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An improved model of structural changes resulting from use of e-commerce

Nick Lethbridge
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**An Improved Model of Structural Changes
Resulting from Use of e-Commerce**

Doctor of Business Administration (Information Systems)

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Document Control

Key date	Change
April 2001	Proposal: First rough draft.
March 2002	Formal presentation (and acceptance) of proposal
June 2002	Post-presentation: Update of Proposal in response to reviewers' comments
November 2003	Publication of two key papers (now chapters) at ACIS 2003
January 2004	Proposal re-written to match current research scope; Ethics Declaration completed and approved
January 2004	Initial framework for the finished thesis.
May 2004	Publication of methodology paper at IRMA 2004
August 2004	Combination of new and already published work to create an initial draft of the full thesis.
September 2004	Change of thesis title (reference to AST removed)
October 2004	Major restructuring to emphasise ideas that are new in this thesis.
December 2004	Clarification of the methodology
October 2005	Minor changes following examiners' comments: diagram attributions and multi-page header rows for tables

Declaration of Original Work

I certify that this thesis is my own work. To the best of my knowledge and belief:

- i. it does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any institution of higher education
- ii. it does not contain any material previously published or written by another person except where due reference is made in the text
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30 Nov. 05

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Abstract

A common use of the Web is for electronic commercial trading, or "e-commerce". For many organisations, websites and e-commerce are new forms of technology; organisations will need to change, as they adopt these new technologies. As new technology is introduced, there will also be unplanned and possibly unexpected changes. In order to minimise the negative impacts of change and maximise the potential benefits, the organisation needs a clear understanding of the changes that are likely to occur. That has been the focus of my research.

Adaptive structuration theory (AST) models the changes that take place to organisational, technological and social structures in response to the implementation of new technology. Prior to my research, the AST model dealt only with new technology operating within a single organisation. It had not been adapted to suit the more complex, cross-organisational environment of websites and e-commerce. If AST is to be used to support management of web-based information system implementation, the AST model must first be extended into the website and e-commerce context.

Research objectives

My research question was, *How must AST be extended in order for it to be applicable to the multi-organisational scope of Web-based e-commerce information systems?* This led to my research challenge, *To develop an extended AST model that will be relevant to websites and e-commerce.* The extended model provides an explanation of the ways in which organisations and other affected groups may adapt to new Web technologies and systems.

As a student in the first cohort of the university's new DBA(IS) professional research doctorate, I had a further problem: what are the requirements of a DBA thesis? The marketing and background material for the DBA clearly distinguishes it from a PhD, with a different target market and different intended outcomes to suit the target market. Yet the only guidelines for a DBA thesis are, it should be half as long as a PhD thesis.

My own background is as a manager and a professional; I am typical of the targeted DBA student. To satisfy the DBA intent I need a research methodology that has relevance to my professional career. It should also – I believe – draw on the knowledge and experience of the student, to bring the benefits of that knowledge into the academic arena. This led to a second major research objective: *To define a research methodology to suit DBA requirements.*

Result: Research methodology

In order to successfully pursue my research, I needed to identify a suitable research methodology. The DBA is a professional doctorate: it targets the needs and interests of senior professionals and managers. I defined my *Critical Insight* approach to research as a means of both providing maximum benefit to the DBA researcher, and providing maximum opportunity for development of new and unique knowledge through the DBA research process.

Result: Maintain the basic AST model

Adaptive structuration theory (AST) describes the process by which an organisation will adapt to implementation of new technology. The process will be dynamic, with irregular but continuing changes to any or all organisational structures. Changes (adaptations) to one structure (organisational system) may cause changes to another structure. Structures are defined and maintained by people, the process of adaptation is driven by the comfort and consensus of users of the new technology. Adaptations may be classified as being ironic, faithful or hyperfaithful. These are the unchanged basics of the pre-research AST model.

Result: New structures subject to adaptation

AST models the ways in which technology is adapted to an organisation. The model also shows that organisational structures, in turn, adapt to the new technology. In order to relate the AST model to website and e-commerce development I have now identified eight key structures that may adapt: technology features, technology spirit, task of the work group, staff in the organisation, management, information system developers, customers and website visitors. Three of these are unchanged from the pre-e-commerce model, two have been redefined, three are newly identified.

Result: New scale of impact

Previous research had defined a scale to rate the impact of new technology; the scale is not applicable to e-commerce systems. My research has developed a new scale to measure the impact of the changes. Key points on the scale are, in order of increasing impact on each structure: refine, extend, redesign and transform. When considering a possible change, the change should be placed independently on the impact scale for each relevant structure. Whether the changes emerge or are planned, placing each change on the scale will give an early indication of the potential impact of that change.

Result: More relevant categories of change

For convenience of understanding, changes may be grouped into a small number of broad categories. The most recent, published categories give guidance but are not suited to e-commerce. Using those as a basis, I define a set of standard categories for grouping changes: knowledge capture, knowledge sharing, access to the website and how information is communicated.

Final outcome: Academic knowledge and practical benefits

In this thesis I extend the AST model so that it is relevant to and applicable to the implementation of websites and e-commerce information systems. My extended AST model adds a major new aspect to existing academic theory. It will also provide a valuable tool for application in business. Thus my research has made a significant contribution to both academic and applied business knowledge. This focus on both theory and practice reflects the professional nature of the DBA course.

1 Introduction: The Journey of Discovery

This thesis documents the results of my doctoral research over several years. The focal point is introduction of web-based systems, the theme is structural change, the result is an improved model of the change process. Along the way, there was a journey.

1.1 Discovering the Research Topic

The journey began with an interest in websites and e-commerce: I was helping two organisations with website development, this offered an insider's insight into the way in which the organisations worked towards the goal of successful web presence. I gained spoken agreement from both organisations, they were happy to be "studied" for my thesis. I wrote the research proposal.

The two organisations had one important feature in common: they both offered services which were entirely physical in nature. One was a private "meet, eat and greet" Club – all existing services depended on attendance at the Club premises. The second was a sporting Association – nearly all members were also participants, almost all services involved attendance at either a sporting or a social event. I intended to study the reasons for such "physical" organisations building a "virtual" web presence.

There the research stalled. I was not satisfied with my research questions, I was not satisfied with my proposed research method, I doubted the usefulness of any potential findings. My then-supervisor provided a major paper on Adaptive Structuration Theory – my path was set.

AST (adaptive structuration theory) provides a model of the ways in which organisations, and groups within organisation, adapt to new technology. AST also pointed out that the new technology itself is also adapted, either by being changed or by being used in different ways. I was fascinated by the basic ideas of AST; and I could see that AST could not – as it then stood – be applied to the technology of the Web.

I had identified my research topic.

1.2 Discovering the Methodology

This thesis is for a "professional" doctorate in information systems, the DBA(IS). I had several requirements of a methodology: it must suit the research questions, it must suit the professional doctorate, it must suit me. The DBA included coursework, one of the five units was devoted to research methodologies. None of the methodologies seemed to suit my requirements.

In particular: what is it about DBA research that makes it more suitable to the "professional" target market? From the ECU handbook, the DBA, "is designed for senior managers who need to develop an indepth understanding of the latest thinking and technologies that are shaping the global world of electronic business." When it comes to the DBA research, "participants develop unique and valuable expertise in an area of their choice" (Anonymous, 2003).

Is there a difference between PhD research and DBA research? Yes: PhD students are at the start of a career in academic research, the PhD provides training in research. DBA students are well established in a career, the DBA provides information, understanding and expertise in an area that could be relevant to their existing careers.

The PhD student is learning about research: a sound approach is essential, the research findings must be original. A DBA student is supporting an existing, professional career: the results must be relevant to work or career. The PhD is driven from methodology to results, research findings advance knowledge, they may or may not be useful beyond academia. The DBA student has a practical requirement that draws the research towards that requirement; value of the result depends on relevance and usefulness rather than on soundness of the methodology. See *Figure 1 Relative Research Priorities*.

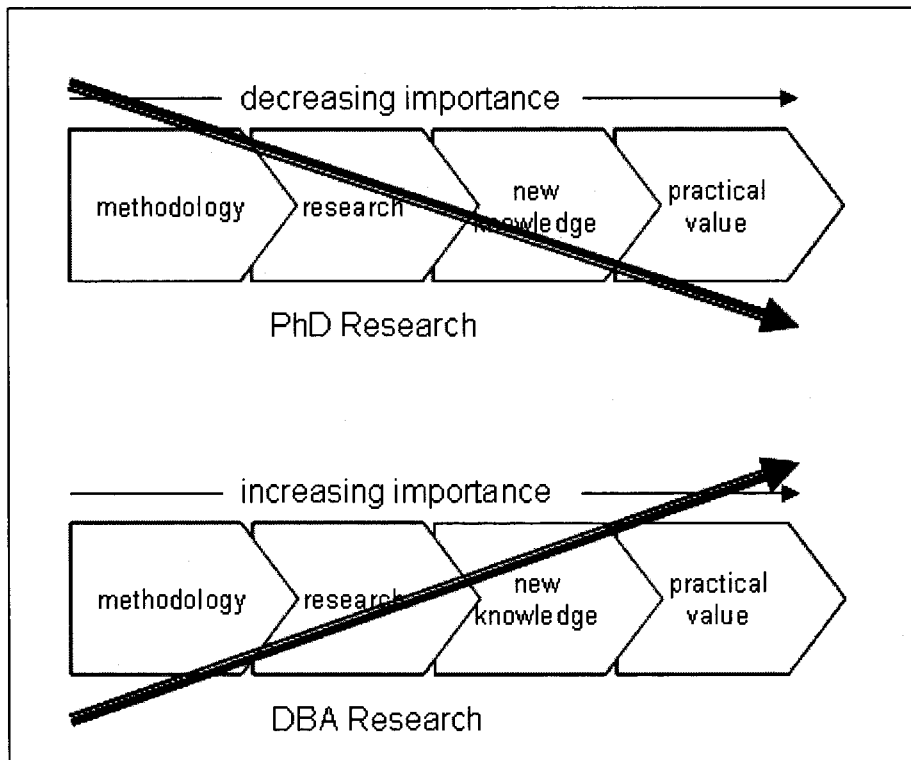


Figure 1 Relative Research Priorities

Source: author's research

As a DBA student – and as a professional – I was looking for a practical result: research findings that would have some value in the workplace. I needed a straightforward methodology that would allow me to spend most of my research time gaining practical, new knowledge. The research component was, at that time, less than half of the total doctoral course. I did not have the luxury of taking several years to build an impregnable framework.

What guidance was available for my research? The research methodology unit introduced a range of methodologies. Which ones suited the clearly stated differences between a DBA and a PhD? The only apparent difference was, a DBA thesis should be half as long as a PhD thesis.

I was not satisfied. The DBA had been introduced to satisfy a clearly defined, non-academic market. A PhD student may wish to prepare for a life of academic research. The DBA student has a different requirement. I needed a methodology; defining this methodology proved to be almost as much work as the research itself.

1.3 Discovering the Theme

The focal point of my research is the introduction of websites and e-commerce, the theme is structural change, the result is an improved model of the change process. Easy to say, but difficult to manage: the world is complex and reality involves complex interactions.

My research involved AST, adaptive structuration theory. At first I believed that AST was the focus and theme of my research. Then I began to look at the practical value of my research – and AST became a supporting idea, a framework to explain what was happening. What I was researching was the structural changes – inside and outside an organisation – as web-based information systems were introduced.

What was the value of understanding the structural change process? Consider the situation: an e-commerce information system – new technology – is being introduced into an organisation. So what? The organisation will need to change, in order to use the new technology. To minimise potential problems and to maximise potential benefits, the change should be effectively managed: change management became relevant to my research.

AST provides a model of structural change; structures – in this sense – are made up of and defined by individuals. Why do individuals react as they do to new technology? AST does not discuss this. A technology acceptance model (TAM) would explore individual reactions to a new e-commerce system. I chose to draw a line and maintain the AST focus on structural rather than individual adaptations.

Before my research, AST did not cater for e-commerce: it considered only structures internal to an organisation. My research extended AST to external groups: customers, for example, may also affect and be affected by a new e-commerce system. This reinforces a view that a move into e-commerce may require a strategic shift by an organisation. I recognised the strategic nature of my research – but chose to draw another boundary on the limits of this research project. See *Figure 2 Boundary of my Research*.

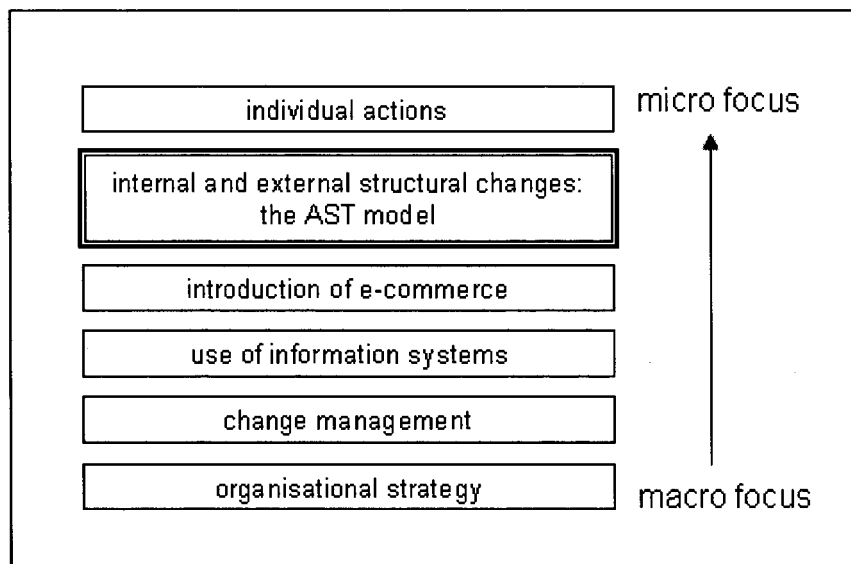


Figure 2 Boundary of my Research

Source: author's research

So the theme of this research could be stated in more detail as: developing a model of structural changes, which are a result of the introduction of an e-commerce information system, in order to support effective change management. The last phrase – about change management – is included largely in order to direct attention to practical implications of the model. Organisational strategy and individual actions provide macro- and micro-level boundaries to the research area, but neither topic is addressed in this thesis.

1.4 The Model at Journey's End

AST provides a model of structural changes when new technology is introduced to an organisation. AST has been applied to the technology of information systems. The purpose of my own research has been to extend the AST model so that it applies when websites and e-commerce – inter-organisational information systems – are the centre of the new technology.

Discovery of the research topic was a slow but steady progression. I began by considering reasons for website development, then moved to the possibly unforeseen results. Websites and e-commerce were always in sight but I spent a lot of time developing a clear and narrow focus.

Even then, the research was still fluid. I began with an understanding that e-commerce had strategic implications. As soon as I read my first article on AST, I could see that the model had relevance to organisational practice. It was only when I asked myself, How would you use this new model, that I realised the relevance of change management. A casual conversation at a conference opened my mind to the realisation that AST was a model of structures which were defined and maintained by individuals – each of whom would react differently to a requirement to use new technology.

The new AST model was largely complete before I fully documented my research methodology. I had known what I was doing but I needed to clearly document the process. Since my methodology was my own, I tested its acceptability by publishing it at a refereed, international, academic conference. The methodology passed that hurdle and was incorporated into this growing thesis document.

I had divided the AST model into sections, so that I could build my model in stages. The essential features of two of the three sections had been published and presented at an international conference. Feedback and further analysis led to refinements in the model. I was ready to build the final thesis document.

As I write this section, I am beginning what I hope will be the final, major revision of my doctoral research thesis. I have researched and developed a model which will enhance our understanding of the changes that occur when a website or an e-commerce system is implemented. The model is useful and – as I demonstrate within this thesis – it is applicable to a range of actual examples.

The journey would appear to be nearing its end.

1.5 The Journey Continues

As with any interesting journey – there is always more to see and do.

I have researched a relevant and interesting topic and I have extended the AST model so that it may be applied to e-commerce implementation. This is, however, only a beginning.

Within this document I outline a number of interesting areas for further research. An extension of one aspect of the model, for example, could lead to a better understanding of intra-organisational conflict, where two organisational structures have contradictory "spirits".

Other major areas for continuing research are in validation of the model.

My own strengths are in ideas and understanding, in drawing broad and coherent conclusions from an tangled mass of detail. "In the successful sciences, generalizations have ... emerged from checking in non-representative ways on an *initial bold generalization*" Campbell (1969, pp 360-361) in (Dermer & Hoch, 1999), my emphasis added. In this research I have aimed for that *initial bold generalization*.

- I have defined the Critical Insight methodology to suit my own requirements within the overall context of DBA professional doctoral research.
- I have used logical analysis – my Critical Insight methodology – to develop new theory: the AST model extended for web-based technology.
- I have shown that the extended model is valid, applicable and useful in at least a small number of actual situations.
- Of the three main areas of the model, none have been "proven" by field research. Each area would require, for reasonable proof, research equivalent to at least one full PhD research project.
- I have completed an initial step: development of a model which extends our knowledge and understanding – a model which will be useful in practice.

This thesis document will complete my DBA research. It will not complete all related research, it will not answer all related questions. The model is valuable but unproven. My research has opened up a broad area for further research: the application of the AST model – of adaptive structuration – to the still developing technologies of websites and e-commerce.

The journey of discovery continues.

2 e-Commerce and Organisational Change

Business change is a fact of life; no matter what the business, change is inevitable. Change brings risk: what if something goes wrong? Change brings challenge: how may the change be managed so that the business gains maximum benefits?

In the latter part of the previous century, a common reason for organisational change was the introduction of a new, computer-based information system. A new theory – adaptive structuration theory, or AST – was developed to model the ways in which an organisation would change as new technology was introduced. Understanding the process of change would support the effective management of that change.

In the current century, many new information systems will use Web technologies: organisational websites and full e-commerce systems are becoming common parts of integrated organisational information systems. The new e-commerce systems introduce change across more than one organisation; to effectively manage that change we need to understand the cross-organisational change process.

My research has developed a model of the change process resulting from e-commerce implementation. Is this really necessary? Is it worthwhile to understand – and therefore be able to manage – change?

This section of my thesis briefly describes some relevant points from the related areas of change management and organisational development. The intent is to show that, Yes, change management is worthwhile. Two case studies are introduced, as examples of the expected and unexpected changes that may occur when e-commerce systems are implemented.

Understanding of change will improve the quality of the change management. Better change management will result in better outcomes for the new web-based system implementation. In practical terms, my new AST model will be able to improve the actual outcomes as websites and e-commerce systems are implemented.

2.1 Information Systems Lead to Change

Today's businesses operate in a dynamic market. There is constant need to gain and maintain competitive advantage, with a resultant need for continuing organisational improvement and change. "Thus it is essential that an organisation, be it commercial or industrial, has in place a highly effective methodology to manage any (not just major) change" (Hall, 1999). In order to effectively manage change, the organisation must first understand the likely path and flow-on effect of each organisational change.

According to Collyer, "It has been reported that over 75 per cent of all business transformation projects fail." Collyer then suggests that two of the biggest problems could be lack of communication with employees, and the failure to recognise the impact that a change project will have on the business as a whole (Collyer, 2000). Again, in order to effectively manage change, the organisation must be able to identify the change and its flow-on effects.

Writings in OD (organisational development) provide at least two contrasting views of the way in which organisational change should be approached: beginning with individual attitudes, or beginning with organisational structures.

The basic assumption [for the first and earlier view] is that you must change your attitudes or ideas (i.e., your mental model, metaphor, theory-in-use, or tacit assumption) before you can change the structure or technology of your organization. In contrast, most of the change management professionals we know lean more toward the view ... that changes in both structure/systems and human process are necessary to effect attitude and behavior change. (Worren, Ruddle, & Moore, 1999)

No matter which view is accepted, there is the same implication: Any organisational change will affect both individual attitudes and organisational structures and processes.

"Well-known OD theories such as those of Argyris, Schein, and Senge still focus on individual skills and attitudes with little regard for the role of structure and systems" and the enabling role of IT has only recently received the appropriate level of attention in OD theory (Worren et al., 1999). As an organisation moves into e-commerce, there is an increasing dependence on information systems (IS) and information technology (IT). The central concept of e-commerce is, that IS and IT become the key enablers of commercial business processes. As such, IS and IT will be key aspects in organisational change; changes to IS and IT may result in changes that affect the organisation as a whole.

To further complicate the situation, Worren et al see that, "Integration and alignment between strategic, social, and technical components require collaboration between people possessing skills in different areas. However, such collaboration is often difficult." IS and IT are part of the technical systems of an organisation. In a move to e-commerce, IS and IT may also be strategic technologies. The combination of strategic and technical component changes offers a significant challenge. The further, social aspects of the change may easily be overlooked.

The references cited above discuss change in terms of organisational development. An OD initiative results in deliberate change to the organisation. In order to manage the change, the related field of change management offers further support. In one paper, for example, "The change management methodology helps to ensure that the organizational dimensions of the IT solution enable business processes to achieve their stated objectives. These organizational dimensions include culture, organization and workforce structure, competencies, information, and human resource and management practices." (Castle & Sir, 2001)

Organisational development provides one source of change that must be managed. The introduction of new IS and IT is another source of change. A move into e-commerce, with its requirement for new information systems and new information technology, will also result in changes: to organisational attitudes, processes and structures. There may also be changes to the strategic, technical and social components of the organisation.

A new website or e-commerce system, or any new information system, may appear to require only a technical change; the reality is different. The introduction of web-based systems may represent a complex organisational change that must be understood and effectively managed. My DBA research has provided a framework to support understanding and management of organisational change as the organisation implements new websites and e-commerce systems.

2.2 Organisational Change Requires Management

New production technologies are known to be competitive weapons, but their implementation is at least as challenging a managerial problem as their invention. The initial implementation stage is particularly crucial. (Leonard-Barton, 1988)

In the current decade, information systems are the new competitive weapons: from basic information processing, to integrated ERP, to inter-organisational e-commerce – effective use of information systems (IS) provides a competitive weapon for the business. Block, for example, links new technology to both production and operation: "Changes in technology include techniques for making products or services more efficient (e.g. work methods, equipment, work flow, etc.)" (Block, 2001). The tools are changing but the challenge of implementation still remains.

So, as Steiner asks, "Why is managing or even just coping with change such a complex problem for people and organisations?" (Steiner, 2001)

A new website or e-commerce system involves change of processes and relationships both within each of several organisations and between those organisations. An ERP system requires change within only one organisation. From that perspective ERP is simpler than e-commerce, yet many ERP implementations still fail. Aladwani sees that, "Many ERP systems face implementation difficulties because of workers' resistance." In order to improve the chances of ERP implementation success, "use of change management strategies" is recommended. Even then, "many ERP systems still face resistance, and ultimately, failure." (Aladwani, 2001)

Leonard-Barton identified a key source of the difficulties with implementation of new technologies: "It is argued that technology transfer requires continuous, ongoing dedication to the process of change and the conscious management of mutual adaptation because the technology will never exactly fit the user environment" (Leonard-Barton, 1988). New web-based technology will not exactly fit the existing user environment: either the technology or the user, or both, will need to change. If the changes are not planned, if suitable change management strategies are not used, technology and users may never match; at the very least, this will result in a less-than-optimal implementation of the new technology.

It is not only "the technology" which may be a mismatch to "the users". Worren et al, for example, identify "many [organisational] components" that may require "comprehensive change". These components include "human behavior, culture, organizational structure, work processes, and IT/infrastructure" (Worren et al., 1999). Comprehensive change, such as the implementation of a new e-commerce system, will require an effective change management strategy in order to deal with the wide range of organisational components that will change, or that may need to be changed.

Block considers that, in order to maximise market impact, four factors may need to change: Technology; Products and services; Strategy and structure; Organisational culture. The changes will be "interdependent; a change in one factor often triggers a change in another part of the organization." In order to manage these expected changes, "strong leadership and a clear vision of the future are considered the building blocks of any successful change effort" (Block, 2001). That is, successful change requires effective change management.

In an example that is specific to information systems, Collyer identifies that, "so many of the former [information systems projects] fail to deliver their full potential because of a failure to recognise the need to help people adapt to change and provide a business infrastructure that supports/facilitates the process of change" (Collyer, 2000). A new information system requires that people (users) change. Implementation of new technology – such as an information system, also necessitates a change management program to guide the new users.

Collyer describes a project to implement a single, integrated information system throughout a global organisation. On the surface, this is a technology project. As it was implemented, "The situation forced us to look at our business and the processes we had in place. Both cultural and organisational changes were needed as we had very separate businesses operating globally ... with the development of new global products we realised that this needed to change" (Collyer, 2000). New information technology requires matching changes to the organisation; these changes need to be identified and managed.

The field of organisational development, OD, overlaps with formal change management. OD "is the planned process of developing an organization to be more effective in accomplishing its goals. It focuses on developing the structures and systems within the organization, with primary emphasis on human resources, to improve organizational effectiveness" (Castle & Sir, 2001). OD provides approaches that may be effective in support of the implementation of new information systems and technologies.

