will trading partner engagement be executed as a project in its own right?
6. Has a single person been appointed to own the engagement project?
7. Will an engagement plan be created detailing objectives, deadlines, roles, responsibilities, communications and tactics to be used to engage trading partners?
8. Is your organisation committed to act on feedback and make regular adaptations to both the system and the engagement process?
9. Is this commitment shared by any solution partners involved in developing and deploying the system?

QUESTIONS 10-20 (SYSTEM CONSIDERATIONS)

10. Will the system streamline or eliminate business processes or procedures for trading partners?
11. Has the system been designed to avoid the duplication of processes and procedures (e.g. to avoid trading partners having to re-key data or learn multiple interfaces)?
12. Will the system replace more than one existing system?
13. Is the system as simple as it can be while still accomplishing its objectives?
14. Has every effort been made to accommodate (to the extent practical) existing business processes within trading partners so that organisation change required to use the system is minimised?
15. Will the system readily work with other systems (e.g. financial software) installed within trading partners?
16. Has the solution been designed to minimise the involvement necessary from IT management within trading partners.
17. Have steps been taken to understand system performance expectations of trading partners?
18. Will the system meet both initial and future performance expectations, and factor for increased load as take-up progresses?
19. Where significant organisational and procedural changes will be required, can take-up of the system be broken down into a series of more manageable steps?
20. Has allowance been made for the reduced capacity of small trading partners to accommodate process duplication?

QUESTIONS 21-32 (BENEFIT, COST & RISK CONSIDERATIONS)

21. Has a careful account been made of the costs and benefits that will apply to both trading partners and the system initiator?
22. Will the system deliver significant benefits to trading partners as well as the initiator? Does a plan exist to communicate these benefits effectively?

23. Can the system be linked directly to better outcomes for trading partner customers (as opposed to just producing internal benefits for trading partners)?
24. Have steps been taken to ensure any costs borne by trading partners are kept in proportion to the benefits they will receive from the system?
25. If the system unavoidably adds new processes and complexity will it deliver sufficient benefit to trading partners to make this worthwhile?
26. Will the distribution of benefits and costs between trading partners and system initiator be perceived as fair?
27. Are risks distributed fairly, and have trading partner risks been minimised as far as possible?
28. Is there room for further adjustment of benefits and/or costs should it be necessary during the project?
29. Have steps been taken to discover if the system introduces new concerns regarding lock-in/dependence on the system initiator?
30. If lock-in concerns exist, can the system be made more open and flexible through redesign and/or by transferring ownership to a neutral third party?
31. Has every effort been made to minimise uncertainties/unknowns in the trading partner business case?
32. Will costs and risks be communicated openly and accurately to trading partners?

QUESTIONS 33-38 (TRADING PARTNER CONSIDERATIONS)

33. Has an assessment of organisational readiness been conducted for targeted trading partners?
34. Have trading partners been categorised into any obvious sub-groups based on factors such as technical capability, transaction volumes, expected benefit, cost differences, e-business awareness, disposition towards technologically-driven change and/or readiness of organisational data?
35. Have personnel/job roles been identified within trading partners that are most critical to the take-up decision or can act as internal champions for the project?

36. Have organisations and individuals been identified that are especially influential in the trading partner community?
37. Have trading partner organisations been identified that can act as reference sites for others?
38. Has an effort been made to identify any conflicting organisational priorities within trading partners? Can the project accommodate a deferment of such organisations until a later time?

QUESTIONS 39-54 (ENGAGEMENT STRATEGY CONSIDERATIONS)

39. Have tactics, timing and prioritisation been optimised for best effect in each of the groups identified in Question 34?
40. Has every step been taken to pre-package the implementation experience, communications about the system and demonstrations of the system?
41. Is there an opportunity to conduct a pilot with a group of trading partners to improve the solution and/or engagement strategy before engaging others?
42. Will the staff selected to engage trading partners have:
 - a. The strongest compatibility and rapport with the people being approached?
 - b. Technical and business knowledge appropriate to the task?
 - c. No conflicts between making the e-commerce system a success and achieving their regular job goals?
43. Have plans been made to promote dialog between take-up candidates and trading partners that are already successfully using the system?
44. Have mechanisms been put in place to collect continuous feedback from trading partners and to capture feedback coming in through informal channels?
45. Will technical implementation assistance be available to trading partners?
46. If the system is relatively complex, will adequate training and post-implementation technical support be made available?

47. If the system is relatively complex, will it be feasible to work individually with larger trading partners to assist in preparing their business case?
48. If technical assistance appears necessary from the outset, has every effort definitely been made to address the points raised in Questions 13 and 39?
49. Is the messaging realistic, avoiding the possibility of creating expectations that will not be met?
50. Does the communication strategy incorporate a degree of sensitivity to detect and adapt to differences in trading partner priorities and what they individually value in the system?
51. Have communications and system demonstrations been streamlined to suit the more rapid, 'first-impression' engagement decisions made by small trading partners?
52. Does the engagement plan avoid dependence on subsidisation as a strategy?
53. If subsidisation is employed, will it be used sparingly, to get trading partners 'over the line' where cost is a remaining hurdle?
54. Has every effort been made to employ 'positive' enablers for engagement before applying coercive pressure?