OD theory provides the organic system model where, "change is seen primarily as an adaptive response by the system [that is, the organisation], acting as a whole or through subsystems with specific functions, to maintain itself in balance with a shifting environment. Change is thus externalized beyond the system boundary" (Beeson & Davis, 2000). Beeson & Davis also describe an alternative model of change – Checkland's soft systems approach – where "attention shifts from the actual constitution of organizations as complex systems towards organizational actors' understandings and formulations of problem situations." Each of these theories provides a different understanding of the process of change, with different methods by which the change should be managed. Both agree on the need to manage the change process.

Several other views of the change process are provided by Block. First, Block outlines Ackerman's "three different types of organizational change: developmental, transitional and transformational. Each of these is associated with a different purpose, a different set of interventions, and a different set of risks." Block then describes Wilson's "more comprehensive framework for understanding organizational change ... based on two fundamental dimensions: planned versus emergent and process versus strategy. These dimensions form the basis of a typology through which the author attempts to characterize a variety of approaches to organizational change" (Block, 2001).

Whatever the model, organisational change must be understood in order to be effectively managed. *Figure 3 Complexity of Organisational Change* indicates the possible complexity of the change process, based on only the few papers referred to in this section.

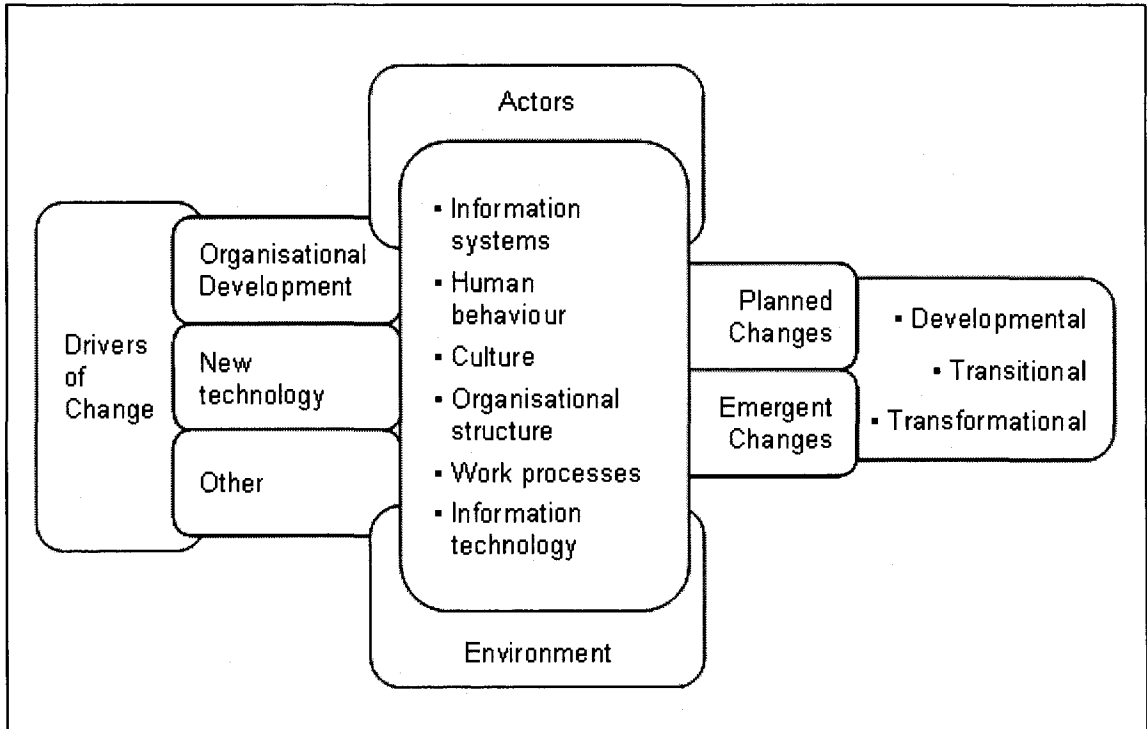


Figure 3 Complexity of Organisational Change

Source: author's research

OD and change management theories offer numerous models for the change process. Each model comes with its own set of solutions, of methods to ensure that organisational change is managed effectively. "But what if those myriad solutions are just momentarily pragmatic, just the latest management fads? Even worse, what if those solutions are exacerbating the problem, creating more instability, more uncertainty, more mistrust of and anxiety about change? (Kleiner and George, 1997; Markus and Benjamin, 1997) The solutions might become part of the problem unless we understand the origins of the problem we are trying to solve (Foegen, 1998; Guha et al., 1997; Hardy and Leiba-O'Sullivan, 1998)" (Steiner, 2001).

Steiner recognises the complexity of the problem and the difficulties of effectively managing change. To support effective management of organisational change, my own research has looked at "the origins of the problem we are trying to solve".

Effective change management needs to begin with a clear understanding of the problem. New websites and e-commerce systems are forms of new technology: The organisation will change, and need to change, as the new information systems are implemented. My current research has extended a model of the way in which an organisation adapts to a new information system. In particular, the model has been extended to describe adaptations – changes – in response to the implementation of new, Web-based, information systems.

I very much like the idea of applying AST to web technology. This is an application that hasn't been done yet so I encourage you to pursue it. (Majchrzak, 2002)

With a relevant and applicable model of the change process, organisational change management will be able to be more effective.

2.3 Some Unanticipated Changes

"Despite a strong consensus concerning the importance of organizational change, there remains little if any consensus regarding a conceptual framework for understanding change or a preferred strategy for implementing change" (Block, 2001). Implementation of change is a challenge. Even before implementation, as Block indicates, we need to understand change itself. When the change is driven by new technology, such as new information systems, the change may be seen as a "technical" issue, with insufficient consideration given to the social and organisational changes that will also occur.

Castle & Sir discuss the three aspects of change, or "disruption", that occur as an information system is implemented (Castle & Sir, 2001). First there is the technological disruption, that is, the essential technical activities involved in system implementation. Next, they identify work process disruption, the changes to organisational processes that are required in order to most effectively use the new system. Third is human disruption, the natural response of humans to change in their working environment. Organisations increasingly depend on information systems to increase productivity, yet the implementation of those systems is poorly managed:

Yet, failure rates in information technology-based (IT) initiatives approach 70% (Davenport, 1995). This trend holds fast regardless the inclusion of a change management component in IT methodologies (Computer Science Corporation, 1995). However, IT change management inadequately addresses the 'people' issues which are the focus of an OD change management practice. (Castle & Sir, 2001)

Information systems implementations may include change management strategies, yet they still fail, perhaps due to a focus on change only to the technology. OD change management offers a focus on people issues. Castle & Sir indicate a need to consider technology, human and process changes. In another example, "Results indicated that the propositions from the literature were insufficient to explain the behavior of the team" (Majchrzak, Rice, King, Malhotra, & Ba, 2000).

Implementation of new technology, such as a new information system, will require and result in a range of organisational changes that extends well beyond the technology itself. When the information system involves websites or e-commerce, planned and unplanned changes may extend throughout and beyond the organisation. The examples described below indicate the potential for change due to e-commerce systems.

2.4 Case Studies in e-Commerce Implementation

The selected research methodology (Critical Insight, as described in the later section, *5.2 Research Methodology*) has two stages: development of new theory, followed by confirmation and validation of that theory. My DBA research has concentrated on the first stage: I have developed a broad and coherent model of the change process.

This thesis develops and presents a new and useful model of the process of AST (adaptive structuration theory). Confirmation and validation of the model could require an effort equal to several PhD theses. My own DBA thesis does, however, include initial validation of the model: each component is tested against the two case studies which are presented below.

Each case study is from published literature, each describes an e-commerce implementation: one based around a new website for a well-established business; the other a website for a start-up organisation. Both cases include a number of significant changes that are directly due to implementation of the new technology. The changes were apparently unexpected, and caused some difficulties within the organisations.

Given an adequate model of the changes that could result from website implementation – a model such as the one that I have developed for my doctoral thesis – perhaps each organisation could have enjoyed a smoother transition into e-commerce.

Leonardo's Vineyard (Sellitto & Martin, 2003)

In the following description, all ideas and direct quotations are from the original article which describes the case study, that is, from (Sellitto & Martin, 2003).

A website was created to capture tenders for the sale of one year's vintage of a premium wine. "The tender was successful from our point of view in that it allowed us to sell all the wine at an average price of \$75 per bottle, which was a higher return compared to our previous \$50 per bottle mail list offer." This was a simple entry into e-commerce, with a successful outcome.

For subsequent vintages (that is, for premium wines produced in subsequent years) email alerts were sent to customers who had registered through the website. The email announced that a new vintage would soon be on offer. "We have about 2500-3000 people on our customer lists. Some 600 are still receiving the traditional postal notification of our vintage releases with the remainder getting an email message. The traditional list is always under review."

Maintenance of the non-email list was a laborious process. Eventually, postal customers were simply directed to the website. That is, they were required to become e-commerce customers.

Maintenance of the email list was also laborious. As email became more common, customers would regularly change their email address. For example, a customer could change jobs, get a new work-related email address, then need to change the address on Leonardo's email list. Rather than improve the internal process for address list maintenance, Leonardo outsourced list maintenance to an Internet-based organisation. This organisation also supported the email newsletter distribution process.

Leonardo "is in transition from the traditional mail list to the electronic medium – a simple substitution of one medium for another." This simple transition has required changes to customer behaviour. It has also resulted in a number of related processes being changed and outsourced. Information systems, organisational processes and customer behaviour have all been changed.

In fact, it is not simply customer behaviour that has changed – the customers themselves have changed. "The winery, as a consequence of having moved to the Internet environment, has also found that its traditional customers appear to be dropping off the wine contact list – they have been priced out of the market and off the winery's list by new email-enabled customers."

The new e-commerce system for wine tenders also caused "considerable criticism" from wine retailers who were not able to buy any of the premium wine. Both wine traders and price sensitive customers were adversely affected by the new system. In order to maintain business relationships – at some expense to immediate profits – Leonardo backed away from the new system of all sales via e-commerce. "As a result of industry feedback" Leonardo now sells 30% of annual production through traditional retail intermediaries.

As a further result of dissatisfaction from traditional customers, Leonardo has also changed from an online tender to online ordering at preset prices. "Thus, because of the feedback dictated from retailers and customers the winery has had to alter its Internet strategy."

Use of e-commerce has resulted in one other major change to both internal processes and customer behaviour: Cellar door sales have been abandoned. It is no longer possible to buy Leonardo wines through a visit to the Leonardo vineyard.

The move to e-commerce has been highly successful, for Leonardo's. Nevertheless, it was not a simple process of implementing a new information system. A system was implemented and organisational processes were changed. Retail and consumer customer processes were affected, customers had to change their purchasing practices, their feedback in turn resulted in changes to both internal processes and the e-commerce system.

There has been a series of changes, many of which were not anticipated. Changes were internal and external, planned and emergent. An effective change management process needs to cater for all of these possibilities. The extended AST model will help management, by highlighting the potential areas of change.

Tail and Dog Online Publishing System (Chiasson, 2002)

In the following description, all ideas and direct quotations are from the original article which describes the case study, that is, from (Chiasson, 2002).

National.com (a pseudonym) is a start-up company, set up to publish an online magazine. The business was to be based on an information system to allow publishing directly to the Web. Since the system would interact with customers through a Web interface, it is a B2C – business to consumer – e-commerce information system.

"We intend to go 'against the grain' and deliver a fresh and hip product that constantly strives to strengthen its brand. national.com will use sex, humour and controversial content to attract its users. Its domain name, in conjunction with its logo, possesses huge branding potential. The Company plans to leverage a large and loyal user base to sell Canadian products and business advertising on-line... our target market is 25 to 34 year old Canadians who use the Internet on a weekly basis; more specifically, middle class, university/college educated singles and DINKS (dual income with no kids) urban dwelling 'experiencers'. This represents 1.5 million of the population. The Company's market penetration is conservatively projected at 10%." (business plan)

The idea for the company came from a discussion between two people: John, a university software developer and researcher; and Marcel, an entrepreneur with an information systems and information technology background. Initial funding came from family and friends, other investors joined later. John worked within a university, employing a small team to develop the information system. Marcel managed the new business and hired a team to develop content and presentation.

Overall development responsibility was divided between the two groups: Marcel's "pizzazz" group planned the look and feel for online presentation; John's "content management" group developed the functionality of a system to present information through the Web. The pizzazz group had a multimedia background, team members saw the main development task as being the production of attractive multimedia Web pages. The content group, with backgrounds in database design and scripting languages, saw the main task as being development of an automated database system to manage content.

John's team produced "a simple recursive database design". The database system could manage a range of content, automated layout and context-sensitive placement of advertisements. Marcel's group, "had trouble understanding the design philosophy". They were critical of the "boring" look of early prototypes. The team leaders worked together to minimise disagreements but there was always some friction between the two teams.

This separation [John's content team from Marcel's pizzazz team] also produced some unexpected surprises. For example, since he had been promised a "generic" system that could handle new functionality, Marcel believed that the e-commerce system developed by the university group would also be able to handle more specific functionality – including events, product sales, and "micro-site" development for advertising clients.

As the system was being developed, Marcel's plans for the company were also developing. The original business plan had involved management of articles and advertising. The business plan was extended to include notices of coming events plus sale of related merchandise. As the range of content increased, system requirements were extended to match. The business plan became more "diffuse" and there was "ambiguity" in the extended requirements. These changes caused further disagreement between the two development teams.

"I mentioned to Marcel today that his company's work across three very different areas may be strategically unwise, and to keep an eye on whether he is stretching himself too thin." (John)

One of [the programmers from John's university team], trained in Web systems design and business strategy, had the following to say:

"I didn't really get the feeling that national.com has the level of technical expertise that would be required to make this kind of venture successful... I don't think they have the right skill set to make the project happen. A project of this scale requires at least two dedicated, very skilled HTML, JavaScript, and database programmers." (university programmer)

Despite disagreements and clashes, the two groups created a content management system which could present multimedia with pizzazz. The new system managed content – subjects, articles, advertisements – and automated the formatting and presentation of content to the reader. The system was generic, in that it could manage a wide range of content and format. Content could be added with little or no knowledge of website design languages. Automation features reduced the need for human intervention in layout; staff were freed for marketing and multimedia development tasks.

The initial business model depended on raising of revenue from advertisers. Despite the flexibility of the system, there was little immediate interest from advertisers. The flexibility of the generic system, combined with lack of advertising revenue, caused a change in strategy: national.com decided to use the software to do website development for other companies.

There were limitations in the system's ability to manage colour and graphics, however, within its limitations the new system could reduce website development time by 80 to 90 percent. New website content could be added with no need for Web coding. Marcel, the two teams and company investors all agreed that the software was "a strategic weapon". Company strategy was adapted to take advantage of this new weapon, by offering management of advertisers' "micro-sites" within the main national.com website.

The original B2C magazine website – funded by advertisers – had failed to attract either readers or advertisers. Automation features within the new system had reduced the need for multimedia designers, so there were staff free for other work. The new strategy used staff and system to develop a B2B (business to business) business of website development and hosting. Once a new site was developed, content could be easily added, as long as the business was satisfied with the e-zine (online magazine) presentation format.

The latest strategy (when Chiasson's paper was published) was to package and sell the content management software.

The software had been developed by John's team, a university-based team of systems developers. The package would be sold by Marcel's team, based within national.com. Marcel and his team still did not fully understand the system. In particular, Marcel was not clear on the division between proprietary intellectual property and publicly available Web software. In a note from Marcel to John:

"I'm running into a problem trying to explain to my potential investors what is proprietary behind the technology and how this is different from our potential competitors. I was just wondering if you could send me some documentation or talk with me on the phone to try to get around this issue. This is crucial towards convincing them that we have a sustainable competitive advantage and will greatly assist in getting the funding that we need. As well, how much time and resources (money and manpower) do you think we'll need to develop this technology into a prepackaged software product? I'm trying to fine tune our new business plan." (Marcel)

2.5 Information Systems and Organisational Change

Implementation of a new or changed information system will involve changing the way in which people interact with the system. A planned move into e-commerce must also plan to manage the change for all of the people involved. "Employees naturally resist change they do not understand. This resistance often can lead to the failure of an effort to implement new and different ways of doing business" (Wilson & Tozzi, 2002). "Note that those affected may not be within the organisation, they could be customers or suppliers" (Hall, 1999).

The simple e-commerce case studies above demonstrated the potential for expected and unexpected impacts of an organisational change into e-commerce. "Even with the best laid plans things go wrong, caused either by circumstances unforeseen within the project plan, or by unexpected reaction by people... The consequence of this is that the project founders" (Hall, 1999).

Part of the challenge of change management is to anticipate the changes that may occur and the manner in which the changes may impact the organisation. Steiner indicates that human nature itself will make it difficult to predict changes: "We cannot be consistent in our thinking about change because we do not have a workable sense of how human beings operate" (Steiner, 2001). It may not be possible to predict the exact changes resulting from a move into e-commerce. At the least, in order to improve our chances of success, we must be aware of the possibility of far-reaching impacts on the organisation, its employees, processes, customers and suppliers.

The process of change may be complex. Wilson & Tozzi point out that one change may have a flow-on effect, causing changes in a related area. These second-order changes may, in turn, cause third-order changes in yet another area (Wilson & Tozzi, 2002). These second- and third-order effects may result in issues more complex than the direct changes due to the new information system. The flow-on effects may also be more difficult to manage, since they are beyond the immediate area of control of the system implementors.

What is happening is more than simply the implementation of a tried and true technology. The organisation is using the technologies of IS (information systems) and IT (information technology) in order to improve organisational performance. Each organisation is unique, so each organisation requires a unique implementation of IS and IT: The process of implementation has been labelled as "re-invention", or "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers, 1995, p. 174) in (Scott, Quinn, Timmerman, & Garrett, 1998). From the same article, "As Leonard-Barton (1988) argues, 'Instead of the predictable realization of a preprogrammed plan, implementation is a dynamic process of mutual adaptation between the technology and its [user] environment' (p. 252)" (Scott et al., 1998).

"According to Rogers (1995), re-invention is likely when the innovation is complex, when users are far removed from system designers, when the innovation is a concept or tool with multiple possible applications, and when 'local' needs may be more important than more centralized ones" (Scott et al., 1998). When the innovation is an information system (IS), it is complex and the designers are very likely remote from many users. When the IS is a website or e-commerce, remoteness is increased. It will also be more difficult to match both local and centralised needs, since local and central users may be in different organisations. The level of re-invention will be high for a new web-based information system.

System users (employees, customers, suppliers) will adapt their own processes to suit the new system. They may use the system in ways not intended by the implementors; they may also attempt to change the new system. "Their capacity to transform circumstances in the desired direction depends on the extent to which they can deploy personal and organizational resources to negotiate appropriate meanings through social and political relationships with relevant others" (Coopey, Keegan, & Emler, 1998). That is, the level and type of change will depend on relative power of the various players.

"The socio-political process and the substance of the innovation have reciprocal effects, yielding the possibility of agreement on a 'working innovation' which, once institutionalized, modifies the existing system and structures in ways that constrain, in new modes, the behaviours of all of those involved" (Coopey et al., 1998). In other words, Coopey et al suggest that the information system will cause organisational change and that that change will cause reciprocal efforts to change the system. There is a to-and-fro process of change which may result in a stable system which is not the same as that originally intended.

The field of OD (organisational development) offers a number of models for the process of change. Collyer, for example, refers to organic: "With more holistic projects that go beyond 'simple' systems implementation... full exploitation of the benefits can only be achieved if the change (people, processes, systems and infrastructure) is organic" (Collyer, 2000). Others, however, reject the organic model.

Beeson & Davis, for example, state that the limitations of the organic model are particularly apparent, "when the pace of organizational and technological change has thrown into question the contemporary validity of organizational models based on central control, stability and bureaucracy" (Beeson & Davis, 2000). The article states that, "the [organic] model attributes too central a role to management and overestimates management's power to control events and actions." Further, it identifies that the way in which an organisation operates is driven by "a multiplicity of actors whose behaviour is not merely adaptive but also creative and contentious." This supports the complex model for IS and IT e-commerce implementation, where operation of the new system will adapt and be adapted by the actions and requirements of a wide range of people, both inside and outside the organisation. Beeson & Davis put forward, "A theory of change management ... which unites a generalized notion of emergence in complex systems with a notion of accomplishment in human action."

According to Block, change is not a linear process, to be rationally planned and implemented. The outcomes of strategic change will be largely determined by political and possibly irrational aspects of the organisation, by the exercise of power and influence. Block uses this argument to support the inclusion of "contextual factors such as power, gender and accounting models" in any model of organisational change (Block, 2001). Again, the implication for a new information system is, that change will be a complex process, affected by the power plays of numerous people.

"[M]any authors have noted instances of adaptation in which either (1) a technology is reinvented by its users to suit their needs (Johnson & Rice, 1987; Rice & Rogers, 1980; Souder, 1987) or (2) a workplace adapts, with reeducation of workers and changes in their rewards (Zuboff, 1982), new work roles, or other organizational changes occurring (Barley, 1986)" (Leonard-Barton & Sinha, 1993). Nevertheless, understanding that changes are driven by both developers and users does not allow every change to be accurately anticipated: "Users are no more prescient than developers about the changes in their workplace that will allow them to best exploit a new technology."

One of the ways in which users adapt to technology is through appropriation, "as the group chooses to use (or not use) features of the technology." These appropriations of the new technology may lead to changes in the relationships amongst users. The hierarchy of power, for example, may change. "Over time, certain appropriations may be reinforced because the outcomes of such appropriations are acceptable to group members or appropriations may change if the group members want different outcomes" (Chudoba, 1999). The process may settle into a new organisational pattern, or the organisation and its use of the new technology may continue to change.

Unanticipated changes in the use of new technology may support the original intent of the technology, or they may not. "DeSanctis and Poole (1994) describe 'faithful' use of the technology as using the technology in ways that are consistent with its design. 'Ironic' use would have group members appropriate the technology in ways that circumvent its inherent design features." Both faithful and ironic uses may lead to positive outcomes, depending in part on the effectiveness of the technology as originally implemented. (Chudoba, 1999)

As described above, a new information system will result in change to the organisation. The change may be either good or bad. It may support the original intent of the system or it may act against that intent. If the new system is e-commerce, the changes may extend beyond the organisation – to customers and suppliers. This raises two important questions: Is it possible to effectively manage that change? Is it possible to control that change?

In answer to the first question, my own research has developed a model of the change process; the model will make effective change management more feasible. The second question was, Is it possible to control that change? Change management may be desirable. Absolute control of that change may, in fact, be against the best interests of the organisation.

Steiner cites more than a dozen references in support of her argument that an effective organisation requires less control and more flexibility (Steiner, 2001). She describes "the tension in the change management paradigm" which is due to unthinking conformity, to "unthinking appropriation of generalised rational products without evaluating them for appropriateness to the situation".

If the members (and customers and suppliers) of an organisation are willing to uncritically accept new processes then there will be no innovation. With no organisational innovation, the organisation will stagnate and lose its competitive edge. Uncritical acceptance, or "theoretical mindlessness", will lead to stagnation. Critical evaluation of a new system, testing its appropriateness to the actual situation and adapting both usage and the system, will lead to innovation and, potentially, organisational improvements.

In discussing mergers of organisations, Howard & Geist identify an existing theory that offers "a compelling framework for the exploration of the discursive responses of organizational members as they cope with and manage uncertainty associated with the change" (Howard & Geist, 1995). This "structuration theory" offers a model of the ways in which organisational members adapt to change by controlling, creating and recreating the power structures of the organisation. "Ideological positioning functions not only as a response to the merger, but also to produce and reproduce organizational structures that enhance or inhibit autonomy, identification, empowerment, and change."

Structuration theory offers a model of organisational change. The introduction of new technology is a particular example of change, with the information systems and technology being specific drivers of the change. Researchers have used structuration theory as a base for the more recent "adaptive structuration theory", or "AST". There are, however, areas in which adaptive structuration theory directly contradicts the original structuration theory. Nevertheless, the new AST offers valuable insights into the way in which new technology is absorbed into an organisation.

In 1993, the new theory was gaining acceptance: "Most theoretical perspectives used to explain the use and effects of communication and decision support technologies assume some form of technological determinism... To date, only adaptive structuration theory (AST) offers the promise of satisfying two requirements for explanation based on an emergent perspective: recursivity and unique effects" (Contractor & Seibold, 1993). By 2000, AST was still being developed. One research project examined the change process in terms of AST, yet a report still stated that, "The adaption process for new technology is not yet well understood" (Majchrzak, Rice, Malhotra, King, & Ba, 2000).

AST has gained some acceptance as a model of the process of change as technology is introduced into an organisation. More recent research has used AST to model change when the new technology is an information system. The research has focussed on systems which operate within a single organisation, or which are used by a virtual team which operates across a small number of tightly linked organisations.

A website or e-commerce information system operates across a potentially large number of organisations. The organisations may be loosely linked, or not linked at all except for a common interest in the commercial exchange of goods or services. This situation, where one system operates across and within a number of organisations, adds complexity to the management of change.

Up to now, there appears to be little or no research linking AST to the implementation of a new e-commerce information system. My own DBA research applies AST to web-based information systems. The result is an extended AST model which will allow more effective management of the implementation of new websites and e-commerce systems.

3 AST: Adaptive Structuration Theory

3.1 A Model for Structural Change

Adaptive structuration theory, or AST, considers organisational change from two viewpoints: the "structures" of technology and the structures of the organisation. AST models the changes that take place to the various technology and organisational structures (that is, structuration) in response to the implementation of new technology (hence, adaptive). As described in at least one paper, AST captures and models the complex interactions between technology and organisation (DeSanctis & Poole, 1994).

As Chudoba explains, the AST model shows that there is a reciprocal relationship between technology and its context. That is, the technology affects the context (organisational structures) and the context also affects the technology. Further, the relationship is iterative rather than one-off: There may be a series of related and unrelated changes and adaptations. "One must go beyond looking for straightforward, cause-and-effect relationships demonstrated at a single point in time, and instead, take a more holistic approach to understand the circumstances of use (or lack of use) and changes in that use over time" (Chudoba, 1999).

In order to effectively manage change, Worren et al state that, "One promising trend is the development of a more systematic understanding of different types of change journeys." Different organisations may have similar patterns of change, continuing research aims to build a standard typology of these patterns of change (Worren et al., 1999). AST models the pattern of change when the driving force is new technology. My DBA research project has extended the AST model into the situation where the new technology is a website or an e-commerce information system.

Once a pattern has been established, the second major challenge (according to Worren et al) is to manage the change program. As the change program continues, the context (technology and organisational structures) may also change. The change management activity must cater for these ongoing changes. The AST model helps to understand and anticipate the changes, or structuration, that may occur.

Many of the changes that occur as new technology is implemented are not a direct result of the technology itself. Rather, they are the result of the ways in which affected people appropriate (that is, adapt and use) the associated structures (Gopal, Bostrom, & Chin, 1992-1993). Individuals and groups selectively use parts of the technology, sometimes in the intended fashion, sometimes in unexpected ways. By doing this they may be altering the technology structure. Organisational structures may also be selectively appropriated, in response to individual and group adaptations. There may be both expected and unexpected changes to organisational structures. These changes may be a direct or an indirect result of the new technology. As groups and individuals interact with the technology, structures are created, changed or removed. This is the process which is modelled by AST.

In organisational development, "These authors [Women, Ruddle and Moore (1999)] argue for the integration of strategic, developmental and technological perspectives into a holistic model of change that is able to address all aspects of this complex phenomenon; however such a challenge is easier said than done" (Block, 2001). Block cites Daft (2001) in identifying four types of strategic change that target competitive market advantage: technology, products and services, strategy and structure, and culture. AST aims to provide an holistic model of changes to technology and organisational structures when the strategic change is implementation of new technology. My own research extended the model to suit the situation where new technology is a web-based information system.

Finally, the AST model considers the timing and patterns of change.

Implementation of new technology is only the first, trigger, change. Subsequent changes are reciprocal, they occur in response to earlier changes. The changes are iterative, the pattern of change is continuous. Some changes reinforce earlier changes, others may reverse earlier changes, some are "new" changes in response to other changes.

Chudoba cites a number of other papers to demonstrate the time-dependent pattern of work and changes. Poole (writes Chudoba) argued that groups could follow many different paths as they worked on a task (Poole, 1983a and 1983b). Maznevski and Chudoba (1999) noted "pulses" of activity in global, virtual teams while Gersick (1988, 1989) described patterns of intense activity bounded by periods of inertia. Similarly, significant appropriations occur at key times rather than at regular intervals. (All cited in (Chudoba, 1999).)

Some researchers suggest that we must study the processes and interactions of technology use over time in order to understand the implications of its use (DeSanctis and Poole, 1994; Nunamaker et al., 1991) in (Chudoba, 1999). There is a strong message, that an understanding of the changes due to new technology must include an understanding of the timing of the resultant changes. AST, adaptive structuration theory, includes this timing as a key element of the model.

3.2 Advantages of the AST Model

In 1992, Gopal et al wrote, "The most clearly articulated of the different approaches appears to be adaptive structuration theory (AST), outlined by Poole and DeSanctis. This approach provides a cogent framework for the study of GSS..." (Gopal et al., 1992-1993). "AST is based on Giddens' (1984) Structuration Theory, which focuses on the practices that constitute social systems. AST narrows the focus of structuration theory to structures associated with technologies and 'provides a model that describes the interplay between advanced information technologies, social structures, and human interaction' (DeSanctis & Poole, 1994, p. 125)" in (Scott et al., 1998). "The concept of structure, agency and the duality of structure are central to the structuration theory, and new technology can inject destabilizing resources into an existing structure" (Borg, 1999).

Early studies of the then-new technology of GSS (group support systems) had taken an object-centred view, where the object being studied was GSS and the study was of the outcomes of GSS use. In order to understand the often conflicting research results, researchers such as Gopal et al changed to a social-actor-centred view, where the objects of research were the people and processes involved in use of GSS. Rather than study the technology itself, researchers studied the use of technology by members of a social system (Gopal et al., 1992-1993).

There may be misalignments between users and technology; allowing and encouraging mutual adaptation may be more effective than forcing changes onto users. "As Leonard-Barton (1988) notes [in (Scott et al., 1998)] user participation in altering a technology can be an important influence on user satisfaction." AST, as described in Poole and DeSanctis (1990, 1992) and DeSanctis & Poole (1994), cited in Scott et al, has provided a useful model for understanding how new technologies are used and adapted in both expected and unexpected ways. The use and adaptation may have positive or negative outcomes. Effective change management will help guide the changes in a positive direction. First, however, we must understand the process of this re-invention and structuration. AST builds a model of the process. My own research extends the AST model to web-based information systems.

In considering success in terms of user satisfaction, technology transfer (that is, implementation of new technology within an organisation) depends on both the process of technology transfer and the characteristics of the technology itself (Leonard-Barton & Sinha, 1993). AST models the process of technology transfer. My research extends the AST model so that it is applicable to the transfer of website and e-commerce technology into an organisation.

Planned organisational change programs are rarely successful if they are directed at only one of the components (strategic, social, and technical) of the organisation (Worren et al., 1999). AST considers at least two of these components, social and technical: The AST model describes the way in which individuals and groups adapt and appropriate technology, to suit their own requirements (Nagasundaram & Bostrom, 1994/1995).

As cited in Chudoba (1999), Poole and DeSanctis proposed AST, in part, to help explain the lack of consistency in GSS research. In order to identify and understand how groups may use the same technology in different ways, they argue the need to explore the physical and social contexts leading to particular patterns of use (Chudoba, 1999).

"Adaptive Structuration Theory (AST) is rapidly becoming an influential theoretical perspective in research on advanced information technologies. However, there still exists a paucity of methods to capture critical AST constructs" (Chin, Gopal, & Salisbury, 1997). Chin et al develop one such method. That method, however, is based on an AST model that is not suited to use with e-commerce technologies: the model has simply not yet been extended to match the context of e-commerce technology.

If AST is to be used to support management of e-commerce implementation it must first be extended into the e-commerce context. That is the purpose and result of my research.

3.3 AST: Basic Constructs and Concepts

The aim of my doctoral research has been to extend the AST model so that is applicable to the new technologies of websites and e-commerce. Where possible I have used the original – and generally accepted – model as is, with changes only where necessary.

In Burt's terms – where he draws change management ideas from the field of biology – my changes to the AST model are epigenetic: "Epigenesis implies discontinuity, but where the old contains the seed of the new" (Burt, 2003). I have not rejected the original model – I have not made a paradigmatic change – in order to substitute my own. Nor have I made incremental changes – I have not simply refined or improved minor points. Using the pre-e-commerce model as a basis, I have built a new model that is relevant to current technology.

This section describes the pre-e-commerce AST model that underlies my extended model. In subsequent thesis sections I clearly distinguish the extensions that I have made to the model.

AST, adaptive structuration theory, deals with structuration, or, the ways in which users adopt and adapt structures. Poole and DeSanctis, as cited in (Gopal et al., 1992-1993) explain structures: "A system is a social entity such as a group, pursuing various practices that give rise to observable patterns of relations, such as the pecking order often seen in groups or organizations. Structures are the rules and resources actors use to generate and support this system."

In comparing AST with Giddens' structuration theory, it is important to note that structures are the "rules and resources" and not physical entities. Structures considered within the AST model have, to now, been: technology, task, work group and organisational environment (DeSanctis & Poole, 1994) cited in (Majchrzak, Rice, Malhotra et al., 2000). Of these, task, work group and organisational environment operate by rules and use resources. Rules may be added, changed or ignored by the people within the organisation. Resources also may be used or not. Technology, however, is relatively fixed. If the technology is an information system, for example, the rules of its operation are built in; they may only be changed by someone who is both competent and authorised to make changes. The rules may be used in unexpected ways but they are difficult for users to change. Because of this relative inflexibility, technology is not a true structure in the sense of Giddens' structuration theory.

Although, following Hirschheim (1985) it may be argued that 'IS are social systems that rely increasingly on computer-based IT for their operation', there still remains a stubbornly material aspect of technology which sits uneasily with Giddens's insistence on structure being 'traces in the mind' instantiated only through action. (Currie & Galliers, 1999) (p.118)

It may be possible to define technology in terms that allow it to be treated as a true (in Giddens' sense) structure. This could be the subject of subsequent research. For now, however, the accepted usage of AST will be used, with technology being considered as one of the structures that is subject to user appropriation.

Technology has two key elements, features and spirit. Scott et al distinguish these as follows:

The structural features of a technology are rules, resources, and capabilities a system can provide (DeSanctis & Poole, 1994). Examples of structural features for GDSSs [group decision support systems] are anonymous submission of comments, voting tools, parallel input of ideas, and automatic record keeping. Spirit is a property of a technology and refers to 'the general intent with regard to values and goals underlying a given set of structural features' (DeSanctis & Poole, 1994, p. 126). The spirit reflects designers' intentions, users' interpretations, and other stakeholders' perceptions of how the technology is to be used. (Scott et al., 1998)

Curiously, AST research has so far considered this dichotomy of spirit and features only for the technology structure. For the purposes of this current research I have maintained that restriction. The next paragraph, however, briefly describes some interesting aspects of future research that could consider the effect of the two elements on structures other than technology.

Consider, for example, the work group structure. The features of the work group include the ways in which it operates, the processes that it follows and the outcomes that it generates. The spirit of the work group includes the intent of the organisation that created it, as interpreted by the people within the work group. If the interpretation of the people within the work group is at odds with the intent of the organisation then there will be potential for conflict. Work group outcomes could be satisfactory for the work group yet not satisfactory for the organisation. This appears to offer a valuable model for some forms of organisational conflict.

As stated above, this research will follow the so-far-standard approach of considering spirit only for the technology structure.

The technology structure is appropriated (adapted and adopted) by its users. AST defines three dimensions of appropriation: faithfulness, users' attitudes toward the structure, and the group's level of consensus on the appropriation (Gopal et al., 1992-1993). Faithfulness refers to the matching of appropriation to the original spirit of the technology. If the appropriation is at odds with the spirit then it is said to be "ironic". Attitudes include user levels of comfort and respect for the technology. Consensus is the degree to which individual users agree with the group level of appropriation.

The basic pattern of adaptation (in the pre-e-commerce AST model) is shown in *Figure 4 Interaction of structural adaptations*.

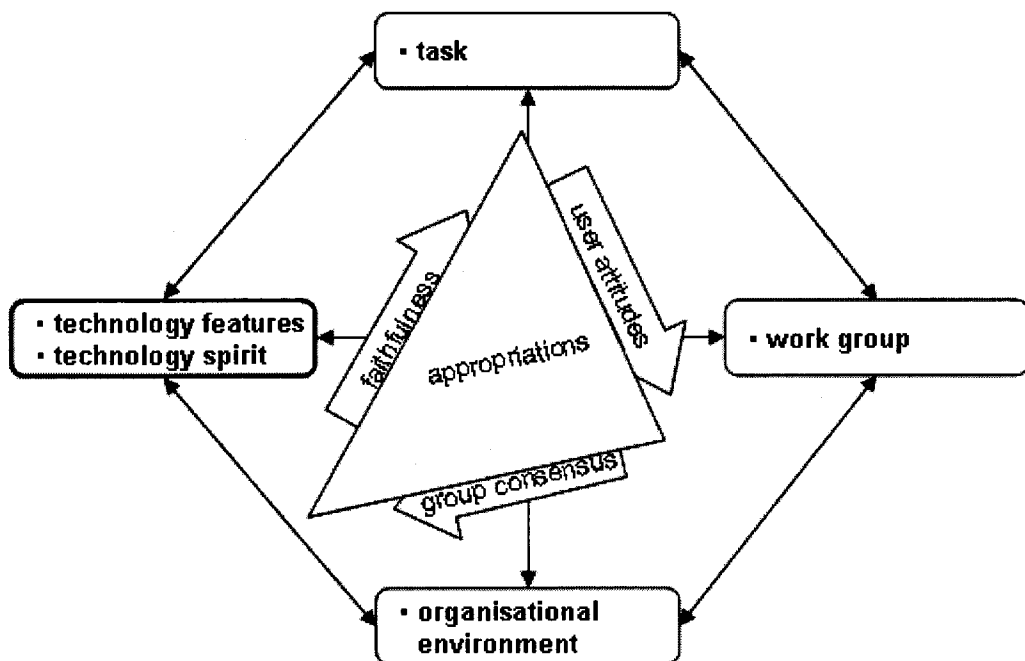


Figure 4 Interaction of structural adaptations

Source: author's representation of work by various others

Technology – or information system – implementation plans may anticipate that users will accept the new technology and use it in expected ways. Efforts may be made to raise levels of user acceptance, with the expectation that this will lead to completely faithful use of the technology. AST recognises that users may appropriate the whole or selected parts of the technology in faithful or ironic ways. The new technology may be in use but in a fashion that is against the original intent. AST provides a model to accept and anticipate this complex source of implementation conflict. An improved model of the change process will allow for more effective change management of technology implementation.

AST models the complex interactions of technology and its users. It includes the concept of mutual adaptation: the users may adapt to the new technology, the technology may also be adapted to suit the users. This process of mutual adaptation is important to technology implementation.

Effective internal technology transfer ... depends not only upon the cost, quality, and compatibility of the technology, but also upon ... user involvement in development and adaptation by the developers and users of both the technical system itself and the workplace... Mutual adaptation can push both the new technical system and the work process to new heights of performance. (Leonard-Barton & Sinha, 1993)

This mutual adaptation will occur; clear understanding of the process of mutual adaptation will support more effective change management.

AST reminds us that technology implementation is not an instantaneous process: adaptation will continue to occur after implementation is apparently complete. Leonard-Barton & Sinha suggest that user involvement will improve the process of technology transfer. Provisions for subsequent mutual adaptation, however, are also likely to result in a better result in terms of improved production output.

3.4 Current Limitations of AST and Change Management

Change management includes a wide range of intervention strategies, including development of information systems. Change management is often integrated with OD (organisational development) initiatives, strategy, business processes, and technology. For example, a change management initiative may aim to create a higher degree of congruence between strategic objectives and new information systems. "Change Management is based on two concepts: That human performance is at the core of business performance; therefore we help clients build the human performance in their organizations" (Worren et al., 1999).

When change management is applied to implementation of a new information system, it is essential that we first understand the likely impact of the new system on human performance. If, for example, human members of the organisation appropriate the technology in ironic ways, the results may be unexpected. AST provides a model to help understand the interaction of users and technology. In this way, AST supports change management. AST, however, does not yet provide a complete model of technology implementation when the new technology is a web-based information system.

AST research has, to now, studied information systems that are largely internal to a single organisation. One AST paper, for example, reports on research involving a GSS (group support system): "Given certain input conditions such as technology and contextual factors, groups create and experience the use process, which is characterized by their modes of appropriation, and in turn leads to certain outcomes, the predictability of which is based on the stability of appropriation" (Gopal et al., 1992-1993). There is no indication that each group is other than within a single organisation. That is, the situation under study involves one technology, one group, possibly one task and a single organisation.

At least one key paper has dealt with AST and a virtual team, where the team (or work group) has members drawn from more than one organisation. The team is described as, "inter-organizational and virtual" (Malhotra, Majchrzak, Carman, & Lott, 2001). This virtual team is used to test and refine the AST model in a separate paper (Majchrzak, Rice, Malhotra et al., 2000). Nevertheless, that paper describes a team with primary reporting responsibility within a single organisation. That is, team members are drawn from several organisations yet the team itself appears to report within a single organisation on progress on its assigned task.

An information system for e-commerce, however, must involve more than one organisation. The underlying concept of e-commerce is, to allow several organisations to interact through a common information system. Each organisation may vary the interface to the common system but the basic concepts and processes of the system are common.

The current AST model deals with several structures: technology, task, work group and organisational environment. An e-commerce system will include at least two tasks, buying and selling. There will be at least two organisations, since buying and selling are (in general) done between two separate organisations. Each organisation may have separate work groups for buying and selling, each group will deal with separate aspects of the e-commerce system and with different groups of organisational partners.

There is a further complication associated with an e-commerce system: The system may allow interaction with suppliers and customers who are not organisations. That is, the system may allow the organisation to buy from and sell to individuals outside the organisation. These individuals are not organisations, they are not a part of a work group. They may, however, have a task to perform, although the task may be relatively short-term, informal and possibly non-repeating.

The current AST model deals only with technology, task and work group within a single organisation. It has not been tested against the more complex environment of websites and e-commerce; it is difficult to see how the model could be applied as is.

To provide guidance for the implementation of an e-commerce system, the current AST model needs to be extended. The model must cater for multiple work groups, tasks, organisations and individuals. My current research extends the AST model to suit the more complex context of e-commerce.

There is published support for further research into AST. For example: "It is suggested that further research is undertaken into the 'adaptive structuration' theory" (Kim, 2000). And in a personal email, as I was beginning my research into AST:

I very much like the idea of applying AST to web technology. This is an application that hasn't been done yet so I encourage you to pursue it. ... Instead, your contribution can go in one of two ways: 1) you can decide to extend our current understanding of AST to improve upon it. ... 2) An alternative contribution is to argue that your technology and adapter group is fundamentally different than either GDSS or CT or hospital scanners or Lotus notes (which are the previous applications used with AST). (Majchrzak, 2002)

My DBA research thesis applies AST to web technology. I do some work to, "extend our current understanding of AST", largely through rationalisation of some aspects of the theory. A large part of this thesis, "is to argue that your [Web and e-commerce] technology and adapter group is fundamentally different". In addition to that, I also extend and apply two other areas of the model, to suit web-based technologies.

4 Objectives of the Research Project

Many organisations implement an information system to enable e-commerce. Implementation of e-commerce, as with implementation of any new technology, requires effective change management; if the change is poorly managed, the new system may result in conflict and confusion rather than improved processes and increased productivity. In order to manage the change, the potential impacts and user responses should be clearly understood.

AST, adaptive structuration theory, provides a valuable model of the impacts and user responses to implementation of new technology. AST, however, has so far only been tested and built with reference to systems within a single organisation. AST – prior to my research – had value in its explanations related to information systems of limited scope and impact. It needed to be extended, to cater for the increased complexity of multi-organisational e-commerce systems.

My key research objective was, to extend the AST model to make it relevant to e-commerce.

As a student in the first cohort of the university's new DBA(IS) professional research doctorate, I had a further problem: what are the requirements of a DBA thesis? The marketing and background material for the DBA clearly distinguishes it from a PhD, with a different target market and different intended outcomes to suit the target market. Yet the only guidelines for a DBA thesis are, it should be half as long as a PhD thesis.

My own background is as a manager and a professional; I am typical of the targeted DBA student. To satisfy the DBA intent I needed a research methodology with relevance to my professional career. It should also – I believe – draw on the knowledge and experience of the student, to bring the benefits of that knowledge into the academic arena.

This led to a second major research objective, to define a research methodology to suit the requirements of a professional doctorate.

4.1 Research Question and Challenges

Research Challenge 1: Develop and define a research methodology that is suited to the unique requirements of the DBA, as a professional doctorate.

Research Question: How must adaptive structuration theory (AST) be extended in order for it to be applicable to the multi-organisational scope of Web-based e-commerce information systems?

Research Challenge 2: Outline the ways in which the new model will support change management initiatives for e-commerce implementation, by showing how the extended model could predict the pattern of changes resulting from implementation of an e-commerce information system.

4.2 Reason for the Research

Web-based information systems are in common use and their use is increasing. The Web allows efficient electronic communication between organisations that are connected only as, for example, suppliers and customers. The Web also allows electronic communication between an organisation and external individuals.

A common use of the Web is for electronic commercial trading, or "e-commerce". That is, a Web-based system allows commercial transactions to be enacted through electronic means of communication. For many organisations and for many groups and individuals, e-commerce is a new form of technology. Groups, individuals and organisations will need to adapt to this new technology.

AST (adaptive structuration theory) models the process of adaptation to new technology. By understanding the process of adaptation, an organisation may improve the implementation of new technology: The adaptation process will be better understood and the change management process will, therefore, be more effective.

My own research identified a gap in the existing AST: it did not cater for multi-organisational information systems such as websites and e-commerce. This left a gap in our understanding of the implementation challenges for an increasingly common form of information system. In order to improve the effectiveness of our management of the change to an e-commerce system, we must first understand the process of adaptation that is likely to occur.

AST needed to be extended to include the context in which a new e-commerce system will be implemented. Extension of the AST model, to apply it to websites and e-commerce, was the reason for this research project. The research context – that the research is a part of a DBA, a "professional" doctorate – indicated that the results should have academic value and also provide value for management and professional practitioners.

4.3 Value of the Research

Implementation of an e-commerce information system is a current challenge for many organisations. The new system will consume organisational resources in its development, implementation and operation. Effective change management will increase the probability that the new system will prove to be a worthwhile investment, but the change management process must be based on a sound understanding of the possible change processes.

By improving our understanding of the process of change as a new website or e-commerce system is implemented, this research has provided practical value for organisations planning a move into e-commerce.

AST (adaptive structuration theory) has been the subject of research for over a decade. As an explanation of the process of adaptation of new technology, AST has (as described above) demonstrated its worth. The new technologies of the Web have introduced e-commerce as a common and achievable goal for many organisations, yet AST did not – prior to my own research – apply to the multi-organisational context of e-commerce.

An extension of the AST model to e-commerce brings AST into line with current technology. This has updated and maintained the value of the theory. My research has provided academic value by making the AST model relevant to current, common information systems that are based on the new technologies of the Web. It has provided professional value by developing a model that will support effective change management of the implementation of modern, web-based information systems.

4.4 Related Topics for Research

There are a number of related topics for further research. These have been introduced briefly above and are described below.

Technology as a "Giddens" Structure

In Giddens' structuration theory, structures are the "rules and resources actors use to generate and support this system" (DeSanctis & Poole, 1994) cited in (Majchrzak, Rice, Malhotra et al., 2000). By this definition structures are not physical entities. Technology, however, is relatively fixed and physical. If the technology is an information system, for example, the rules of its operation are built in; they may only be changed by someone who is both competent and authorised to make changes. The rules may be used in unexpected ways but the rules themselves are difficult for users to change.

Because of its inflexibility – its physical nature – technology is not a true structure in the sense of Giddens' structuration theory. Future research is possible, to define technology in terms that allow it to be treated as a true (in Giddens' sense) structure. This will allow AST to be generalised, with structuration and appropriation applied equally and in the same fashion, to each of the structures that are a part of the model.

This research would align AST (adaptive structuration theory, dealing with the impact of new technology) with the larger body of theory based on Giddens' structuration theory.

Spirit of the Non-Technology Structures

The technology structure has two key elements, features and spirit.

The structural features of a technology are rules, resources, and capabilities a system can provide (DeSanctis & Poole, 1994). Spirit is a property of a technology and refers to 'the general intent with regard to values and goals underlying a given set of structural features' (DeSanctis & Poole, 1994, p. 126). The spirit reflects designers' intentions, users' interpretations, and other stakeholders' perceptions of how the technology is to be used. (Scott et al., 1998)

So far, AST research has considered this dichotomy of spirit and features only for the technology structure. For the purposes of this current research I have maintained that restriction. Future research, however, could consider the impact on our understanding of organisations if every structure were considered to consist of both features and spirit.

It seems reasonable to consider that an *organisation* has a spirit, a general intent with regard to values and goals, an intent that reflects (for example) owners' intentions, managers' interpretations and customers' perceptions. This may be prove to be related to the organisational culture. Similarly, the work group and task structures could also have spirit as well as features. Understanding the concept of spirit and features could shed light on several areas of organisational activity.

Consider, for example, the "work group" structure. The features of the work group include the ways in which it operates, the processes that it follows and the outcomes that it generates. The spirit of the work group includes the intent of the organisation that created it, as interpreted by the people within the work group. If the interpretation of the people within the work group is at odds with the intent of the organisation then there will be potential for conflict. Work group outcomes could be satisfactory for the work group yet not satisfactory for the organisation.

Research into the spirit of non-technology structures would provide a deeper understanding of the impact of new technology on other related structures. The current AST model considers only the features, the visible aspects, of non-technology structures. Extending the model to include spirit of all structures would give a deeper understanding of the underlying actions and perhaps motivations of the actors, that is, of the people involved in the structures.

Validation of the Extended AST Model

As described in the next section, this research project has used logical analysis ("critical insight") in order to extend the AST model. The intent is to open up a new (and useful) area for development and application of adaptive structuration theory. The new model is logically consistent and demonstrably reasonable. It has not yet, however, been supported by extensive testing in the field; the current research project has been tightly constrained to fit within the scope of a DBA research thesis.