Appendix E: Format of semi-structured interviews in Phase II

Interviews were conducted in a semi-structured manner. The initial explanation and opening question was the same for all respondents, but the other questions were used only if deemed necessary by the interviewer. In some interviews respondents provided very rich narratives almost unprompted, while in others the prompts were used regularly. The prompts were not used in any particular order, but were employed selectively, based on the flow of the conversation.

This sheet reflects the wording of for interviews with trading partner respondents. The wording was amended (e.g. “take-up by your organisation” became “take-up by your trading partners”) for respondents from system initiator organisations.

The questioning emphasis varied depending on the timing. For respondents that had already been interviewed, the emphasis was on events that had taken place since the last interview. The format was much freer flowing during repeat interviews.

Purpose and timeframe reviewed with respondent:

The purpose of this research is to improve our understanding of the changes that take place during the deployment of e-commerce systems between trading partners, and from this to identify ways to improve the way businesses engage in e-commerce. The outcomes are intended to help other businesses as they try to deploy similar systems.

The expected time to complete this interview is 45 minutes to one hour. Please note that this interview is voluntary and you can withdraw at any time.

Question:

1. Please take me through the history of your organisation’s involvement with <system_name>, including how the system, your organisation and your use of the system has progressed and changed over time.

Potential prompts, if required, to deepen the narrative:

2. What changes have been made to <system_name> since it was first introduced?
 - a. When did the change occur?

- b. What prompted the change?
 - c. What was the impact on take-up/usage of the system?
- 3. What changes have been made to your business / processes / systems in your organisation in relation to <system_name>?
 - a. When did the change occur?
 - b. What prompted the change?
 - c. What was the impact on take-up/usage of the system?
- 4. Describe any other factors / events that have played an important role in helping/inhibiting take-up of <system_name>.
 - c. Prompt: What happened, and when?
 - a. Prompt: Why was this important?
- 5. Has there been any definite point when your organisation decided to use/not use <system_name>?
- 6. Where do you expect things to go from here?

Identification of other respondent candidates:

Who else should I interview to understand the history of your organisation's involvement with <system_name>?

Close interview

That completes the interview. Thank you very much for taking the time to answer my questions and for contributing to the success of this study.

Appendix F: Timeline of key events at case Omicron

Key events & milestones in the evolution of the Omicron IOS	Time
Decision to move to e-commerce for trading operations with distributors	Q4/1998
Virtual shopping mall concept (OM-0) developed.	Q4/1998
Distributors reject OM-0	Q1/1999
EBI Services engaged by Omicron as a technology partner.	Q3/1999
Decision to focus e-commerce effort on large distributors.	Q3/1999
OM-1 system designed and built	Q4/2001
OM-1 implemented with Distributor A.	Q2/2002
OM-1 implementation begins with Distributor B	Q3/2002
Implementation suspended at Distributor B, OM-1 development discontinued	Q4/2002
New customer service manager starts at Omicron	7/2003
EBI Services demonstrates OM-2 prototype.	Q3/2003
Completion of export documentation system.	Q4/2003
Decision to refocus e-commerce effort on small distributors.	Q1/2004
OM-2 launched	4/2004
3 distributors install OM-2, rejected by others.	Q2/2004
Work completed on OM-2 enhancement: integration with distributor financial software	Q3/2004
IT Department "bottleneck" identified as an issue	Q4/2004
CEO reinforces importance of e-business project	Q1/2005
Distributors pass electronic backorder/inventory information to customers	Q2/2005
12 distributors using OM-2	5/2005
OM-3 completed	5/2005
9 distributors take-up OM-3. OM-2 users begin migrating.	6/2006
Development begins on enhanced service module, electronic returns, credit notes, customs transactions, special pricing, equipment maintenance tracking.	Q3/2005
Restructure of Omicron customer service department.	7/2005

OM-3 enhanced: richer information on backorders, estimated time of arrival.	8/2005
Distributors ask other manufacturers of cleaning equipment to use OM-3.	8/2005
Move to ERP-2 announced.	10/2005
Work stopped on service module	10/2005
30 distributors using OM-3	11/2005
Proposed electronic clearance sale enhancement fails to get support	1Q/2006
Move to ERP-2 delayed.	4/2007
Work recommences on service module	4/2007
New version of service module planned for very large customers	4/2007
CFO presents results of e-business developments to US parent company	6/2006
New service module deployed inside Omicron	6/2006
US parent investigates replication in other subsidiaries	7/2006
60 distributors using OM-3	7/2006
Customer service manager asked to travel around Australia promoting OM-3	7/2005
EBI Services announces plans for ground-up rebuild of OM-3	7/2006

Table 10: Key events & milestones in the evolution of the Omicron IOS