This leaves room for future research in order to validate the extended model. The model consists of a number of dimensions, each of which may be separately tested. A series of research projects could test each of the dimensions of the model. These projects would provide valuable validation of the new and extended model of AST.

The model developed by this research project is valuable as theory and relevant to practice. It could, however, benefit from further validation by testing in the field.

5 Plan of the Research Project

5.1 Research Paradigm

This section describes the underlying paradigm of my DBA research. The explanation is drawn from concepts presented in the 1981 paper by Guba, in which the "naturalistic" paradigm is explained, largely in terms of its difference from the "rationalistic" paradigm (Guba, 1981). Ideas, explanations and direct quotes are all drawn from Guba's paper.

In Guba's terms my research paradigm is *naturalistic*.

Both rationalistic and naturalistic paradigms have been used to support disciplined enquiry. Neither paradigm is better than the other, each is more or less suited to a given context. The two each rest on a number of key assumptions: Rationalism assumes a single reality and that research will converge on that reality. Naturalism assumes multiple realities and that research may diverge as more "truth" is discovered. Rationalism assumes that truth is absolute and context free; naturalism assumes that generalisations are not possible, that a "working hypothesis" is all that one can hope for.

In my own research, the key subject is e-commerce within business. Businesses vary enormously, as each strives to gain a unique, competitive advantage within its own market. I am seeking no absolute truth, rather, I am looking to build a working model that will be of use to businesses as they work with the new information technologies. This is clearly within the naturalistic paradigm.

"Rationalistic practitioners have preferred quantitative methods while naturalistic practitioners have preferred qualitative methods." This is a preference but not an absolute criterion, nevertheless, my own research paradigm does show a preference for qualitative methods. That is, the research method is qualitative.

Rationalistic approaches require the statement of hypotheses or questions in advance; research will then prove or disprove the hypotheses or answer the questions. The naturalistic approach prefers to build theory on the emerging data, with little or no requirement for predetermined expectations. My own research begins with a clearly stated theory but the intent is to develop an extension to that theory. At the start of the research there was no expectation of the final result, the model emerged from the analysis which formed the bulk of the research project.

Rationalistic research methods are based on *explicit* knowledge, or propositional knowledge: knowledge that can be clearly stated. Naturalistic researchers are more interested in *tacit* knowledge, knowledge such as intuition and feelings that is known but that cannot be stated in the form of language. My own research is drawn almost entirely from tacit knowledge, from the experience, knowledge and understanding of myself, the researcher.

Whichever paradigm is chosen, there are four general measures that indicate the value of the research findings: truth value, applicability, consistency and neutrality. Rationalistic researchers describe these "trustworthiness" measures in terms of: internal validity, external validity, reliability and objectivity. The naturalistic paradigm has a different view of reality and reliability, the naturalistic measures of trustworthiness are also different to those which are expected in rationalistic research.

The naturalistic measures of trustworthiness are explained in a section following the description of the research methodology. That same section explains the ways in which trustworthiness has been maintained in my own DBA research.

5.2 Research Methodology

The research methodology described in this section was formally documented, reviewed and accepted in my paper presented at and published in the proceedings of the IRMA 2004 Conference (Lethbridge, 2004). Some changes have been made as a result of feedback received after presentation of that paper.

Abstract

The DBA is a professional doctorate. PhD students are learning academic research skills and may have little or no management or professional experience, whereas DBA students are expected to be senior managers or experienced professionals. This section of my thesis presents a research methodology, currently labelled "Critical Insight", that specifically draws on the experience of the DBA student in order to build new theory. The bulk of the research effort is theory development, drawing heavily on the knowledge, understanding and analytical ability of the student. This methodology allows professional experience to be formally incorporated into the academic body of knowledge, through DBA research.

Introduction

The DBA (Doctorate of Business Administration) is a "professional" doctorate. From the aims and objectives of my own DBA: "Participants will identify and conduct a piece of excellent research to suit their interests and needs" (ECU, 2003). The DBA supports the interests and needs of managers rather than academics and it supports those needs through research that is more "applied" than that of the traditional PhD: "For the research component, participants develop unique and valuable *expertise* in an area of their choice" (Anonymous, 2004), my emphasis added. The DBA student is seeking expertise rather than simply knowledge.

PhD research may be seen as training for future research. A PhD student is at the start of a career, with little or no practical experience, learning to learn. The DBA student, on the other hand, is expected to be an experienced professional. The DBA targets senior managers and professionals who wish to extend their knowledge through study and research. Where a PhD student is expected to begin with little or no field experience, the DBA student may already have many years of experience in the field being studied.

DBA research should suit the needs and build the expertise of the researcher, that is, the manager or professional. At the same time, since a DBA is a high-level academic qualification, the research must support academic goals, such as gaining and documenting new knowledge.

The DBA student has a wealth of practical experience, business understanding and applied knowledge. Rather than forcing the DBA student back to the level of a relatively inexperienced PhD student, DBA research should encourage use of existing knowledge. By drawing on and interpreting the accumulated experience of the DBA student, new insights may be gained.

The following diagram (*Figure 5 Why is a DBA Different?*) summarises the differences between a DBA and a PhD. The diagram is a slide drawn from the original presentation of this material at the IRMA 2004 international conference.

Why is a DBA Different?

- **PhD – training for future research**
 - researcher has little experience, is at start of career, learning to learn
- **DBA – targets senior managers**
 - researcher is experienced professional, building on practical knowledge
 - looks for "applied" research
- **Both are academic qualifications**

Slide 2

Figure 5 Why is a DBA Different?

Source: author's research

The professional doctorate encourages experienced managers and professionals to work with academia, thus providing access to a new source of practical knowledge. This section of my thesis presents a research methodology that draws maximum academic benefit from the new resources of students of the professional doctorate.

A Sample of DBAs

In Australia, DBA courses appear to have been developed in response to a 1990 Australian Higher Education Council recommendation that universities should "augment traditional doctoral programs ... by introducing ... professional doctoral degrees which require advanced application of existing knowledge and technology in professional fields" (Spear, 1997). A key phrase here is, *advanced application of existing knowledge*.

The ECU postgraduate handbooks – from each year of my enrolment – state, "For the [DBA(IS)] research component, participants develop unique and valuable expertise in an area of their choice" (Anonymous, 2001, 2003, 2004). The 1999 Curriculum, Teaching and Learning Committee Executive minutes refer to the proposal for a professional doctorate – the DBA(IS) – that would, "offer the opportunity for senior business managers to enhance their managerial effectiveness through broadening their knowledge of information management and strategies for effective exploitation of on-line information systems" (Walmsley, 1999). Again, the emphasis is on effectiveness and exploitation – the practical application of knowledge.

Monash University states that their DBA, "is ideal for students who wish to research their area of expertise in depth, but who do not wish to do this using the methodology of a single research topic" (MonashU, 2003) (p.62). Where a PhD student may focus on a narrow area, the DBA student is encouraged to work on a broader – more applicable – level. The University of Western Sydney DBA program, "is different from that of the PhD... [DBA research] will involve original fieldwork in industry and will need to demonstrate a convincing level of original analysis and interpretation" (UWS, 2003). At UNSW the focus is again on industry, with an emphasis on analysis and interpretation.

Hong Kong Polytechnic University (HKPU) states in its DBA philosophy: "Reflecting the professional practice nature of the programme and the academic input, the participant will be required to apply relevant theory to the problem, and perhaps, as a result, develop that theory" (HKPU, 2002). Here the university has clearly stated a preference for solution of a problem – *application* of knowledge – rather than simply knowledge for its own sake. The University of South Australia appears to support this distinction between development and application of theory: "The DBA program presents significant differences from the traditional higher research degree, the Doctorate of Philosophy (PhD)... The focus of the DBA is on generating knowledge which contributes to practice and/or policy" (UniSA, 2001).

In the United Kingdom, the Association of Business Schools (ABS) has developed guidelines which distinguish various aspects of the DBA from the PhD (ABS, 2004). The basis of the ABS report is, that a DBA and a PhD are different: "The DBA is primarily designed to enable a significant contribution to the enhancement of professional practice in the business area through the application and development of theoretical frameworks. This may be contrasted to the PhD which places more emphasis on the development of new knowledge and theoretical perspectives."

The research methodology used in my own DBA research emphasises the development of the AST (adaptive structuration theory) framework, with an overall emphasis on potential application of the extended AST model to professional practice. I bring practice-based insight and analysis to the extension of adaptive structuration theory.

Reason for Examining Various DBAs

This research thesis is the result of my own DBA research. Assessment for the DBA(IS) (ECU, 2003) consists of coursework plus a research project. I have completed the coursework, with an average Distinction mark. For the research project I looked for guidelines – but with little success. Only one DBA-centric guideline was available – that the thesis should be 50,000 words or less – and that was only documented in 2004.

The DBA is reportedly different from a PhD, yet there were no clear guidelines to distinguish DBA research from PhD research. The DBA includes coursework, so the thesis is expected to be only half as long as a PhD thesis. The DBA draws students with different skills, different educational requirements, different expectations. Yet every indication was – by the very lack of any indication – that a DBA research project would be exactly the same as a PhD project.

Faced with the requirement to design a DBA research project, armed with a wish to do doctoral level academic research that would benefit my own professional work, I was not willing to simply accept that I was enrolled in a mini-PhD. I developed a research project and methodology that reflect both my own interests and the stated intent, that the DBA program is a doctoral course that provides unique value for experienced managers and professionals.

Overview of the Methodology

This section of the thesis presents a research methodology to support requirements of the professional doctoral student. The methodology draws on the knowledge and experience of the student who is a senior manager or professional. It provides a means to bring that existing, applied knowledge from the student's experience into the more carefully controlled sphere of academic knowledge. In order to encourage a higher level of academic rigour, the new knowledge is then tested against other situations. As a working title, I refer to the methodology as *Critical Insight*.

The Critical Insight methodology supports a number of clearly defined objectives:

- The professional DBA is different from an academic PhD; the research methodology must support this difference
- DBA students already have a high level of professional and management knowledge and experience; this should be used to support the research project
- The DBA research project should encourage advanced application of existing knowledge held by the researcher
- As a result of the project, the researcher will develop unique and valuable expertise
- The research will contribute knowledge in support of practice and policy.

The Critical Insight methodology uses the researcher's prior knowledge and experience at an early stage of the research, as an essential component in the development of new theory. The research begins with a standard proposal, including the "literature review" which initiates most research projects. The researcher evaluates existing literature within the intended area of study. This is followed by research within the Critical Insight methodology.

Stage 1: Apply Knowledge and Experience to Extend the Theory: This is the key aspect of Critical Insight: it is the deliberate incorporation of the researcher's own professional knowledge and understanding into a doctoral research project. Any research project may use existing data, this methodology uses *insights* from the researcher's own professional experience. The insights may be irreplaceable and unrepeatably and this gives them a unique value: they are from a professional source that may be unavailable to any other researcher.

Knowledge gained through professional experience has value in understanding and extending theory. These insights must, however, be treated carefully and supported as far as possible by existing theory and by clear logic. The "Insight" stage of the methodology combines existing theory from the literature with logical analysis and professional knowledge, in order to develop new theory. This is shown in *Figure 6 Develop the New Theory*, below.

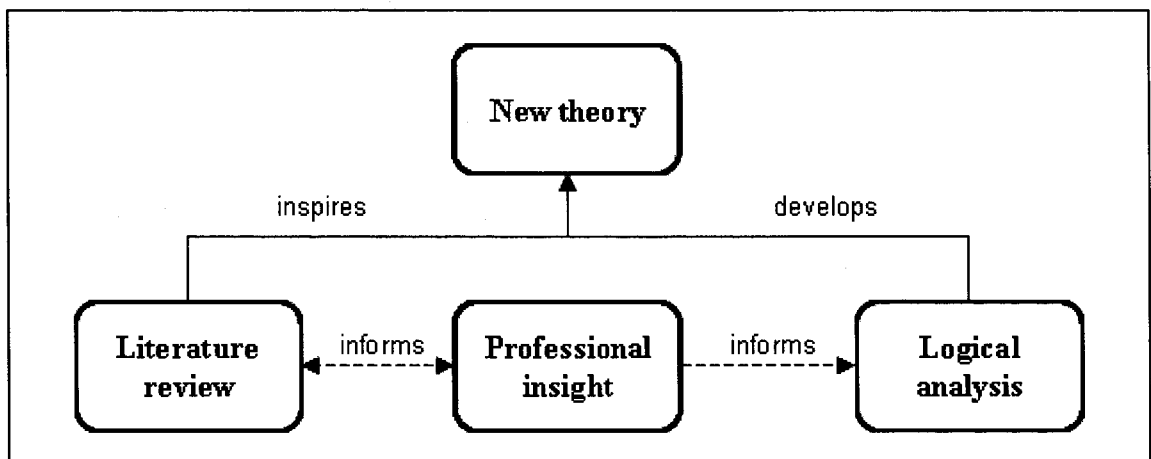


Figure 6 Develop the New Theory

Source: author's research

At this stage of the methodology, a key point is the source of the new theory. The researcher uses literature review, professional insight and logical analysis to *inspire* and *develop* new theory. This is the point at which the student's professional experience, knowledge and understanding is brought into the academic research environment; this stage is the primary means by which Critical Insight is able to bring industry knowledge into the academic arena.

The professional manager – the DBA student – has a depth of industry experience that is both unique and uniquely available to the DBA researcher. This experience is logically combined with published theory, to provide new theory that is soundly based in both theory and practice.

At the end of this stage, new theory has been inspired and developed. Stage 1 is the equivalent of an in depth case study of several organisations, as viewed and interpreted by a single manager or professional. The new theory will have been developed and presented in a logical fashion – and it should be a theory with value in a practical, business situation – but there is no data-based proof that the theory is "true". Stage 2 will add weight to the possibility that the theory is true.

Stage 2: Critically Evaluate the New Theory: New theory has been developed by combining existing professional knowledge and experience with existing theory. These research findings will then be tested by application of the new theory to a new situation, with critical evaluation of the strength of the new theory. See *Figure 7 Validate the New Theory*, below.

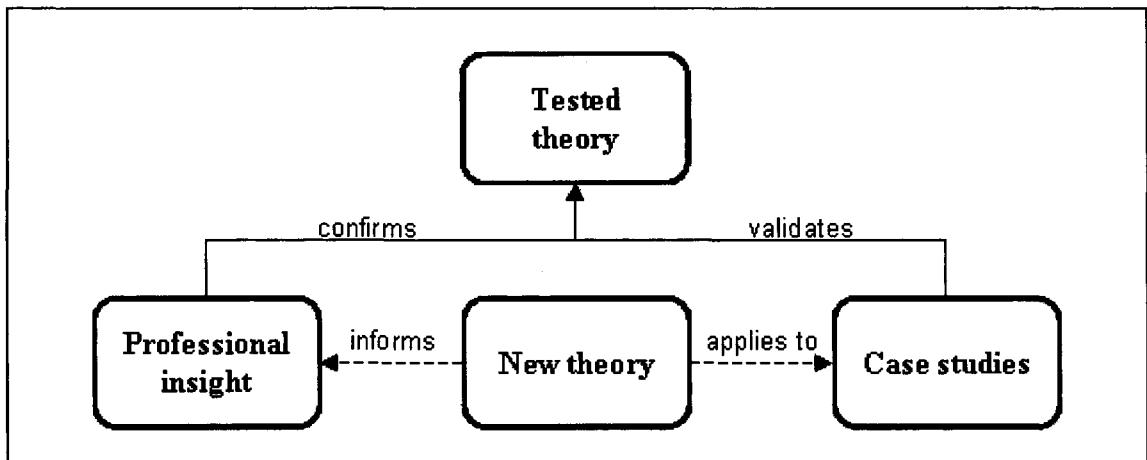


Figure 7 Validate the New Theory

Source: author's research

The new theory (developed in Stage 1 of the Critical Insight methodology) is tested against case studies. Case studies may be drawn from literature or they may be documented specifically for the current research. Previously published case studies have the benefit of being general, rather than tailored to the new theory; this will provide a stronger argument of validity. Tailored case studies may be a better match to the new theory, more and more relevant data may be available. On the other hand, tailored case studies may include bias towards the researcher's own, new theory.

The new theory is applied to case studies in order to validate the theory. At the same time, the researcher uses professional insight – knowledge and understanding accumulated from actual industry experience – in order to confirm that the theory is reasonable. In most instances, professional insight will be used to add depth to the application of the new theory to case studies.

At the end of Stage 2 of the Critical Insight research methodology, new theory has been developed and tested. Due to the nature of the research – and the DBA researcher – the test is in the form of a reasonableness or reality test: it is intended to demonstrate that the new theory is a strong contender for explaining the given situation. The theory is useful and, in certain situations, valid. There is no proof that the new theory is either universally true, or, the only explanation of the research situation.

Both stages of the Critical Insight methodology emphasise the unique qualifications of the DBA researcher: the DBA student already has a wealth of professional knowledge, experience and understanding. A key aim of the methodology is to capture that experience, to take advantage of that unique source of knowledge in order to merge professional insight with academic theory.

The research project will build strong new academic theory that is both based on and applicable to the professional environment of the working DBA student. Applicability and relevance are key aims of the Critical Insight methodology; "absolute proof" is less important than usefulness. This supports the key aims of the DBA, as quoted earlier.

The DBA (Doctorate of Business Administration) is a "professional" doctorate. "Participants will identify and conduct a piece of excellent research to suit their interests and needs" (ECU, 2003). The DBA targets students who are still active in a professional or management career; their interests and needs are likely to be relevant to that career. "For the research component, participants develop unique and valuable expertise in an area of their choice" (Anonymous, 2004). The outcome of the methodology is theory that is also applicable in practice – theory that provides the student with unique and valuable *expertise* in an area of industry that is relevant to their continuing career.

Application of the Methodology

The Critical Insight methodology has been developed for initial use in my own DBA research. With more than 20 years of professional experience, I am keen to apply my existing knowledge (Spear, 1997), to exploit my aptitudes (Eisner, 1997), and to do excellent research that will suit my needs (ECU, 2003). Existing methodologies seemed to lack, in particular, the formal inclusion of existing knowledge gained through my own professional experience.

None of the standard PhD methodologies appeared to suit my own research requirements. Many methodologies emphasise a form of "scientific detachment": The researcher as external observer and analyst. As a professional, in a DBA course, I expect to use as much as possible of my own experience in the development of new theory. Reflective methodologies appear to use personal experience as the basis for a thesis yet with little requirement to analyse and apply what was documented.

Almost all methodologies assume that the researcher will base research on new observations that are gained for that particular research project. For a while I considered Grounded Theory, with its emphasis on analysis of data with no preconceived theories. Yet the insights that I have gained through experience are largely undocumented and fragmented: It would be difficult to use them as the basis for the rigorous use of Grounded Theory methods.

A standard hypothesis-testing methodology seemed suitable: I intended to develop a theory, or hypothesis, and then test the validity of that theory. Yet the standard approach is to develop the hypothesis at a very early stage of the research, as a part of the research proposal, after a literature review. In these methodologies, the hypothesis is generated by the identification of a gap in existing theory, there need be no expectation of whether it will prove true or false. For my own research, I intended to develop a "plausible" hypothesis: One backed by sufficient logic and analysis to build an initial expectation that it will be true. Further tests of the theory would be, as it were, "icing on the cake".

The Critical Insight research methodology has been developed to suit all of my requirements. First, it uses logical analysis to combine existing literature with the researcher's own insights based on experience. The result is a new theory or, in my own case, a major extension to existing theory. This stage is the crux of the methodology: It allows the researcher to bring professional and managerial knowledge into academic research. The result of this stage will be a logical and convincing argument that builds and presents some new aspect of theory. The new theory will combine the benefits of academic literature with the reality of practical experience.

The second stage of research then tests and confirms the new theory. In a typical PhD research methodology, formulating the hypothesis is relatively simple, the bulk of the effort goes into testing the truth or trustworthiness of that hypothesis. Critical Insight places the bulk of the research effort into development of the initial theory or hypothesis. The second stage is then a relatively simple validation of the theory using a "new" set of data.

The resultant new theory has been tested and, in a limited fashion, validated. In my own research I have developed a model of the structural changes due to implementation of an e-commerce information system. In follow-up research – beyond the scope of this DBA – each part of the model could be separately tested and validated, using standard hypothesis testing methodologies that would be well suited to a series of interrelated PhD research projects.

Validation of the Methodology

My own DBA research may be classified as interpretive field study, with the field study drawn from my own experience. "Interpretive methods of research in IS are 'aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context' (Walsham 1993, pp. 4-5)" in (Klein & Myers, 1999). My DBA research has extended the previous model of Adaptive Structuration Theory (AST) that is presented by Majchrzak et al (Majchrzak, Rice, Malhotra et al., 2000). AST emphasises mutual adaptation in the implementation of an information system, that is, the way in which the system adapts to (is influenced by) its organisational environment (the context) and vice versa.

Klein and Myers propose seven research principles for interpretive field studies (Klein & Myers, 1999). In this section, each of these principles is briefly discussed with respect to the Critical Insight methodology. The principles and quotations defining them are from Klein and Myers.

The Hermeneutic Circle: "[W]e come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships." Critical Insight combines theory with existing knowledge. In its worst case, this knowledge may be seen as preconceptions rather than research data. My methodology uses these preconceptions to build better theory. The second stage strengthens the new theory by testing it against new data.

Contextualization "is based on Gadamer's insight that there is an inevitable difference in understanding between the interpreter and the author of a text that is created by the historical distance between them (Gadamer 1976b, p. 133)." The use of the researcher's own professional experience will reduce the "historical distance" between author and interpreter. On the other hand, the passage of time (and lack of clear documentation) will serve to increase the distance. This distance and tension will be recognised, and dealt with by the requirement for clear and believable logic as the link between historical text and new theory.

Interaction Between Researchers and Subjects: "[I]nterpretivism suggests that the facts are produced as part and parcel of the social interaction of the researchers with the participants." Meaning does not exist by itself, it exists only in the relationship between the researcher and the subject. My research will be "as it appeared through my own eyes, filtered through my own background, my likes and dislikes, qualified by my own strengths and weaknesses (Read 1965, P. 247)" in (Klein & Myers, 1999). Much of my insight is based on more than twenty years of experience, on having experienced what actually works (or does not work) in an organisational environment.

For example, in Adamson's research, "The business-like rationality built into client/consultant models of interaction did not seem to be there [in a real situation]." To the practical manager, this is no surprise. An academic researcher may focus on an area of academic research and expect (or hope) to find rationality in reality. Unfortunately, "the notion that rational models can satisfactorily explain interpersonal interaction seemed unrealistic, since they tend to ignore the 'human' factor" (Adamson, 2000). Critical Insight draws on professional and practical knowledge and experience to include the human factor in research.

Abstraction and Generalization: "[T]he validity of the inferences drawn from one or more cases does not depend on the representativeness of cases in a statistical sense, but on the plausibility and cogency of the logical reasoning used in describing the results from the cases, and in drawing conclusions from them' (Walsham 1993, p. 15; see also Lee 1989)." Critical Insight allows for generalisation from the particular, based on logic and interpretation rather than mathematics and statistics. "[T]o find out what people do in general, we must first discover what each person does in particular, then determine what, if anything, these particulars have in common" (Thorngate, 1986, p,75) in (Dermer & Hoch, 1999). Hill and McGowan support this view:

Is Shakespeare's portrayal of Lady Macbeth simply a tale about a particular Scottish noblewoman who lived in the latter part of the eleventh century? What Shakespeare has done here of course is to illustrate significant common human attributes by the way he has written about particular individuals... Basically what is being said here is that we shape our information pick-up system by what we learn from individual cases. (Hill & McGowan, 1999)

Critical Insight allows the researcher to draw – where it is plausible and logical – valid conclusions and worthwhile generalisations from what may be a small number of personally-experienced situations.

Dialogical Reasoning "requires the researcher to confront his or her preconceptions (prejudices) that guided the original research design... As a minimum, the researcher should identify what type of interpretivism s/he prefers." Klein & Myers offer two interpretivist alternatives. "IS research can be classified as positivist if there is evidence of formal propositions, quantifiable measures of variables, hypothesis testing, and the drawing of inferences about a phenomenon from a representative sample to a stated population (Orlikowski and Baroudi 1991)" and "IS research can be classified as critical if the main task is seen as being one of social critique, whereby the restrictive and alienating conditions of the status quo are brought to light."

Positivist and critical do not appear to cover an entire spectrum of alternatives. However, my research is definitely not "positivist": The approach has similarities to grounded theory, where there is no initial hypothesis to be tested. A literature review plus my own understanding have provided the base data – the insights – from which a new theory has been drawn. By elimination, my Critical Insight research methodology is classified as "critical".

Multiple Interpretations "requires the researcher to examine the influences that the social context has upon the actions under study by ... a confrontation of conflicting interpretations of the participants in the field." The use of professional experience will provide multiple viewpoints. Many of the original viewpoints may, however, have been already lost, or merged into one compromised view and perhaps several related insights. This is both a strength and a weakness of the Critical Insight methodology.

The strength is, that a large number of viewpoints have been examined, considered and built into the new theory. The weakness is, that many of these viewpoints will have been discarded or forgotten, once the data was incorporated into my – the researcher's – knowledge. Much of the knowledge will have become "tacit" through use and acceptance. The original experience and interpretation may have been irrecoverably lost. From a positive point of view, this process may be considered as equivalent to prior research, with continuous building of a body of practical theory.

Suspicion "goes beyond understanding the meaning of the data because it points the researcher to 'read' the social world behind the words of the actors, a social world that is characterized by power structures, vested interests, and limited resources to meet the goals of various actors who construct and enact this social world." The suspicion is of the words, actions and motivations of the research subjects themselves.

This principle will be a particular strength in research by a DBA student. The experienced manager or senior professional (the target market as a source of DBA students) has both knowledge and first-hand experience of the importance of power structures, vested interests and the battles for limited resources. This is the real world in which the manager and the professional operate. It is almost natural to incorporate this principle of suspicion into any DBA research project.

A Qualitative Methodology

The Critical Insight research methodology is qualitative and not quantitative. "In qualitative research the researcher's goal is to expand and generalise theories, not to establish the frequency with which a phenomenon is likely to occur in a population" (Hyde, 2000). The first stage of Critical Insight research involves the analytical development of a general theory based on professional experience and knowledge of a limited number of particular cases.

Taking in May, 1800, a very parochial and idiochronic sample of Soho water, inserting into it a very biased sample of copper wire, into which flowed a very local electrical current, they obtained hydrogen gas at one electrode, oxygen at the other, and uninhibitedly generalized to all the water in the world for all eternity... In the successful sciences, generalizations have ... emerged from checking in non-representative ways on an initial bold generalization. Campbell (1969, pp 360-361) in (Dermer & Hoch, 1999)

My own research may be parochial and idiosyncratic (let alone idiochronic). In fact it is difficult to be other than parochial, in any location other than an homogeneous, static, world state. Nevertheless, my research has allowed me the luxury of making some initial, possibly bold generalisations. Whether or not they are subsequently proven to be universal truths, they have been clearly and logically grounded in the insights that I have gained from many years of practical experience. And that same experience has driven me to create a model that has, as far as I can make it, some relevance and application to actual business practice.

Strengths and Limitations

The Critical Insight methodology includes a number of inherent limitations. It uses a restricted set of data: the researcher's own knowledge and experience. On the other hand, this knowledge and experience have a depth and breadth that is not readily available to other researchers. The value of the research result is dependent on the strength of the analysis linking experience to new theory; this is exactly the same as for any research project.

The link of existing-to-new theory is very strong in the Critical Insight methodology. A simple PhD project may research literature, look for a gap in the theory, form an hypothesis and test that hypothesis, to prove it true or false. Critical Insight examines the literature with a view to forming an hypothesis that is likely to be true. More specifically, the new theory will be based on past research but with an emphasis on applicability to practice.

A limitation that is specific to this project rather than to the methodology, is that the new theory is logically reasonable but not thoroughly tested. This is due to a combination of factors: the need to complete the research within a DBA timeframe, and the amount of work in the initial development of theory. The initial stage is doing more than looking for gaps in existing theory: it is building a model that extends existing theory into a practical situation. Due to strict time limitations, the new model is largely untested. Testing the model will be a subject for later, separate research.

My research methodology draws on the particular strengths of the DBA student. The DBA targets senior professionals and managers, the methodology takes advantage of insights that have been built on professional practice and refined by results. Critical Insight research avoids difficulties involved in interpretation of a subject's knowledge by a researcher because the researcher is the primary subject of the research.

Finally, the Critical Insight methodology extends the concept of providing academic knowledge to senior professionals through a doctoral level university program: the professionals, as students, are able to bring their own knowledge and experience into academia. By using their own experience and knowledge in a research project, DBA students are able to enhance and extend academic theory. Both student and academia gain unique and valuable benefits from a DBA Critical Insight research project.

These strengths are summarised in the following *Figure 8 Strengths of the Critical Insight methodology*, drawn from the original conference presentation of this methodology.

Strengths

- **Knowledge-based generalisations**
 - base data was built on practice
 - then refined based on results
- **Researcher / subject interaction**
 - clear understanding of subject data
- **Adds professional experience**
 - strengthens academic research

Slide 10

Figure 8 Strengths of the Critical Insight methodology

Source: author's research

Concluding Comments

The pressures on scientists today oppose truly creative thinking. (Loehle, 1990)

The reference is to scientists yet the same pressures apply equally to many academics and research students. My intent, and the final result, was to take full advantage of my academic studies and to do original and creative research.

The unique attributes and benefits of the DBA are that it is doctoral level, academic research which supports the needs of professionals and managers as well as academics. It supports professionals and managers through research that is more "applied" than that of the traditional PhD. The DBA also builds on the strengths of students who are experienced professionals or senior managers. The Critical Insight methodology allows the managerial and professional experience of DBA students to be formally brought into the realm of academic knowledge.

5.3 Trustworthiness of the Research Methodology

Before describing the Critical Insight methodology I introduced the underlying research paradigm (see *5.1 Research Paradigm*, above). The discussion was based on a 1981 paper by Guba. This section of my thesis completes the analysis based on Guba's work, by describing the "trustworthiness" of my methodology. Basic ideas and quotes in this section are again from the paper by Guba (Guba, 1981).

There are four aspects, or measures, of the trustworthiness of a research project: truth value, applicability, consistency and neutrality. In rationalistic research these measures are covered by: internal validity, external validity, reliability, and objectivity. The equivalent measures for naturalistic research – such as my own, using Critical Insight – are: credibility, transferability, dependability, and confirmability. These measures are summarised in *Table 1 Four Aspects of Trustworthiness*, below. Several of Guba's suggestions for ensuring trustworthiness of naturalistic research are then discussed and applied to my research methodology.

Table 1 Four Aspects of Trustworthiness

Aspect	Rationalistic term	Naturalistic term
truth value	internal validity	credibility
applicability	external validity	transferability
consistency	reliability	dependability
neutrality	objectivity	confirmability

Source: author's summary of Guba

Credibility may be tested by a check of the findings and interpretations with the various sources of research data. Rationalistic researchers break reality into component parts and then control each part. Naturalistic researchers prefer to take an holistic view, since the whole may reflect more (or less) than its component parts. Although I break the AST model into several large components, I try to maintain the overall view as I examine the parts.

Prolonged engagement and persistent observation allow the naturalistic researcher to confirm the credibility of their findings. As theory emerges from the data, the researcher is able to check and confirm the data against new observations.

The Critical Insight methodology does not plan for future long engagement and persistent observation. It depends, rather, on long engagement in the past – the expected length of work experience of the professional DBA student – and sufficient unique understandings to allow checking and rechecking of the accumulated insights. The longer the work experience of the researcher and the wider the range of unique experiences, the more credible the findings.

Transferability may occur where two contexts (situations) have sufficient, relevant similarities. Naturalistic research looks for working models which may – given a suitable level of similarities – be transferred from research to another situation.

Critical Insight's dependence on knowledge gained in the past restricts the ability to plan for purposeful sampling: experience was gained for work purposes rather than for research. What may be possible would be to include sufficiently detailed descriptions of past situations, lessons learned and the context in which the insights were gained, to know whether or not the findings could apply to a new situation.

In this research thesis I depend more on general insights than on specific examples. I use a single case study throughout the thesis but the role of the case is to explain the developing model rather than to prove the findings. The strength of the research is in the analysis. The result is a working model that will allow my own insights to be transferred to a new situation. The model will provide valuable insights but is not intended to predict exactly what will happen.

Dependability is reliability affected by trackable change. Naturalistic research deals with multiple views of reality; as research progresses, a different view may be taken. Results may not be consistent but changes should be explicable in terms of the changing views of reality.

Critical Insight may improve dependability through overlap, by drawing on the researcher's experience of a number of unique but similar situations. The equivalent of "stepwise replication" would be to have more than one researcher checking and comparing insights gained from their own experiences.

My own research uses a form of "dependability audit". Each major part of the new model is developed and explained in terms of a single case study. (That case study is not "proof", just a descriptive example.) The resultant new model is then applied to two new and unrelated case studies. The ability to apply the model to two more, independent case studies demonstrates a certain level of dependability. Given the strict time and word limit restrictions of a DBA thesis, two extra case studies provide, I believe, a sufficient indication of the dependability of the new model.

Confirmability accepts that the researcher, or observer, may not be neutral. It should, however, be possible to confirm that the collected data itself is accurately described. Triangulation and reflexivity are recommended means of ensuring confirmability.

The success of Critical Insight research depends, in part, on triangulation and self-reflection that has occurred as the researcher was gaining their knowledge and understanding. Senior managers and experienced professionals – targeted as DBA students – have had the opportunity to gain experience and insights from a number of unique situations. In order to develop their professional careers they will have reflected on those situations.

Triangulation and reflection are both in the past and are (most likely) undocumented. Their benefits should, however, be reflected in the power and clarity of the logical argument which supports the new theory. I hope that my own thesis provides a convincing demonstration that my insights are based on triangulation and sound reflection. Stronger confirmation will require at least one further, major study for each component of the extended AST model. This is suggested, but not followed through, in section *10.3 Future Research*, below.

5.4 Outcomes of the Research

The research question states, "How must adaptive structuration theory (AST) be extended in order for it to be applicable to the multi-organisational scope of Web-based e-commerce information systems?" The research project answers this question by the development of an extended, adaptive structuration theory that is applicable to e-commerce. Thus the key part of the project is the research challenge:

This research project will develop an extended AST model that will be relevant to e-commerce. The extended model will support change management initiatives for e-commerce implementation, by providing an explanation of the ways in which organisations and other affected groups may adapt to the new technology. (section *4.1*, above)

As a student in the first cohort of the university's new DBA(IS) professional research doctorate, I had a further problem: what are the requirements of a DBA thesis? The marketing and background material for the DBA clearly distinguishes it from a PhD, with a different target market and different intended outcomes to suit the target market. Yet the only guidelines for a DBA thesis are, it should be half as long as a PhD thesis.

My own background is as a manager and a professional; I am typical of the targeted DBA student. To satisfy the DBA intent I needed a research methodology with relevance to my professional career. It should also – I believe – draw on the knowledge and experience of the student, to bring the benefits of that knowledge into the academic arena. This led to a second major research objective, to define a research methodology to suit the requirements of a professional doctorate.

That is, the research question has been answered in two parts: First, identification of required extensions to the model; Second by actual development of the required, extended model. The outcome of this research is a new structuration model that will allow AST to be applied to our understanding of the appropriations that will occur when a new e-commerce system is implemented.

The research methodology, as described above, has allowed full use of the skills and experience of the researcher, as an experienced professional who is currently a DBA student. This does not, however, mean that the researcher's experience has been used as "proof" of the correctness of the new theory.

The researcher's experience "informs" the research project. That is, the research methodology accepts that the DBA researcher has a breadth and depth of experience and prior understanding that may not be available to, for example, a typical PhD researcher. A PhD student is often at the start of a career in research and academia; a DBA student is typically in a well-established career as either a professional or a manager.

The outcome of this research project is a model, one which helps us to understand the process of technology appropriation when the technology is a website or e-commerce information system. That is, the extended model describes the process by which a web-based system is adapted, adopted or rejected by users and others, both inside and outside the organisation.

The model has been developed, in this research project, through a logical process. Experience has informed the development – that is, the researcher's experience has indicated that certain aspects of the model are quite likely to be valid in practice. The experience has not, however, been presented as proof of correctness. All aspects have been logically developed based on reasoned argument and existing theory.

The logical development of an extended AST model has provided sufficient scope to more than satisfy the restrictions and requirements of a DBA thesis. Field testing of the new model will, as described earlier, be left to a subsequent series of tightly constrained research projects. Each dimension of the model will require one or more field-test projects. This is beyond the scope of a single DBA research thesis.

The outcome of this research project is a model of the appropriation process for implementation of a website or e-commerce system. The model is logical, coherent and, as far as possible, complete. It provides insights and understanding for both theory and practical application. It has not, however, been fully tested in practice.

6 The AST Model before e-Commerce

6.1 Abstract

AST (adaptive structuration theory) describes the process by which an organisation will adapt to implementation of new technology. The process will be dynamic, with irregular but continuing changes to any or all organisational structures. Changes (adaptations) to one structure may cause changes to another structure. Structures considered by the model are: the organisation, work group, task and the technology itself. In practice, the process of change may be measured by a series of static snapshots examining misalignment of structures and the resultant adaptations. The process of adaptation is driven by the comfort and consensus of users of the new technology. Adaptations may be classified as being ironic, faithful or hyperfaithful. Changes may be grouped into a small number of broad categories: knowledge capture, knowledge sharing, access to the tool (information system) and decision making.

6.2 Introduction

Prior to this research project, AST (adaptive structuration theory) was based on and applied to technology systems that operated within a tightly constrained environment. Essentially, AST was applied to systems within a single organisation. My own research project extends AST so that it may be applied to technology systems that operate across more than one organisation: specifically, to website and e-commerce systems.

The starting point for my project was the AST model described in the Majchrzak paper published in 2000. That paper presents findings which improved upon existing models of the adaptation process. The paper clarified aspects of the AST model. It also gave a good description of AST. (Majchrzak, Rice, Malhotra et al., 2000)

This section of my thesis describes AST as it was at the end of the Majchrzak research. Much of this material has been clearly stated in previously published works although some is implicit and difficult to clarify. The intent of this section is to clearly define the starting point for my own research. Subsequent sections develop AST so that the model may be applied to web-based information systems technology.

6.3 Dynamic Model

AST describes and models the adaptive "process". It reflects the process of structures changing over time. Changes (adaptations) occur continuously, to a number of interacting structures (systems). This process of structures adapting as they interact is known as "adaptive structuration".

Very briefly, the Majchrzak et al AST model indicates that the structures may be adapted and that adaptations are a result of sporadic and discontinuous misalignments between the structures. The adaptations may be convergent – they may result in an ever-improving interaction between the structures – or the changes may be divergent. This process is shown in the figure, *Figure 9 Adaptive Structuration over Time*, below.

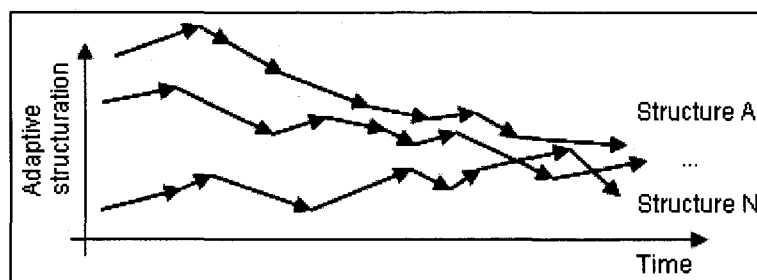


Figure 9 Adaptive Structuration over Time

Source: author's representation of work by various others

This is a dynamic model, where the adaptations occur sporadically over time. The process is continuous and potentially never-ending. Majchrzak et al found that their study group experienced the repeated need for adaptations as the project progressed. The adaptations were in response to changing task requirements, where a perceived change to the requirements of the task necessitated new adaptations. They also found that the adaptations were discontinuous. They were sporadic changes in response to discrepant events that were seen as being problems.

There appears to be no means to accurately predict adaptive structuration. There are, however, broad patterns that may be anticipated.

The socio-political process and the substance of the innovation have reciprocal effects, yielding the possibility of agreement on a 'working innovation' which, once institutionalized, modifies the existing system and structures in ways that constrain, in new modes, the behaviours of all of those involved. (Coopey et al., 1998)

In other words, an innovation such as a new technology will affect existing systems and structures. The structures will, in turn, affect the new technology. Both technology structure and organisational structures will adapt to each other.

AST proposes a reciprocal and iterative relationship between technology and the context in which it is used (Chudoba, 1999). That is, the technology affects the organisation and the organisation affects the technology. Organisations may adapt in different ways in order to use the same technology; the technology itself may be changed to suit the organisation in which it is being used. "Instead of the predictable realization of a preprogrammed plan, implementation is a dynamic process of mutual adaptation between the technology and its (user) environment" (Leonard-Barton, 1988).

Although initial adaptations may be applied to the technology, these changes to technology may in turn lead to changes in the organisational structures. This process is referred to as mutual (or reciprocal) adaptive structuration.

Over time, certain adaptations may be reinforced because the outcomes are acceptable to group members. Alternatively, adaptations may change if the group members want different outcomes. Early adaptations affect future adaptations. This is referred to as iterative structural adaptation. Contractor and Seibold referred to this iterative adaptation as "recursivity" (Contractor & Seibold, 1993) where similar processes of adaptation happen again and again.

In summary, these are aspects of dynamic organisational adaptation to new technology:

- The technology may be adapted and user structures may be adapted.
- Adaptations to one structure may cause adaptations to another structure.
- An adaptation may be reinforced or reversed by subsequent adaptations.
- Adaptations will continue to occur but at irregular intervals.

6.4 Static Model

In practice, the research was based on adaptations occurring and being observed at discrete points throughout the duration of the study. At each discrete point the researchers noted the current situation, including changes since the previous observation and discrepant events that led to those changes. In order to record each current situation, a situational model is required: This is the "static" model behind the process model of adaptive structuration theory.

The static model has a number of parts, including: structures, misalignments, appropriations and categories of adaptation.

Majchrzak et al considered adaptations to three structures: the new technology, existing work group, and the existing organisational environment. The new technology in their study was CT, collaborative technology. The work group was a virtual team, set up for a specific project, with team members drawn from two organisations. Although this indicates adaptive structuration operating across more than one organisation, the paper discusses just a single organisational environment. It appears that the project was owned and managed by one organisation, even though team members were drawn from more than one.

These three structures were represented as concentric circles, as shown in *Figure 10 Structures from Majchrzak et al Study*, below. The circles may be seen to represent the organisation, managing a work group, which uses new technology.

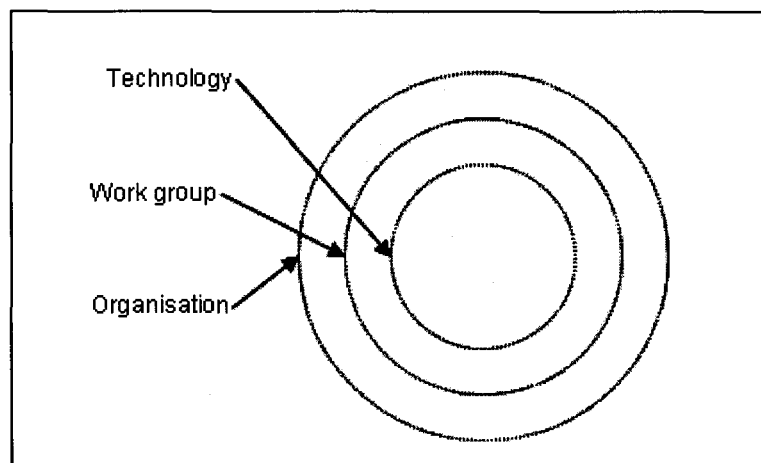


Figure 10 Structures from Majchrzak et al Study

Source: adapted from Majchrzak et al

A fourth structure – task – is described but discounted. "Since the essential nature of the task – new product development – did not change throughout the project, the task structure was not examined" (Majchrzak, Rice, Malhotra et al., 2000) (p. 576). In the summary of results Majchrzak et al state, "we found that, when a workgroup is allowed to modify its structures, it is possible that all structures may be changed" (p. 592). If the task were also allowed to be modified – in a different case study situation – it seems reasonable to expect that this fourth structure would be changed. In that case the figure above would include a fourth circle, for the task structure.

(It is interesting to note that, in fact, there appear to be changes to the task in the Majchrzak et al case study. The "essential nature of the task" may not have changed. There were, however, changing task requirements, such as the way in which the work group reported progress to the managing organisation. On page 593, for example, "the emergent task demanded a different set of aligned structures." As a simplifying assumption, however, assuming a fixed task does not detract from the Majchrzak et al research findings.)

AST models the interactions between information technology structures, social structures and human activities (Scott et al., 1998). Although the diagram above does not show it, the technology structure has two parts. First is the spirit, or generally accepted objectives and attitudes promoted by the structure. The second part consists of the specific structural features that implement the spirit promoted by the new technology (Gopal et al., 1992-1993).

Scott et al describes the structural *features* of a technology as the rules, resources, and capabilities a system can provide (Scott et al., 1998). The *spirit* of the technology is the general intent with regard to values and goals underlying a given set of structural features (Poole & DeSanctis, 1990).

Either the spirit or the features, or both, may be adapted. The Majchrzak et al static model does not distinguish spirit and features. Nevertheless, the distinction between adaptations to the spirit of the technology and adaptations to the features, are a key part of the AST model.

The diagram of concentric circles was used to summarise adaptations to the structures. Although AST represents a process, one diagram was used to document static states at the beginning and end of a discrete interval. Each diagram showed misalignments between structures at the start of the interval, and adaptations that had been made during the interval.

At any given time, there were a number of instances where one structure was not in accord with another, where there was a misalignment between the structures. In order to reduce these misalignments, one or more structures were changed. The misalignments are also referred to as discrepant events, or actions within one structure that were at odds with actions within another structure. The adaptations are also referred to as appropriations, referring to the ways in which for example the work group members would appropriate or use particular features of the technology.

In this model of AST the emphasis is on the appropriation of the technology structure. AST describes the adaptations that occur as a result of implementation of new technologies. Thus the focus is on the ways in which the work group and the organisation affect and are affected by new technology.

In the Majchrzak et al diagrammatic representation of AST, misalignments and appropriations are inserted into the concentric circles. The technology circle describes the technology features. The work group and organisational circles describe initial misalignments and resultant adaptations. This is shown in the figure, *Figure 11 Misalignments and Appropriations*, below.

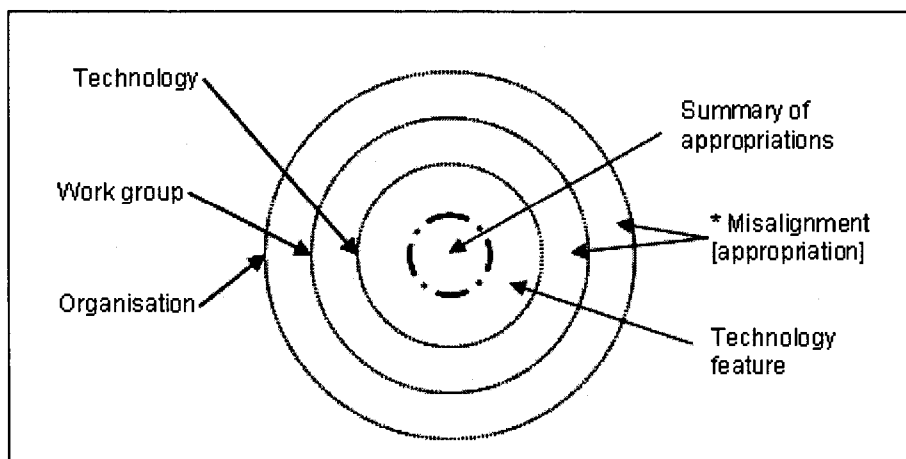


Figure 11 Misalignments and Appropriations

Source: based on Majchrzak et al

The figure also shows that a central circle was added, to provide a summary of the appropriations within the relevant time interval.

The AST diagram included a final set of information: categories for the technology feature that was misaligned and appropriated. Majchrzak et al identified four categories of appropriation, each of which was divided into two subcategories:

- Access to Same Communication Tools: who has access; when do they have access
- Knowledge Capture: what gets captured; how is it captured
- Knowledge Sharing: what helps sharing; what gets shared
- Decision Making: participation in decision making; questioning of technical requirements.

These eight categories are represented on the AST diagram as segments of the structural circles. By this stage, the diagrams are getting rather complicated. The diagrams are "busy", with many words on each, and it is a challenge to fit lines of text into a segment of a circle. A simplified version of the AST diagram is shown in *Figure 12 The AST Diagram*, below. Each misalignment and appropriation would be inserted within the circle segment that represents its category and structure.

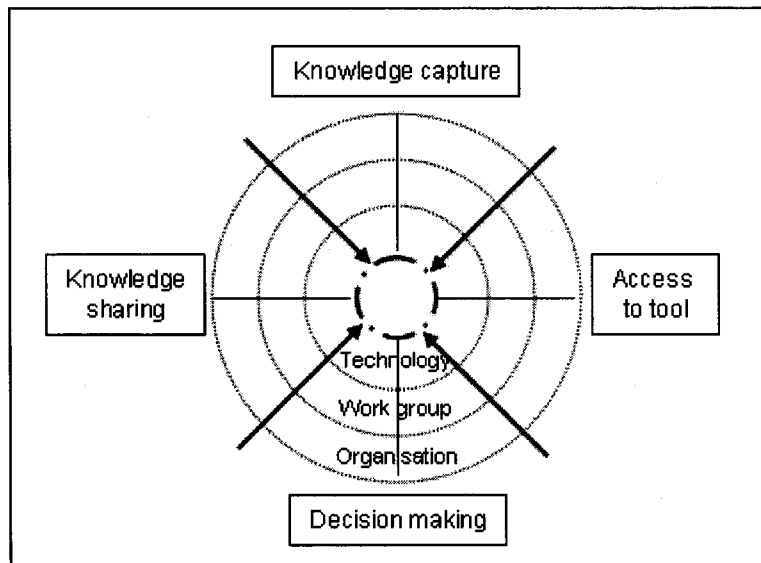


Figure 12 The AST Diagram

Source: based on Majchrzak et al

In summary, the static model of the Majchrzak et al adaptive structuration theory includes several key parts:

- Structures. These are the systems that may change. The organisation, work group and technology structures are indicated on the diagram; technology features and spirit are not distinguished by the diagram itself.
- Categories of adaptation. Majchrzak et al found, in their research based on use of collaborative technology, that observed adaptations could be grouped within four broad categories: knowledge capture, knowledge sharing, access to tool and decision making.
- Adaptations (or Appropriations). Each identified adaptation may be placed into one of the segments of the diagram according to the structure being affected and the category of the adaptation.
- Misalignments (Discrepant events). Each adaptation is driven by one or more misalignments, or problems which are the reasons for an adaptation to occur.

As a group works on its tasks or an organisation operates its processes, technology structuration occurs; that is, the group chooses to use or not use features of the technology. This process may occur without group members being conscious of their appropriations, of the ways in which they selectively adopt and use the technology in order to satisfy their own group requirements. The technology appropriations may lead to group and process structuration. That is, there may be observable changes in relationships such as the hierarchy of group members (Chudoba, 1999).

"AST describes how individuals and groups appropriate structures from procedures and technologies and adapt them to their own purposes in the course of accomplishing their tasks" (Nagasundaram & Bostrom, 1994/1995). And, "Appropriation refers to the manner in which structures are adapted by a group for its own use... structures are continuously produced and reproduced (or confirmed) as the group's interaction process occurs" (Gopal et al., 1992-1993).

Organisational outcomes, successful or otherwise, are not simply a result of the use of new technology. The outcomes are affected by the way in which the various organisation-related structures appropriate the features of the technology and by the way in which the organisational structures adapt their own structures in response to the technology. The organisation both adapts and selectively adopts (appropriates) features of the technology.

6.5 Three Further Dimensions for Adaptation

A means of measuring, or characterising, the adaptive structuration process is described by Gopal et al: "The process can be characterized by the modes of appropriation defined in AST: faithfulness of appropriation, attitudes toward the [technology], and level of consensus on appropriation" (Gopal et al., 1992-1993). These provide three dimensions for measurement of adaptive structuration.

Ironic, Faithful and Hyperfaithful Adaptations

Faithfulness refers to the extent to which an organisation keeps to the spirit of the technology being used. At one end of the faithfulness dimension, a faithful appropriation supports the spirit. At the other end, an ironic appropriation goes against the intended spirit. An appropriation would be ironic if it went against a recognized way in which the technology were supposed to be used, or if it resulted in an outcome inconsistent with the goals of the technology.

There are also two less obvious categories of ironic adaptations: unintended and hyperfaithful. Unintended ironic appropriations act against the original spirit of the technology yet the unintended adaptations were neither deliberately appropriated nor intended to be ironic. Hyperfaithful appropriations provide an extreme reinforcement of certain intentions or features of the technology. This reinforcement of faithful usage may act against the original spirit of the technology. Or, the reinforcement of selected intentions may act against other intentions within the original spirit of the technology. (Scott et al., 1998)

Identification of the change as being ironic is important. It highlights the need to carefully consider the overall impact before a new adaptation is approved. Given the emergent nature of the adaptations, a true picture may not be possible in advance. Nevertheless, those planning changes should at least consider the potential for emergent, flow-on adaptations to all structures.

It is useful to learn about and understand why technology gets used in both faithful and ironic ways. "Exploring such questions acquires increasing importance as these new innovations with their multiple uses continue to enter the workplace and other aspects of our lives" (Scott et al., 1998). An implication of AST is, that new technology will be used in new and unexpected ways. Some appropriations will have a positive impact on success, some impacts will be negative.

Attitudes and Consensus

Attitudes include organisation members' level of comfort with and degree of respect for the use of the technology. Level of consensus is the extent to which organisation members agree on the ways in which the technology should be appropriated (Gopal et al., 1992-1993; Scott et al., 1998). There are various explanations for individual responses to technology (such as TAM, the technology acceptance model). This thesis does not look into those. Adaptive structuration is driven by individuals but AST has a focus on the group, or structural, responses.

Summary of these Further Dimensions

In summary, the impact of adaptive structuration may be measured on a number of scales:

- Selective appropriation. Not all features of the new technology will be or need to be implemented. Features may be adopted now, adopted later, never used, changed or removed at various times.
- Ironic adaptation. An ironic adaptation acts against the spirit of the technology or it may change the spirit. An ironic adaptation may be intended or unintended.
- Faithful and hyperfaithful. An adaptation may be faithful to the spirit of the technology. It may even be hyperfaithful, a feature so faithfully implemented that it overrides other features that may be required to maintain the original spirit.
- Comfort and consensus. Members of the organisation may be comfortable with new technology and they may support the way in which it is implemented. This comfort and consensus may reflect factors not directly related to the new technology.

7 AST Structures for e-Commerce

The material in this section is an extension of my research paper presented at and published in the proceedings of the international ACIS 2003 conference (Lethbridge, 2003b). The paper was peer reviewed before acceptance. Some changes have been made based on feedback during and after my presentation.

Abstract

Adaptive structuration theory (AST) models the ways in which technology is adapted to an organisation and organisational structures adapt to the technology. AST has been developed through research involving technology applications such as group decision support systems and collaborative technology. Compared to these, e-commerce technologies are both more common and more complex; use of AST with e-commerce requires an extension to the basic AST model. This section determines that for relevance to e-commerce development there are not four, but eight structures that may be adapted: technology features, technology spirit, information system developers, task of the work group, staff in the organisation, management, customers and visitors.

7.1 Introduction

When an organisation introduces new technology, there is change. The organisation adapts to more effectively use the technology and the technology is adapted as more is learnt of its potential uses. The way in which these adaptations occur is the subject of research into AST, or *adaptive structuration theory*. This research extends our understanding of AST, to make it relevant in the context of websites and e-commerce information systems based on Web technologies.

Research by Majchrzak et al (Majchrzak, Rice, Malhotra et al., 2000) improved on existing models of the adaptation process. Very briefly, the Majchrzak AST model indicates that any of the then-recognised structures may be adapted and that adaptations are a result of sporadic and discontinuous misalignments between the structures. The Majchrzak research provided a considerable advance for AST. However, as with earlier papers in the area, it is restricted in the scope of technologies to which it may be applied.

The Majchrzak research was based on structural adaptations in a situation where the central technology was a CT, or collaborative technology. Other technologies studied in AST research have included GDSS (group decision support systems), hospital scanners and Lotus Notes (a commercial CT application). These technologies may be valuable tools in the appropriate situations. For researchers they have the advantage that they may be closely constrained in both application and accessibility.

An e-commerce website, on the other hand, is barely constrained at all, in either potential applications or in its universal accessibility. Development of a website is also a common challenge in very many organisations. Was it possible to use the then-current model of the structural adaptation process in order to understand website development? Can AST be successfully extended from technologies such as CT and GDSS to the technology of the Web?

Using the Majchrzak model as a starting point, I have examined the central aspect of AST: which structures must be considered when applying AST to Web technologies. My analysis indicates that the nature and impact of e-commerce (Web) technologies are significantly different to that of technologies such as CT and GDSS. To match the broader impact of Web technologies, a broader set of structures must be considered. Rather than the four structures of earlier models, AST for e-commerce must consider adaptive structuration of twice that number of affected structures.

7.2 Organisations Adapting to Technology

A decade ago, Nagasundaram & Bostrom wrote: "Radical and discontinuous change is the order of the day in the 1990s." They saw that corporations, large and small, were using methods such as TQM (total quality management) and BPR (business process redesign) in an attempt to create new organisational forms that would enable success. To stay ahead in the highly competitive market environment, organisations needed a steady stream of new products and new services. (Nagasundaram & Bostrom, 1994/1995)

In 1988 Leonard-Barton wrote: "New production technologies are known to be competitive weapons, but their implementation is at least as challenging a managerial problem as their invention." Further, "The initial implementation stage is particularly crucial... It is argued that technology transfer requires continuous, ongoing dedication to the process of change and the conscious management of mutual adaptation because the technology will never exactly fit the user environment" (Leonard-Barton, 1988).

In 1988 the issue for Leonard-Barton was new production technology. In the new century it is Web technologies that are affecting all organisational processes: from production, through marketing and sales, to long-term customer support and service.

In the field of GDSS (group decision support systems) the factor of "organisational" change appears to have caught early researchers by surprise.

"A recent trend in the [GDSS] literature has been the attempt to understand the process of [GDSS] use. This trend follows on the heels of early [GDSS] research efforts that sought to understand the effects of [GDSS] use primarily through the outcomes of such use. This early approach resulted in conflicting research results, as the influence of the process of [GDSS] use was often not considered." There was a resultant shift in focus, from direct study of the GDSS technology, to study of the use of the technology by members of a social system. (Gopal et al., 1992-1993)

That is, researchers began to look at the changes in organisational interactions as the GDSS technology was introduced: The introduction of new technology had an impact on the surrounding sociotechnical environment.

Development of Adaptive Structuration Theory (AST)

Organisational outcomes, successful or otherwise, are not simply a result of the use of new technology. The outcomes are affected by the way in which the organisation adopts and adapts the structures of the technology and by the way in which the organisation adapts its own structures in response to the technology. This adaptive structuration influences the impact and the success of the new technology.

AST proposes a reciprocal and iterative relationship between technology and the context in which it is used (Chudoba, 1999). That is, technology affects the organisational structures and the organisational structures affect the technology. Different organisations may adapt in different ways in order to use the same technology; the technology itself may be changed to suit the organisation in which it is being used.

Scott et al described AST as being based on Giddens' Structuration Theory ((Giddens, 1984) cited in (Scott et al., 1998)). That earlier theory focuses on the practices that occur within social systems. AST narrows the focus to structures associated with technology and, more recently, information technologies. AST models the interactions between information technologies, social structures and human activities.

In 1993 Contractor and Seibold wrote of the rejection of technological determinism in favour of an emergent perspective: "To date, only adaptive structuration theory (AST) offers the promise of satisfying two requirements for explanation based on an emergent perspective: recursivity and unique effects" (Contractor & Seibold, 1993). In 1997 Chin, Gopal and Salisbury wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an influential theoretical perspective in research on advanced information technologies" (Chin et al., 1997).

In 1994, DeSanctis & Poole wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an important theoretical paradigm for comprehending the impacts of advanced information technologies" (DeSanctis & Poole, 1994). In 2002 that statement was considered sufficiently current to be quoted in a research article (Salisbury, Chin, Gopal, & Newsted, 2002). AST "has provided a useful framework for describing how group communication technologies are used in both expected and unexpected ways. These unexpected usages may have positive or negative outcomes." (Scott et al., 1998)

In 2000, AST was still a relevant subject for research. Kim, for example, wrote: "A number of leading theories connected with social interaction in computer-mediated communication are investigated. It is suggested that further research is undertaken into the 'adaptive structuration' theory" (Kim, 2000).

Again in 2000, Majchrzak et al reported (Majchrzak, Rice, Malhotra et al., 2000) on a study of a virtual work team using a CT (collaborative technology) application throughout a ten month project. As the project progressed, the team was seen to adapt each of four structures: work group, organisation, technology spirit and technology features. Four research questions were addressed, the two structure-related questions and results are outlined below.

"(1) Can the workgroup adapt any or all structures, or does it primarily try to adapt to the technology's initial spirit?" Over the course of the project, the workgroup adapted all structures: organisational, group, technology spirit and technology features. The research found that each area had been changed therefore each area was, indeed, malleable.

"(2) Do pre-existing structures constrain the workgroup's adaptation process, even when these structures are malleable?" All three structural areas were found to be malleable, structures in each area were changed. No area was absolutely constraining, although the organisational environment did eventually revert back to its pre-existing structure. Further, the changes were found to be a result of discrepant events: adaptations were made when existing structures failed to satisfy task requirements.

Majchrzak et al studied four structures that were adapting in an environment where CT technology was in regular use. The four structures were found to be mutually adaptive. In an environment where the central technologies are those used in a new e-commerce website, will this AST model still apply? An initial and vital question is: What structures are subject to adaptation in response to the introduction of new Web-based technologies?

7.3 Structures Subject to Adaptation: Previous Model

Structures are the rules and resources used to generate and support a system. A system, in this sense, is a social group or organisation that acts in such a way that there are observable and consistent patterns of inter-personal relations. The technology structure has two parts. First is the *spirit*, or generally accepted objectives and attitudes promoted by the technology. The second part consists of the specific structural *features* that implement the spirit promoted by the technology. (Gopal et al., 1992-1993)

Scott et al describe the structural features of a technology as the rules, resources, and capabilities a system can provide (Scott et al., 1998). The spirit of the technology is the general intent with regard to values and goals underlying a given set of structural features (DeSanctis & Poole, 1994; Poole & DeSanctis, 1990). The spirit reflects designers' intentions, users' interpretations, and other stakeholders' perceptions of how the technology is to be used. Either the spirit or the features – or both – may be adapted.

The "features" of technology are the more visible aspects of the technology structure. Features are the actual processes and operations, the things that can be done with and by the technology. Poole & DeSanctis describes the "spirit" as, "the 'official line' which the technology presents to people regarding how to act when using the system, how to interpret its features, and how to fill in gaps in procedure which are not explicitly specified" (p.126). In other words, the spirit is the underlying purpose of the technology. It could also be seen as being the intent of website owners.

Previous research appears to consider "spirit" only in terms of technology: The spirit of the other structures is not formally discussed. This is clearly seen in the Majchrzak et al paper which forms the basis of the description for the pre-e-commerce AST model. Changes to, for example, the spirit of a work group would have an impact on organisational theory. AST, however, is primarily concerned with technology. In this paper I will maintain the "convention" of dealing with spirit only with respect to the technology structure.

The work by Majchrzak et al studied changes within three "structural areas": technology, work group and organisational environment. The technology structure was considered as two parts, features and spirit. A further structure, task, was said to be fixed for the duration of the study and so was not examined. These structures were drawn from earlier work by DeSanctis and Poole (DeSanctis & Poole, 1994) cited in (Majchrzak, Rice, Malhotra et al., 2000).

An important point to note is, that different structures were adapted in different ways. Also, the task structure was considered to be fixed but it influenced adaptations in other structures. There are several affected structures, it is important to identify which structures are relevant.

This section of my thesis will now show that implementation of Web and e-commerce technologies will require consideration of a wider range of potentially adapting structures.

7.4 The AST Model for e-Commerce

AST (adaptive structuration theory) has been tested and developed on GDSS and CT applications. GDSS and CT are technologies with clearly defined objectives: They are specifically aimed at changing inter-personal communication in order to improve communication or to support decision-making processes. They are specialised tools, useful in certain situations. The virtual team studied by Majchrzak et al had a defined objective, a limited life, and it operated within a known, if unique, corporate environment.

The Web is a set of generalised technologies. It may be adopted and adapted for a wide variety of purposes. As with CT, an underlying objective is improved communication, however, Web-based e-commerce provides a wide range of communication options. Communication may be, for example, B2B (business to business) or B2C (business to consumer). Web technology also supports communication between individuals, between computers, within an organisation, within a virtual organisation or across and outside all formal organisational boundaries.

CT is an application, the Web is an enabling set of infrastructure and technologies. Even if Web technologies are restricted to creation of a website, there is an almost limitless range of possible applications. Yet organisations are selecting amongst all of these possible applications, and implementing organisational websites. This is not a trivial task. Anticipating the organisational structures subject to adaptations related to website and e-commerce development will improve the overall likelihood of success for that development.

Web-based Case Study

Web-related structures will be explained, in this research, in terms of a particular case study. The case study represents a small organisation with clear objectives. Its current operations are strongly based on provision of physical services at a fixed location. It has developed a website, although the purpose and ultimate method of operation of the website are still not clear: Development involved adaptation of Web technology structures, it may also lead to adaptation of the structures of the organisation itself.

"The Club" provides a meeting place for business people:

[The Club] is the leading business and professional persons' Club in [the City]. We offer the privacy and warm ambience that only a private Club can provide. The Club is a place to build long-term friendships and business relationships founded on high ethical standards. We provide a slightly conservative Club culture, modern but with a respect for traditional values. We are a Club of non-political character, for the interaction, enjoyment, entertainment and comfort of our Members and their guests. We encourage Membership from metropolitan and country areas throughout [the State]. (from the Club's Web page, October 2002)

This is a traditional "community" with a fixed physical focus and a common purpose. The physical focus is the Club-owned premises in the city centre, which provide the main benefits for members. The premises include a restaurant, cafe, meeting and function rooms, squash courts and a gym. The "members" of the Club are equivalent to "customers" of other forms of commercial organisation.

The Club provides a neatly bounded environment for explanation of the extended, e-commerce model for AST (adaptive structuration theory). This section of the research thesis examines one aspect of the AST model: the structures which may need to be considered.

Redefining "CT-Model" Structures

The Club has implemented a website which affects communication between the organisation and its members; the site may also affect communication between the Club and its potential members, and between individuals and groups within the Club organisation. The structural areas become more complex than those examined by the Majchrzak et al study:

- **Technology:** The implemented technology is the Web. The Club implemented website technology to improve communications. Initially, it was not clear how communications would be improved, nor with whom.
- The "task", in this case study, is the operation of the Club. Or rather, the new website performs one part of the broad task of Club operations. This is a very general definition of the task but, as with the Majchrzak et al case, it does not vary. Up to the present the website appears to be a minor activity, with little impact on the operational task. Yet this may change as the Club explores further website and e-commerce applications. For completeness, task structures must be included in the extended AST model.
- The "work group" is the management and operational groups within the Club, that is, the committee and Club staff. These are the people responsible for operational matters, they manage and perform the operational tasks. They have also used and supported the website as it developed. I will refer to them as the "staff" group.
- The "organisation" is, in this situation, the Club Executive Committee. In the Majchrzak et al situation, "organisation" represents the controlling environment in which the work group operates. The controlling environment for the Club is its committee; Employees report to the committee. So the Club committee has a dual role, as both work group and controlling organisation. I will refer to them in their controlling role as "management". The key difference between staff and management is that the former are "doing" and the latter are "deciding".

Table 2 Structure Name Changes for the New Model (below) summarises the changes described so far. The "pre-e-commerce model" is that used by Majchrzak et al.

Table 2 Structure Name Changes for the New Model

Pre-e-commerce model	Web case study	New model
Technology (CT or GDSS)	Web and e-commerce technologies, organisational website	Technology
Task (considered as being fixed)	Club operations including website operations	Task
Work group (virtual team)	Club committee and staff involved in website development	Staff
Organisation (one "owner" of the virtual team)	Club committee, responsible for overall Web development decisions	Management

Source: author's research

When the technology is CT, technology adaptations are driven by the requirements of the virtual team that is using the CT. The team has its task direction, yet each member of the team is also responsible to one or more managers in the controlling organisation. (Virtual team members are drawn from several organisations. Majchrzak et al describes the structural adaptations of only one of those organisations.) The team has been formed to create a new product, the product will be used by the controlling organisation.

When the technology is the Club website, technology adaptations were driven by the requirements of the Club committee. The committee set its own task direction, it was also responsible for overall Club management. The committee was managing the creation of a new website which would provide an improved means of communication between the committee, other Club members and potential Club members. As described above, the committee is both work group (staff) and organisation (management) in this application of AST.

In a more complex case study there could be an added level of structural complexity: multiple "staff" and "task" structures.

Many websites form the visible presence for e-commerce information systems. Commerce – and therefore e-commerce – consists of a number of inter-related tasks, with buying and selling as the control drivers. In a large organisation, these separate tasks may be supported by separate groups or departments. Each department may be supporting a different task through the one website.

The purchasing and sales departments (for example) may operate almost independently. This leads to the situation where one new technology – e-commerce – may affect multiple tasks and multiple staff structures. AST for e-commerce must include this possibility in the extended AST model.

Technology Structures

There are numerous features available using Web technologies. Broadly speaking, the features may be summarised as being various means of communication. The broad range of features is matched by an equally broad range of possible spirit.

Historically, the spirit of the Web could be, to enable and improve communication between independent researchers. For a business, the spirit could reflect an intent to market the organisation, to improve communication from business to consumer. For a student, the Web spirit could involve gaining access to various otherwise unavailable sources of information. For a casual Web surfer, the spirit could include entertainment, discussion and keeping in touch with friends. What do these aspects of spirit have in common?

The spirit of the Web is determined by the person or organisation using the Web. Each Web developer has an intent, a purpose, which will be supported by features selected for inclusion in the website. Each Web user may selectively access the Web in order to match the technology spirit required by that Web user. If the spirit offered by a website matches the spirit required by a user then that user will be encouraged to use that website.

The technology spirit of the website may reflect the underlying reasons for the development of that website or it may support overall requirements of website users. Korgaonkar and Wolin, for example, identified several factors that determined whether or not a website would be used (Korgaonkar & Wolin, 1999). Web users may be seeking social escapism, information, socialisation, or economic benefits. They may require transaction security, transaction privacy, privacy of personal information, and interactive control. Although this thesis does not discuss that research, this brief statement does indicate the variety of "spirits" that may be looked for by Web users.

A website may be developed by business managers who are not familiar with the technology, working with developers who are not familiar with the business. (A later section discusses the role of the developer as being a separate structure.) Because of the way in which development takes place, the website may reflect both the intent of the site owners and the understanding, or misunderstanding, of that intent by the developers. There may be features that exist only to suit developer intentions, that are transparent or simply accepted by the website owners.

So the spirit of a website may reflect the site owner intent as implemented by the developer.

For the Club, the intended spirit involved improved communication between the Club and its members and others. The intent was to provide an alternative means of providing information, a means that was effective and efficient. In the initial stages of development, the communication was largely one-way, out from the Club. There was no early intent to replace existing, paper- and voice-based communications. The intent was to provide one more means of communication.

As Club website development continues, it is possible that a key structural adaptation will be made to the spirit of the technology: The Club may extend its vision of the Web – its intended spirit of the Web technologies – from one-way communication to a multi-way, community-style extension of the purpose of the Club. So far, however, the intended spirit is relatively restricted.

This research is extending the Majchrzak et al model of AST. The Majchrzak model used just one "technology" structure but with two subcategories. For Web technology in particular, the two aspects of technology are sufficiently distinct to be treated as two, separate structures.

- technology features: for the Club this is various forms of communication via an organisational website
- technology spirit: alternative, efficient and effective means of communication

The Club example also indicates a further complexity for the e-commerce AST model: there may be more than one technology to be considered.

The Club intended that a website would supplement existing voice- and paper-based communications – but the voice and paper communications would be retained. There is not necessarily an either-or choice of technology; several communication technologies may be in use at the same time, in the same organisation. How will this affect use of the AST model?

There are several options. One, we can consider all means of communication as being part of the one technology structure. Two, we can include multiple technologies in the model and deal with each as a separate structure. Three, we can focus on the "new" technology of a web-based information system, with older technologies included as part of the other structures.

The Majchrzak paper (Majchrzak, Rice, Malhotra et al., 2000) uses – implicitly – the third option. The paper deals with the effects of a single collaborative technology. Alternative means of collaboration (written reports, conversations, etc) are dealt with as changes within the task, work group or organisation structures.

To determine the best option we need to consider both features and spirit of the various technologies. In the Majchrzak paper, features varied across the technologies. Spirit also varied, since team sharing of information was a key feature and intent of the collaboration system. Using these pre-e-commerce technologies, the differences in features and spirit indicate that option two is suitable, to deal with each technology as being a separate structure.

Comparing web-based, paper and voice technologies, the features vary with the technology. The intent of the Club website was, initially, to provide an alternative means of communication, to supplement existing voice and paper communications. On the other hand, at least one improvement has been considered that would also result in a changed spirit for the Web technology: the Web could be used to support a "virtual" discussion group. Further, as website communications become more common, other communications may be reduced. The various technologies affect each other.

The differences in features and spirit indicate that each form of technology should be treated as a separate structure. The idea that changes to one technology may result in adaptations in another further supports this view. In my extended AST model there may be more than one technology, each with its own, independent but adaptable spirit and features.

New Structures So Far

To summarise, these are the key changes to the AST model that I have identified so far:

- Web technology is – by its basic concept – intended for use across more than one organisation. Web-based "technology" is still the central construct for AST analysis. There may, however, be other related technologies, such as paper. Each technology will consist of two structures.
 - Technology spirit is the structure representing the intent, objectives or attitudes encouraged and supported by the technology
 - Technology features are a separate structure consisting of activities which may be done or supported by the technology, the visible aspect of the technology; features are the means of supporting the technology spirit
- The task structure is no longer unique. The e-commerce information system may support a number of organisational tasks – such as purchasing and sales. Thus there may be more than one "task" structure within each organisation.
- "Work group" and "organisation" are no longer clearly identifiable structures and there are multiple versions of each. I have replaced them with "management" and "staff".

- In earlier AST models "organisation" represented the controlling group of decision-makers within the one organisation. I have clarified this role by defining the "management" structure of organisational decision-makers. There will be one management structure for each organisation that is affected by the new technology.
- Groups may include multiple organisational levels, so "work group" is too narrow a title. I have identified "staff", with the defining feature that a staff structure has responsibility for day-to-day operations of a task within an organisation. There will be at least one "staff" structure per task.

Beyond the Organisation

There is a further complication in the application of AST to development of an organisational website: Every Web surfer is a potential user of the Web technology. Technology that has been adapted for use by Club committee and members is also available for use by non-members, including potential Club customers. Where the CT team used communication technology to support its development of a totally separate product, the Club task includes development of the communication product itself, the website.

Club committee members, employees and members have been encouraged to use the site. Any Web surfer may have access to the Club website. Structural adaptations of the Web technology may suit the Club committee, employees, members, potential Club members, and any Web surfer who accesses the site. Use of the site may then result in adaptations of the structures of any of those groups: committee, employees, members, potential members and other Web surfers.

Due to the public nature of the Web, we have two new groups to consider for our AST analysis: Web users who are members and those who are not members of the Club. Club members who may gain membership-related benefits through use of the Club website may be willing to adapt, in order to gain those benefits. The adaptations will affect their interactions and communications with the Club itself. Non-members and potential members may also adapt but in different ways to members. A key adaptation of interest to the Club will be if non-members choose to become members.

In other organisations these groups are equivalent to the organisation's "customers" and website "visitors". So there are two new structures to be considered:

- customers: members of the Club, customers of the organisation
- visitors: Web surfers including potential Club members or potential customers

Web Site Developers

There is one more area in which the Majchrzak et al study was less complex than development of an organisational website: Consideration of the people who do the technology development and implementation.

The virtual team of Majchrzak et al used a CT technology that already existed but that was adapted by the developer on request from the team. In an ideal situation, this is the way in which all technology applications are developed. In practice, a more complex situation may exist.

In the example of the Club, initial website development was done by an external organisation, selected by competitive tender. The Club agreed to the overall website design on the basis of a simple, textual block diagram. See *Figure 13 Sample Website Design Documentation*, below.

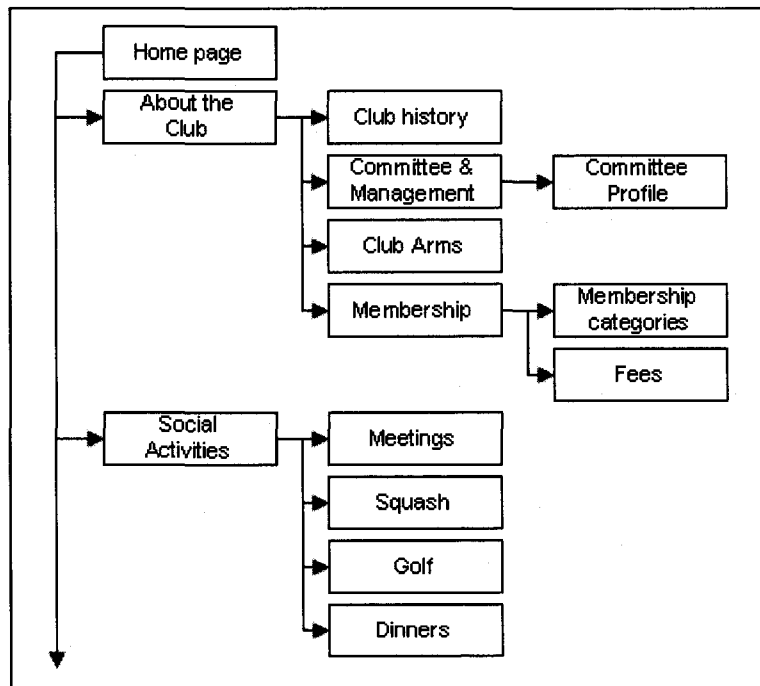


Figure 13 Sample Website Design Documentation

Source: author's professional work

It is very difficult to visualise a finished website from the block diagram. (It is interesting to note that the block diagram itself included simple errors which could have lead to later misunderstandings.) Features such as colour, content and interactivity were not defined in the initial design: That is, development itself involved a deliberate process of adaptive structuration. Features were subsequently implemented by the developers for approval or comment by the Club management. Management depended on the developers to provide good examples and then to adapt according to management suggestions. From this simple beginning, development of the Club website has already been through several distinct phases.

- In the first phase, the successful tender organisation developed a prototype website. The Club management team were responsible for working with the developers. The developers worked to a price, with a clear customer-supplier relationship.
- In the second phase, a Club member (myself) voluntarily acted as the key "customer representative". I took on single-point responsibility for most decisions relating to the developing website. A live website was implemented by the developer.
- Third, I took on the role of developer. Again, my work was as a volunteer and a Club member. Using my representative "authority" as a Club member, I made major changes to the structure of the site, and minor changes to style and content. This stage of development was limited by the developer's (my) range of expertise.
- The fourth distinct development phase was to pass responsibility back to a Web development company. This company has "professional" development expertise but the work is being done in exchange for membership of the Club. There was strong technical expertise but an unclear customer-supplier relationship.

Each of these four phases demonstrates a distinct change in the developer structure. The first two changed the interface between management and developer, the final two were completely new developers. In each situation there is a different mechanism for suggesting and agreeing changes to the organisational website. This simple example indicates that, for website development, the developer must be considered as a separate and important structure:

- developers: doing the "technical" implementation of the technology

Totally New Structures for e-Commerce

I have now added structures that did not exist pre-e-commerce but that are essential in consideration of web-based systems.

- Customers are a very "loose" structure, individuals within this structure may not interact with each other – but they are vitally important to the organisation
- Visitors to the website may have a positive or negative impact on the organisation, one positive result is that a casual visitor may become a customer

- Developers interpret intent of the owner of the website or e-commerce system; the interpretation may be accurate or not

7.5 Summary

Prior to my research work, our knowledge of AST (adaptive structuration theory) was based on situations where the central technology was collaborative technology (CT), group decision support systems (GDSS) and other, clearly defined applications with a limited range of users. Many organisations may use these technologies, but use of the Web is potentially universal. Adaptation and confirmation of AST in a Web-based e-commerce situation will be a valuable contribution to the theory. This research extends the adaptive structuration theory to include structures relevant to website technologies.

The pre-e-commerce model, as summarised and presented in Majchrzak et al, considers three structures: technology, group and organisation. A fourth structure, task, had been assumed constant in that particular case study. My extended e-commerce model for AST considers eight structures:

- there may be more than one technology, each with
 - **technology features:** that which may be done with an organisational website or e-commerce system
 - **technology spirit:** the intent of the website owners, as implemented by the developers
- **developers:** those responsible for technology design and implementation
- **task:** operations of the organisation, particularly those areas affected by the website; there may be several task structures
- **staff:** those within the organisation who support and use the website; there may be several staff structures

- **management:** responsible for ultimate decisions regarding the website; each affected organisation will have its own management structure
- **customers:** outside the organisation, using the website for its intended, customer-support purpose
- **visitors:** outside the organisation, using the website but not as customers

The extra structural areas reflect the increased visibility and accessibility of the Web, compared to the relative restrictions of the technology applications in earlier studies. The earlier model of AST is not suitable for application to Web technologies. As more and more organisations implement e-commerce websites, an understanding of the structures which may adapt will be more and more valuable.

7.6 Application of the New Theory to Practice

The new set of structures required by the extended AST model has been described and explained in terms of one small organisation. In order to provide initial confirmation and validation of the theory, this section concludes with the application of this part of the new theory to other case studies. Each case study has been described in section 2.4 *Case Studies in e-Commerce Implementation*, above.

As shown below, the new set of AST structures is relevant to each case study. The use of an extended set of structures increases the range of groups that we consider could be affected by the new e-commerce systems. By considering a more complete group of affected structures, we would be more likely to correctly anticipate – and thus successfully manage – the implementation of the new information systems.

Leonardo's Vineyard

The following table (*Table 3 Leonardo's Vineyard Structures*) summarises the structures involved in this case study. The e-commerce system went through several stages, each of which is shown in a separate column.

Table 3 Leonardo's Vineyard Structures

structure	application to the case study		
	stage 1	stage 2	stage 3
technology features	online tender	email list, online tender	email list, online ordering
technology spirit	maximise sales price, minimise cost of sales	as for stage 1, plus increased customer list	improved customer relations, simplified sales
developers	website developers	website developers	website developers
task	sell wine through an online tender system	manage customer list for annual tenders	sell wine through an online order system
staff	vineyard staff	vineyard staff	vineyard staff
management	Leonardo	Leonardo	Leonardo
customers	wine buyers with online access	wine buyers with online access and no sensitivity to price	retailers and other wine buyers with online access
visitors	web surfers	web surfers	web surfers

Source: author's interpretation of Sellitto & Martin, 2003

Benefits from the New Structures

A major difficulty with this case study was the "considerable criticism" from wine retailers. Stages 1 and 2 dealt only with individual buyers and effectively excluded retailers. It is possible that an early analysis of affected structures would have avoided this problem, by reminding Leonardo that wine retailers were also customers. (Of course it is also possible that a desire for extra profit would have led Leonardo to discount the potential problem.)

Identification of customers as requiring "online access" would have indicated that cellar door sales would cease, or would have resulted in consideration of a second group of customers, those "at the cellar door". (From reading the case study it appears that this is not a problem. It may even be a benefit.)

A consideration of technology spirit for stages 1 and 2 could have highlighted potential problems. With a spirit to "maximise sales price", problems could be expected from traditional buyers who did not want to pay a maximum price. Thus my new set of AST structures would have allowed Leonardo's to benefit by early technology adaptation in order to maintain good customer relationships.

Tail and Dog Online Publishing System

The table below (*Table 4 Tail and Dog Structures*) summarise the e-commerce structures for this case study. The business went through four distinct stages, as the business plan was modified to look for a successful business model. The four stages are shown as four separate columns in the table.

Table 4 Tail and Dog Structures

structure	application to the case study			
	stage 1	stage 2	stage 3	stage 4
technology features	online e-zine publication system	event notices and sale of associated merchandise	micro-site development and management	website development package
technology spirit	provision of "a fresh and hip product that constantly strives to strengthen its brand", supported by sales of advertising	a central site for entertainment news, supported by sales of advertising	an entertainment-related set of websites, supported by companies buying a location within the site	generic software for sale to other companies
developers	product: John's university team for database development pizzazz: Marcel's national.com team for development of content and presentation	John's team Marcel's team	John's team Marcel's team for micro-site sales and development	John's team for software packaging Marcel's team for package sales
task	publish articles and advertisements online	publish articles, advertisements and event notices sell merchandise	develop and manage micro-sites within the website	develop websites
staff	Marcel's national.com team	Marcel's national.com team	Marcel's team and micro-site advertisers	other companies

structure	application to the case study			
	stage 1	stage 2	stage 3	stage 4
management	Marcel (although John has some influence)	Marcel (although John has some influence)	Marcel (although John has some influence)	Marcel (although John has some influence)
customers	web surfers (specifically, "25 to 34 year old Canadians who use the Internet on a weekly basis")	web surfers	advertisers	other companies
visitors	web surfers	web surfers	potential advertisers and web surfers	any other company

Source: author's interpretation of Chiasson, 2002

Benefits from the New Structures

First, it is clear that the extended, e-commerce set of structures is suitable for use with this case study. Second, identification of the structures highlights a possible source of difficulty as the company (national.com) changes its business plan: each stage of change involves new structures that will be affected.

For example: as the technology features are changed, the technology spirit will also change. Changing the spirit – the owner's intent for the website – will require changing the overall approach taken by the "product" developers. In order to match product development to owner intent, close communication may be necessary. An early analysis of the structures could have indicated this potential need for good communication – and reduced the conflict between the product development team and Marcel, representing management.

The new features lead to new tasks, new staff and new customers. Each of these new structures will involve change – change which must be effectively managed. The analysis of structures also highlights the existence of two groups of system developers, only one of which is directly managed by the start-up company.

Adding new features to an information system may appear to be a simple task. Highlighting the changes to structures, at each stage of information system development, highlights the complexity of the planned changes. Early analysis of the structures can be used to better prepare for the effect of the proposed changes. It could have reduced the conflict described in the case study, as features, spirit and task were all changed.

8 An Impact Scale for e-Commerce Adaptations

The material in this section is an extension of my paper that was presented at and published in the proceedings of the international ACIS 2003 conference (Lethbridge, 2003a). The paper was peer reviewed before acceptance. Some changes have been made based on feedback during and after my presentation.

Abstract

An earlier scale for technology "reinvention" required comparison against "ultimate functionality". This is not practical with a website that is continuously under development. This section of the research thesis develops a scale for the impact of adaptive structuration on website and e-commerce technology structures and user structures. The new scale has, in order of increasing impact on the structure, four key points: refine, extend, redesign and transform. When considering a possible change, the change should be placed independently on the impact scale for each relevant structure. Whether the changes emerge or are planned, placing each change on the scale will give an early indication of the potential impact of that change.

8.1 Introduction

The implementation and use of new technology is not a deterministic process: Technology is not simply installed and run according to predetermined methods. In practice, new technologies are adapted ("structured") by users to suit user requirements. This has been researched and explained using Gidden's "structuration theory". ((Majchrzak, Rice, Malhotra et al., 2000) provides relevant references.) The technology is implemented, the technology is then adapted by its users.

Research also found that user structures themselves adapt in response to the new technology. That is, both technology and user structures will adapt to each other. The adaptations may be non-deterministic (emergent) in response to perceived problems, or they may be initiated by management. Adaptations may be gradual or they may be discontinuous (Majchrzak, Rice, Malhotra et al., 2000). The process of adaptation is described by *adaptive structuration theory*, or AST.

AST examines the way in which technology is adapted to suit the needs of a particular organisation and the way in which the organisation adapts itself in response to the technology. These mutual, reciprocal adaptations need not be driven by the organisation. Rather, they emerge in response to the varying situations as the organisational structures impact on each other. "To date, only adaptive structuration theory (AST) offers the promise of satisfying two requirements for explanation based on an emergent perspective: recursivity and unique effects" (Contractor & Seibold, 1993).

Unexpected adaptations may make it difficult for an organisation to gain maximum benefit from new technology. Understanding of the impact of possible adaptations would improve the level of benefits to be gained, because the organisation could better recognise, guide and prepare for changes as they occurred. If change is expected and understood then there is a better chance to manage and control its effects on the organisation.

This section of the thesis develops a suitable scale for adaptive structururations. Use of the scale will help understanding and management of developing e-commerce and website technologies.

A decade ago, Nagasundaram & Bostrom wrote: "Radical and discontinuous change is the order of the day in the 1990s." They saw that corporations, large and small, were using methods such as TQM (total quality management) and BPR (business process redesign) in an attempt to create new organisational forms that would enable success. To stay ahead in the highly competitive market environment, organisations also needed a steady stream of new products and new services. (Nagasundaram & Bostrom, 1994/1995)

Today, there is a need for more than new products and services. To be successful, an organisation may need to implement new business processes within the new business and market environment of the World Wide Web. At the same time the increased communication abilities of the Web allow, or even force, new organisational forms. The Web may be used to introduce any or all of new organisational structures, new products and new services.

In 1988 Leonard-Barton wrote: "New production technologies are known to be competitive weapons, but their implementation is at least as challenging a managerial problem as their invention." Further, "The initial implementation stage is particularly crucial... It is argued that technology transfer requires continuous, ongoing dedication to the process of change and the conscious management of mutual adaptation because the technology will never exactly fit the user environment." (Leonard-Barton, 1988)

In 1994, DeSanctis & Poole wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an important theoretical paradigm for comprehending the impacts of advanced information technologies" (DeSanctis & Poole, 1994). In 2002 that statement was considered sufficiently current to be quoted in a research article (Salisbury et al., 2002). Also, "It is suggested that further research is undertaken into the 'adaptive structuration' theory" (Kim, 2000). Majchrzak et al continued the research with a major advance in our understanding of the adaptation process (Majchrzak, Rice, Malhotra et al., 2000). This thesis extends the AST model as described and clarified in Majchrzak et al.

8.2 Adapting to New Technology

Previous AST research has investigated implementation of various technologies, including GDSS (group decision support systems) and CT (collaborative technology). These technologies each offer a specific application that will be used by a clearly defined and tightly restricted group of users. Websites and e-commerce, in contrast, provide a very broad range of technology options and potential users.

GDSS and CT are applications of technology that are specifically aimed at changing interpersonal communication processes. The Web enables communication between individuals, organisations and systems. Theories developed for GDSS and CT may equally be applied to Web technologies. This section of the thesis takes AST (adaptive structuration theory) as developed after study of GDSS, CT and other technologies and applies a key aspect of that theory to implementation of an organisational website.

In 2000, Majchrzak et al reported a study of a virtual work team using a CT (collaborative technology) application throughout a ten month project (Majchrzak, Rice, Malhotra et al., 2000). As the project progressed, the team adapted both its own structures and those of the CT. In order to improve our understanding of the adaptation process, Majchrzak et al addressed four research questions. The two relevant questions and results are outlined below.

"(3) After the initial adaptation to achieve alignment, does the workgroup experience the need for further adaptations?" The research by Majchrzak et al found that their study group did experience the need for adaptations as the project progressed. The adaptations were not, however, a series of changes that converged on a suitable set of structures; The changes were in response to changing task requirements. The initial adaptations may have suited the initial task but the developing task necessitated new adaptations.

"(4) What is the nature of these adaptations: are they discontinuous, responding to windows of opportunities, or are they continuous, gradually closing misalignments?" Majchrzak et al found that the adaptations were discontinuous. They were not, however, responding to windows of opportunity. Rather, there were sporadic changes in response to discrepant events that were seen as being problems. There were no clear windows for adaptation. Discrepant events were almost continuous and resolution could take any time from minutes to weeks.

Discrepant events take varying levels of effort to resolve. For any discrepant event there could be a choice of several adaptations, each providing resolution but each with a different impact. How do we manage the adaptation process? How much effort is it worth investing in managing the impact of a particular change? How severe an impact is the change likely to have? This section develops a simple analysis to evaluate the potential impact of adaptations.

Web-Based Case Study

To explain and demonstrate adaptations related to Web-based technology, I will use a particular case study organisation. It is a small organisation with clear objectives. Its current operations are strongly based on provision of physical services at a fixed location. It developed a website, although the purpose and method of operation of the website were not immediately clear. Development involved adaptation of Web (technology) structures, it also led to adaptation of the structures of the organisation itself.

"The Club" provides a meeting place for business people:

[The Club] is the leading business and professional persons' Club in [the City]. We offer the privacy and warm ambience that only a private Club can provide. The Club is a place to build long-term friendships and business relationships founded on high ethical standards. We provide a slightly conservative Club culture, modern but with a respect for traditional values. We are a Club of non-political character, for the interaction, enjoyment, entertainment and comfort of our Members and their guests. We encourage Membership from metropolitan and country areas throughout [the State]. (from the Club's website, October 2002)

This is a traditional "community" with a fixed physical focus and a common purpose. The physical focus is the Club-owned premises in the city centre, which provide the main benefits for members. The premises include a restaurant, cafe, meeting and function rooms, squash courts and a gym. The "members" of the Club are equivalent to "customers" of other forms of commercial organisation.

The Club provides a neatly bounded environment for explanation of the extended model for AST (adaptive structuration theory). The next section provides groundwork, by examining one aspect of the AST model: a scale for the adaptations which may occur.

8.3 Levels of Adaptation

Technology and the organisation adapt in response to each other; this is the "adaptive" part of adaptive structuration theory. "Structuration" refers to the changes, where the structures of the technology and of the organisation are adapted (changed) as a result of the technology-organisation interaction.

Adaptation as Reinvention

Using the language of Scott et al, implementation of a website requires "reinvention" of the Web technology. Reinvention is simply a more descriptive word for the process of adaptation. It is "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" ((Rogers, 1995) quoted in (Scott et al., 1998)). Reinvention "appears to be the norm for many innovations" (Scott et al., 1998).

The Club website has, to now, been through four stages of reinvention. Stages one and two each used the same underlying technologies but the visible features were slightly adapted between stages. Several major but incomplete features of stage one were removed from stage two. Stage three involved completely new underlying technologies (a complete rewrite using a new development package) but the visible features were largely unchanged. Stage four involved another complete rewrite that maintained existing visible features but the appearance of some features was changed and new features were added.

The technologies of the Web are as much opportunities as applications. The Web provides the opportunity for improved communication, both within and without the organisation. It is left to the organisation to determine the ways in which this improved communication may be used to benefit the organisation. The underlying Web technologies may be relatively stable but the visible applications may vary enormously.

The Club aim is for a website that supports and enhances but does not replace existing Club functions. Online payment of Club accounts (that is, payment by members to the Club) is a completely feasible application of Web technologies. It has not been implemented. The opportunity is there but the Club has chosen not to use it. Instead, the Club has chosen to provide online information on payment options, including the option of direct bank-to-bank payment that is managed through the websites of members' banks.

"A technical system transferred from a development site to a user site always encounters differences in context: equipment, operators' skills, and performance rewards all may differ" (Leonard-Barton & Sinha, 1993). The Web is a technical system: Its basis is technology even though (as indicated by both common sense and by AST) it operates in, affects and is affected by a sociotechnical system.

The Web is a technical system that is under constant development. The "development site" is world-wide, in numerous research, development, commercial, industrial and personal work areas. At some point, an organisation may elect to implement some application of Web technology. At that point, the Web-under-development may be stabilised and adapted to the context of an operating organisational environment.

Even then, when Web technologies have been selected and a website is being developed, there is adaptation. The site may be implemented in stages, with each new stage bringing its own adaptations. The fully implemented website may be rewritten in response to new Web technologies or new management requirements. For as long as it exists, a website is likely to be in a constant state of reinvention. At the very least, a website will reflect changing business requirements by undergoing a process of incremental change.

The Club has developed its website and then reinvented it several times. Redevelopment from stage two to stage three did use new technology. The key reason for redevelopment was to satisfy the management requirement for better control and reduced cost of the development process. Stage four redevelopment again used new technology but this stage had an underlying reason based on management requirements, to reintroduce the facility for Club staff to update variable data on the website.

A Scale for Reinvention

Leonard-Barton & Sinha provides a quantitative set of measures for the level of technology reinvention. System adaptation is calculated from (1) a system's initial functionality, defined as the percentage of its ultimate functionality that is available at the time of the pilot test, and (2) the change in its functionality between the pilot test and general release into the production environment. The organisational adaptation is measured as a function of changes: user retraining, procedural changes, reward system changes, and equipment changes. (Leonard-Barton & Sinha, 1993)

Using these quantitative measures, the Club website has had only a low level of reinvention. Stage one created a pilot site, stage two moved the pilot site into production, stages three and four changed the production site. If stage four, the current website, reflects ultimate functionality then almost all features of the ultimate site were available in the pilot version. (In fact, the pilot version included features that have since been removed from the production version: the production version has less features than the pilot.)

A difficulty with the application of this quantitative measure is the way in which the Club website has been developed: There is no "ultimate" organisational website, the website will continue to develop for as long as it exists. So far, for example, the site offers largely one-way communication from the Club to its members and to other Web surfers. A potential development is to build a Club-based online community, with computer mediated multi-directional communication between Club members. This will involve a major reinvention of the website – if and when it occurs.

The Web is new and developing technology. An organisational website reflects the unique features of each organisation, so each organisational website is unique. In order to maintain that uniqueness and to take advantage of technology developments, the Club website is expected to be under continual development. The newness of the Web also means that most Club managers are not aware of its full potential, so website development reflects lessons learnt along the way. As managers see what can be done, they are able to visualise further improvements.

All of this means that "ultimate functionality" is a moving target. AST in part predicts this difficulty. As stated earlier, "Adaptations will continue to occur but at irregular intervals." On top of this adaptation – in systems development terms, maintenance and minor enhancements – there may be major site changes. If the business changes, or available Web technology changes, or a competitor's website improves, or the site is simply successful enough to justify the effort – the website will continually change and grow.

In the decade since Leonard-Barton & Sinha developed their measures of reinvention our understanding of adaptive structuration has improved. Web technology is unlikely to have a measurable "ultimate functionality". The developing and learning nature of Web technologies – and the reality of changing organisational requirements – are unlikely to allow a clear end-point against which to measure the level of technology reinvention.

Similarly, organisational adaptation is not subject to absolute quantitative measurement. In qualitative terms, however, the Club has made some simple procedural changes and provided informal training. The website is seen as an extra means of communicating with Club members, it does not replace the existing mail and voice communications, there are no online commercial transactions. The level of reinvention is low.

Yet the website development has led to adaptations in a related area: email communications. The developers of stage four of the Club website have also improved the quality of email design. They have taken design work from the website and applied it to email bulletins to members. The Web redevelopment resulted in adaptations to a user structure, the development work group. This in turn resulted in adaptations to a related technology, the use of regular emails to Club members. The change from early email formats to the current email bulletins represents a high level of technology reinvention.

From the above discussion, the key points of reinvention are:

- Reinvention is the level of change as a new technology is implemented
- A website will be in a constant state of reinvention
- An absolute measure of the level of reinvention is impractical and perhaps even impossible
- Implementation of one technology may lead to reinvention of another

The concept of reinvention provides one way of measuring the level of adaptation as a new technology is implemented within an organisation. A more viable alternative is to adapt terms from creativity research, to measure the changes in terms of *adaptation* and *innovation*. In the rest of this section I take these concepts from an unrelated field and use them to develop a viable scale to measure the relative impact of changes on the various structures that are subject to adaptation.

A Two-Point Scale

For individuals, adaptive behaviour may take the form of either adaptation or innovation. This relates to the form of change that will be attempted as a first response to a problem within a system. The following description is based on Kirton's research on creativity ((Kirton, 1987) as described in (Nagasundaram & Bostrom, 1994/1995)).

Some individuals, when confronted with a problem, turn to conventional rules, practices and perceptions of the group to which they belong. These *adaptors* drive their ideas towards a solution that is based on the established procedures. When established procedures provide no answers, adaptors will attempt to adapt or stretch a conventional response until it provides an effective solution. This characteristic behaviour is adaptation.

Innovation, on the other hand, is the characteristic behaviour of individuals who initially look for non-conventional solutions. An *innovator* confronted with a problem will attempt to reorganize or restructure the problem, and to approach it in a new light. The innovator will be free of the customary perceptions or presuppositions which would be the starting-point for adaptors.

Innovators are likely to produce answers which are less predictable and thereby sometimes less acceptable to the group. Neither of the two styles is necessarily superior. Specific contexts demand one style rather than the other and organizations typically experience various contexts at various times.

Within AST, adaptive structuration may result from either adaptation or innovation, applied to any of the relevant structures. Alternatively, structural changes may be placed on a scale with adaptation and innovation as the extremes of the scale. This will provide a measure, or an indication, of the extent and type of the adaptive structuration that is occurring.

At the Club, structural changes have varied from adaptation to innovation, with most being at the adaptation end of the scale. Even the initial decision to implement an organisational website was adaptation rather than innovation: the site was seen as being no more than an extra means of communication with Club members. There were no expectations that existing means of communication would be affected. There were no expectations of more than minor changes to existing organisational structures.

Stages one and two of the Club website were straight adaptations of existing information into an electronic form. For example, the Club arranges occasional sports challenges between members. There are four sports which are each played once or twice a year, each sport was given its own Web page for announcements and challenges. Since the challenges were very irregular, each sports page was almost static. This matched the rare mentions of each sport in the printed newsletters: a one-for-one adaptation of existing structures.

When I redeveloped the website (stage three) my effort included rationalisation of the page structure. Sports notices (for example) were amalgamated onto one Web page, to increase the apparent level of activity and hence interest in the sports notices. This was an innovative change, it could be said that I was, as described above, "free of the customary perceptions or presuppositions" that had resulted in separate Web pages for each sport. In absolute terms, however, this change was hardly innovative and far closer to simple adaptation, "a solution that is based on the established procedures". It was equivalent to moving all sports results onto one page of a printed newsletter.

Since "adaptation" seeks to work with existing procedures it will have minimum impact on existing structures. This is simply an inverted view of the definition of adaptation. Innovation, however, will have a more noticeable impact: The innovator is willing to change existing structures in order to find a solution.

We now have a very simple scale for structural changes in response to new technology. As shown in *Figure 14 Impact of a Change on Related Structures* (below), changes may be either adaptations or innovations, and innovations will have a higher impact on existing structures than will adaptations.

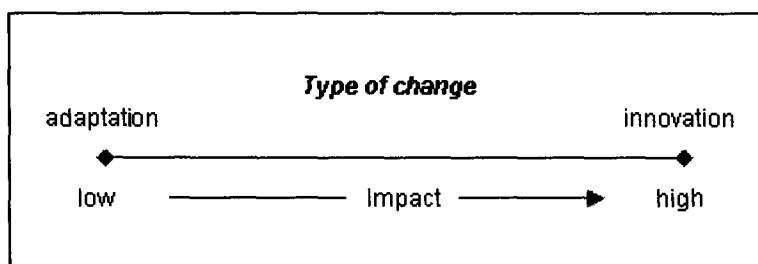


Figure 14 Impact of a Change on Related Structures

Source: author's research

So far, there are only two clear points on the scale of impact of change. The next step is to define intermediate points.

Varying Levels of Innovation

Kirton's findings have further application to AST, when considering the types of modification that may be introduced. Kirton discussed elements and context. In the following paragraphs, I relate Kirton's ideas to the concepts of AST.

Structures are the rules and resources used to generate and support a system. A system, in this sense, is a social group or organisation that acts in such a way that there are observable and consistent patterns of inter-personal relations. As defined within the AST model, structure has two parts. First is the spirit, or generally accepted objectives and attitudes promoted by the structure. The second part consists of the specific structural features that implement the spirit promoted by the structure or the system. (Gopal et al., 1992-1993)

In Kirton's analysis a new idea, a solution to a problem, may affect either the "elements" of the paradigm (or system) or the "context" of the paradigm. The elements are the ideas that form the basis of the paradigm; this has a direct correlation to the spirit of the structure that is one aspect of AST. The context, on the other hand, is the relationship of ideas within the paradigm. Altering the relationship of ideas is equivalent to changing the features of the relevant structure.

Thus Kirton's description of the way in which systems may be adapted is related directly to the way in which adaptive structuration may apply to the spirit and the features of a structure. This parallel leads to four possible categories of adaptive structuration: Refine, Transform, Extend and Redesign. These are summarised in *Figure 15 Grouping by Adaptation and Innovation* (below). An adaptor will prefer the first of these, Refine. An innovator will prefer ideas that result in Transform, Extend or Redesign.

Spirit of the structure	New ideas (change to spirit)	Redesign (paradigm modifying, innovation)	Transform (paradigm modifying, innovation)
	Old ideas (same spirit)	Refine (paradigm preserving, adaptation)	Extend (paradigm modifying, innovation)
		Old (same) features	New features
		Features of the structure	

Figure 15 Grouping by Adaptation and Innovation

Source" author's research

The table allows adaptations and potential adaptations to be grouped: by impact on features and spirit of the structures. Use of the above table indicates that Club website development has included a number of innovative adaptations, changes involving either new ideas (changes to the spirit) or new features. Some of these adaptations are described below.

Stages one and two were definitely "old ideas". The spirit of the technology was being maintained, only the technology was changing. That is, the new technology of the Web was being used but the purpose was the same as for the old paper and voice technologies: to communicate with Club members. There were new features in use, technology features that were available with the Web but not with voice or paper. This places the initial development into the "extend (paradigm modifying, innovation)" quadrant.

The Club sports notices described earlier could be seen as being "refine (paradigm preserving, adaptation)". Old ideas and old features of technology were still used. Pages were linked in an hierarchical tree structure: this was a direct copy from the older, hardcopy newsletter. In both newsletter and initial website, the tree structure was implemented as a "sports report" page which included a number of notices and reports grouped by sport. The sports report page was within (or linked under) a newsletter, which in turn was under Club publications.

By the third stage of website implementation, however, the idea was new: Rather than report on each sport on its own, information was grouped by type of information. So "coming event notices" for all sports were in one part of the tree structure and "event reports" for all sports were in a separate part of the tree structure. Relative to the simple adaptation of codifying information to be presented on a website, this was an innovation: a Redesign of the website.

The examples so far have involved adaptations of the technology structure. A key understanding within AST is that user structures may also adapt. For each adaptation we will need to consider the position within the Grouping matrix (*Figure 15 Grouping by Adaptation and Innovation* above) for each of the structures. An adaptation that simply "refines" the website technology, for example, may "refine" or it may "transform" the user structures.

Changes to the organisation and work groups of the Club have, so far, been minimal. There have been some small changes to internal processes to ensure that the website is updated with new information. These changes are very clearly on the adaptation end of the adaptation-innovation scale: Old ideas were maintained and old features were slightly rearranged. This is a paradigm preserving adaptation, in the "refine" quadrant of the adaptation and innovation table.

There has been a proposal for the website that it should support a "virtual community". The Club is a physical community, a group of members who communicate through the physical means of meetings and newsletters. A virtual community would use the website to support computer-mediated communication, through electronic bulletin boards and chat rooms. This adaptation of the website would involve new ideas for the Club in its use of the Web. It would require a new technology spirit and use of new Web technology features. As such it would be a technology structure innovation, well up towards the innovation end of the adaptation-innovation scale. In terms of the table it would "transform" the website.

The same change, to build a virtual community of Club members, would also require innovation in changes to the user structures. The present spirit of each Club structure is built on the concept of the Club as a "community", an environment for meeting and exchanging ideas. At present the Club is a "physical" community. Extending the Club into a virtual community would maintain the old idea (as stated in the Club website) of providing "a place to build long-term friendships and business relationships". In order to communicate through the website with Club members, staff and management would need to adopt new features in their regular operations, new means of performing the task of communication. The organisation structures would need to "extend", to use new features to support old ideas in paradigm modifying innovations.

In this section I have developed the new idea that the level of structural adaptation may range from simple adaptation through varying levels of innovation:

- Adaptation: Refinement of the existing spirit or features of the technology
- Innovation: Changes to the spirit of the technology (redesign), to the features of the technology (extension) or to both (transformation)
- The adaptation-innovation categories apply to all structures, including technology, work group and organisation
- A single adaptation may fit in different categories, depending on the structure being considered

Two More Points on the Scale

The adaptation-innovation scale has been presented as a matrix, this is the obvious format for a scale based on two simple dimensions. In terms of visualising overall impact, however, the matrix view is inadequate.

A simple adaptation – refinement of old ideas and old features – will have minimal impact on both technology and user structures. Compare this to an innovation where both ideas and features are to be transformed: Due to the scope of the change, the "transform" innovation will have more impact than the "refine" adaptation. In AST terms, transformation will involve changes to both spirit and features, refinement will involve neither. On a simple scale, refinement will be at the low end of the impact scale, transformation at the high end.

Between the extremes of the scale we can place "redesign" and "extend". The first involves modification of the spirit, the second modifies the features. A change to the spirit, to the underlying purpose of a structure, will have a major impact on that structure. A change to the features, to the way in which the purpose is implemented, will have less impact: The underlying purpose is intact, only the way in which it works will change.

Changing either spirit (ideas, underlying purpose) or features will have an impact on the structure. The impact will be greater than that of an adaptation, a change which affects neither spirit nor features. On the scale of potential impact, "redesign" will have more potential impact than "extend". Neither of these will have the impact of "transform", where both spirit and features will be changed. The resulting four-point scale of impact due to adaptive structuration is shown in *Figure 16 Adaptive Structuration Scale of Impact*, below.

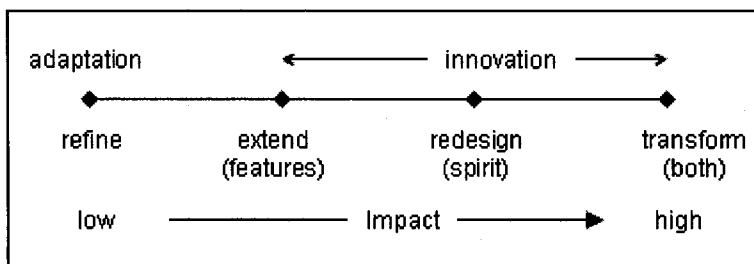


Figure 16 Adaptive Structuration Scale of Impact

Source: author's research

A New Scale to Support AST

I have developed the four-point impact scale (*Figure 16 Adaptive Structuration Scale of Impact*) because there was no scale suitable for use with web-based information systems. An existing scale had – as I have described – the limitation that it related level of reinvention to the "final" production version of an information system; this is not a practical measure for a website. By drawing on ideas from creativity theory I was able to create a qualitative scale which indicates the relative impact of any change.

The earlier scale measured reinvention, my new scale measures impact. The two are related since, broadly speaking, the more a system is reinvented, the more impact the change will have. My impact scale, however, offers more benefits to people who are planning or managing change to a website or e-commerce system: the higher the expected impact of a change, the more resources should be devoted to ensuring that the results of that change are beneficial.

8.4 Summary

My DBA research has now developed a scale for the impact of adaptive structuration on technology and user structures. In particular, my research has developed a scale suitable for use when the new technology is the Web. An organisational website is constantly developing, it is in a constant state of reinvention or (at least) incremental change. This lack of a clear endpoint makes a previously published scale of reinvention almost impossible to apply. A new scale of potential impact has been developed and shown in *Figure 16 Adaptive Structuration Scale of Impact* (above).

Although this research does not discuss creativity theory in detail, the new scale is based on ideas from that area of knowledge. There are four key points on the scale. In order of increasing impact on a structure, the points are: refine, extend, redesign and transform. Whether the changes emerge or are planned, placing each change on the scale will give an early indication of the potential impact of that change.

Adaptive structuration theory deals with the effect and impact of one structure on others. In particular, AST examines the reciprocal effects of the technology structure on user structures. When using the new scale of impact due to a change, a change in one structure may have the same or different impact on another structure. When considering a possible change, the change should be placed independently on the impact scale for each relevant structure.

8.5 Application of the New Theory to Practice

The adaptive structuration scale of impact has been described and explained in terms of one small organisation. In order to provide some confirmation and validation of the theory, this section concludes with the application of the new scale to the other case studies which have been described in an earlier section, *2.4 Case Studies in e-Commerce Implementation*, above.

Leonardo's Vineyard

The following *Table 5 Impact of Change – Leonardo's Stage 1* summarises the potential for change at the first stage of e-commerce development, the implementation of a system for wine sales by online tenders.

Table 5 Impact of Change – Leonardo's Stage 1

structure	change	ideas (old or new)	features (old or new)	position on scale
<i>technology feature:</i> online tender	from manual to Web-based	old	new	extend
<i>technology spirit:</i> maximise sales price, minimise cost of sales	from satisfying orders by time received to satisfying orders by tender price	new	new	transform
<i>developers:</i> website developers	from clerical employees to technical specialists	new	new	transform
<i>task:</i> sell wine through an online tender system	from order, deliver to tender, compare, deliver	new	new	transform
<i>staff:</i> vineyard staff	no change	old	new	extend
<i>management:</i> Leonardo	no change	old	old	refine
<i>customers:</i> wine buyers with online access	from cellar visitors and mail orders to online orders	new	new	transform
<i>visitors:</i> web surfers	from cellar visitors to website visitors	new	new	transform

Source: author's application of new theory

Benefits from my New Scale

The analysis in the above table provides interesting insights into the potential impact of the changes at Stage 1. For example, the customers – who would be expected to be key players in any business – will be expected to "transform" the way in which they deal with Leonardo's. This is a high impact change for the customers. Will they accept this change?

- This simple analysis would indicate – if done before the change – that customer adaptations will be at the highest level of impact. Care should be taken to effectively manage the change for customers. If this analysis had been done, some of the actual customer-related problems may have been avoided.

When considering a new website, Leonardo's management may have considered the impact on their own staff and management. As seen in the table, this impact will be quite low, extend and refine. Staff will need to do some low level innovation, to extend the way in which they deal with customers. Management will need only to refine their activities. If the analysis had stopped here – as it apparently did – then Leonardo's would have anticipated an easy implementation of the new Web-based system for wine sales.

If Leonardo's had considered the impact of the change on all structures, they would have realised that there would be a high impact of the change on several structures. In particular, the technology spirit, task and customers would be affected by the highest level of impact. With this knowledge – in advance of the change – Leonardo's could have managed all of the changes more effectively.

Tail and Dog Online Publishing System

The following *Table 6 Impact of Change – Tail and Dog Stage 3* summarises the potential for change at the *third* stage of e-commerce development, the change from a B2C entertainment site, paid for by advertising display, to a business model which earns revenue by supporting advertisers' micro-sites within the main site. That is, advertisers pay for a part of the site rather than paying for advertisements inserted within e-zine articles.

Table 6 Impact of Change – Tail and Dog Stage 3

structure	change	ideas (old or new)	features (old or new)	position on scale
<i>technology features:</i> micro-site development and management	from display of e-zine articles to management of advertisers' websites	new	old	redesign
<i>technology spirit:</i> an entertainment-related set of websites, supported by companies buying a location within the site	from publication to website support services	new	new	transform
<i>developers:</i> John's team	John's team: no change	old	old	refine
Marcel's team for micro-site sales and development	Marcel's team: from publication to sales and website development	new	new	transform
<i>task:</i> develop and manage micro-sites within the website	from e-zine publication to website sales and support	new	old	redesign
<i>staff:</i> Marcel's team and micro-site advertisers	no change	new	new	transform
<i>management:</i> Marcel (although John has some influence)	no change	new	old	redesign
<i>customers:</i> advertisers	from providing advertisements to building websites	new	new	transform
<i>visitors:</i> potential advertisers and web surfers	no change	old	old	refine

Source: author's application of new theory

Benefits from my New Scale

The above analysis highlights the difference between technology features and technology spirit. This third stage of e-commerce development uses existing features of the technology but with new ideas, resulting in a redesign of the features. So the change involves innovation to the technology features but not at the highest level of impact. The technology spirit, however, is transformed, the highest level of impact.

- I have defined spirit as being owner's (Marcel's) intent as interpreted by the developers (John's team). The technology spirit is to be changed at the highest level of impact; the product developers are involved in a low impact "refine" change to the website. This simple analysis would have indicated a potential source of conflict between the developers making a low impact, minor change and the owners expecting a high impact, major change. The differing expectations could then have been managed more effectively.

Similarly, Marcel's team of developers will need to change their structural features (what they do as developers) and their ideas, from publication of an e-zine to sales of website services. John's team will simply refine what they already do, Marcel's team will transform. The impact on Marcel's team will be higher than the impact on John's team.

An analysis of the impact of change – if done in advance of the change – could have indicated the likelihood of a high impact on technology spirit, Marcel's team, staff and customers. Given this high level of impact on key structures, difficulties would be expected. Although the paper (Chiasson, 2002) does not detail difficulties at this point, it is interesting to note that national.com very quickly moved their strategy past the development of advertisers' micro-sites. This could indicate that there were, in fact, difficulties with stage 3 – as indicated by the brief analysis using my new adaptive structuration scale of impact.

9 Categories of Change with e-Commerce

9.1 Introduction

Adaptive structuration theory (AST) examines the way in which technology is adapted to suit the needs of a particular organisation – and the way in which the organisation adapts itself in response to the technology. These mutual, reciprocal adaptations are not driven by the organisation. Rather, they emerge in response to the varying situations as the organisational structures impact on each other. "To date, only adaptive structuration theory (AST) offers the promise of satisfying two requirements for explanation based on an emergent perspective: recursivity and unique effects" (Contractor & Seibold, 1993).

In 1997 Chin, Gopal and Salisbury wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an influential theoretical perspective in research on advanced information technologies" (Chin et al., 1997). "It is suggested that further research is undertaken into the 'adaptive structuration' theory" (Kim, 2000). Majchrzak et al continued the research with a major advance in our understanding of the adaptation process (Majchrzak, Rice, Malhotra et al., 2000).

The emergent nature of the adaptations makes it difficult to plan for the changes. Unexpected adaptations may make it difficult for an organisation to gain maximum benefit from new technology. Knowledge of the types of possible adaptations would improve the level of benefits to be gained, because the organisation could then either recognise, guide or prepare for changes as they occurred. If change is expected then there is a better chance to manage and control its effects on the organisation.

For many organisations implementation of a Web site is a major, new technology. The potential for change from the introduction of new Web technology is a current concern for many organisations. This section of my thesis explores the types and categories of adaptations that may result when new Web technology is introduced into an organisation.

9.2 Organisations and Technologies

A decade ago, Nagasundaram & Bostrom wrote: "Radical and discontinuous change is the order of the day in the 1990s." They saw that corporations, large and small, were using methods such as TQM (total quality management) and BPR (business process redesign) in an attempt to create new organisational forms that would enable success. To stay ahead in the highly competitive market environment, organisations also needed a steady stream of new products and new services. (Nagasundaram & Bostrom, 1994/1995)

Today, there is a need for more than new products and services. To be successful, an organisation may need to implement new business processes within a new business and market environment: the World Wide Web. At the same time the increased communication abilities of the Web allow, or even force, new organisational forms. The Web may be used to introduce any or all of new organisational structures, new products and new services.

In 1988 Leonard-Barton wrote: "New production technologies are known to be competitive weapons, but their implementation is at least as challenging a managerial problem as their invention." Further, "The initial implementation stage is particularly crucial... It is argued that technology transfer requires continuous, ongoing dedication to the process of change and the conscious management of mutual adaptation because the technology will never exactly fit the user environment." (Leonard-Barton, 1988)

In 1988 the issue was new production technology. In the new century it is new Web technologies that are affecting all organisational processes from production, through marketing and sales, to long-term customer support and service.

Web technologies are pervasive, flexible and ever-changing. They will never exactly fit the user environment: by their very nature, Web technologies encourage change to every aspect of the user environment. Use of the Web will bring organisational change, the Web may be adapted to the user, the user may adapt to the Web. To ensure success, this process of mutual adaptation requires conscious management.

Previous Research

The Web provides a broad range of technology options and impacts. GDSS (group decision support systems) offer a specific technology application with less people likely to be affected. In the relatively narrow field of GDSS the factor of "organisational" adaptation appears to have caught early researchers by surprise.

"A recent trend in the [GDSS] literature has been the attempt to understand the process of [GDSS] use. This trend follows on the heels of early [GDSS] research efforts that sought to understand the effects of [GDSS] use primarily through the outcomes of such use. This early approach resulted in conflicting research results, as the influence of the process of [GDSS] use was often not considered." There was a resultant shift in focus, from direct study of the GDSS technology, to study of the use of the technology by members of a social system. (Gopal et al., 1992-1993)

That is, researchers began to look at the changes in organisational interactions as the GDSS technology was introduced.

GDSS is an application of technology that is specifically aimed at changing inter-personal communication processes. The Web enables communication between individuals, organisations and systems. Theories developed for GDSS may equally be applied to Web technologies. This thesis – the documentation of my DBA doctoral research – takes AST (adaptive structuration theory) as developed after study of GDSS, CT (collaborative technology) and other technologies and extends that theory to implementation of an organisational or e-commerce website.

Adaptive Structuration Theory (AST)

AST "has provided a useful framework for describing how group communication technologies are used in both expected and unexpected ways. These unexpected usages may have positive or negative outcomes. We believe the adoption of group decision support systems (GDSSs) in many organizations provides a situation in which a technology may not always be used in intended or anticipated ways" (Scott et al., 1998). It is this potential for unintended or unanticipated uses that is of particular interest for my own research.

In 1994, DeSanctis & Poole wrote that, "Adaptive Structuration Theory (AST) is rapidly becoming an important theoretical paradigm for comprehending the impacts of advanced information technologies" (DeSanctis & Poole, 1994). In 2002 that statement was considered sufficiently current to be quoted in a research article (Salisbury et al., 2002). Researchers have continued to develop AST, with a key paper being published in 2000 (Majchrzak, Rice, Malhotra et al., 2000).

A key thrust of the Majchrzak et al paper is to improve upon existing models of the adaptation process. This is reflected by the research questions posed (and answered) in that paper. Very briefly, the Majchrzak et al AST model indicates that any structure may be adapted and that adaptations are a result of sporadic and discontinuous misalignments between the structures.

Web-based Case Study

To explain and demonstrate the categories of adaptation related to Web-based technology, I will use a particular case study organisation. It is a small organisation with clear objectives. Its current operations are strongly based on provision of physical services at a fixed location. It has developed a website, although the purpose and method of operation of the website were not initially clear. Development involved adaptation of Web structures, it also led to adaptation of the structures of the organisation itself.

"The Club" provides a meeting place for business people:

[The Club] is the leading business and professional persons' Club in [the City]. We offer the privacy and warm ambience that only a private Club can provide. The Club is a place to build long-term friendships and business relationships founded on high ethical standards. We provide a slightly conservative Club culture, modern but with a respect for traditional values. We are a Club of non-political character, for the interaction, enjoyment, entertainment and comfort of our Members and their guests. We encourage Membership from metropolitan and country areas throughout [the State]. (from the Club's website, October 2002)

This is a traditional "community" with a fixed physical focus and a common purpose. The physical focus is the Club-owned premises in the city centre, which provide the main benefits for members. The premises include a restaurant, cafe, meeting and function rooms, squash courts and a gym. The "members" of the Club are equivalent to "customers" of other forms of commercial organisation. The Club provides a neatly bounded environment for explanation of the expanded model for AST (adaptive structuration theory).

9.3 Categories of Adaptations

Each of the identified structures (see *7 AST Structures for e-Commerce*, above) is subject to adaptive structuration. Potential adaptations will vary from area to area. In this section I define a possible categorisation of potential adaptations.

Majchrzak et al (Majchrzak, Rice, Malhotra et al., 2000) identified four general categories within which all of the CT (collaborative technology) related adaptations could be grouped. The categories were drawn from actual adaptations observed in a study based around CT technology. These categories are discussed below, and applied to the situation of website or e-commerce implementation. With explanations and examples I show that three of the four categories are as applicable to the website situation as to the use of a CT.

The numbered points in quotation marks are the categories from Majchrzak et al. Each point is followed by my own explanation of the way in which that topic may apply to the implementation of a Web-based information system. Only the last category requires more than a minor review.

In the following discussion, the Club case study is used to help explain the categories.

"1. Access to the communication tool (who gets access, when should they get access)"

I have renamed this category as, "Access to the website". The Web is in the public domain: it may be accessed by anyone, from anywhere in the world. Individual websites, however, may be made secure. A site or a part of a site may restrict access to known and identifiable people or groups. (For the purposes of this thesis I have not considered problems of security and security breaches.)

In the Club staff, management and customer structures there will be a large number of people who do not have access to the web. There will also be a separate group of potential members (customers) who do not have Web access. Given the physical nature of Club services and the type of members that it attracts, lack of web access is likely to be by choice rather than by misfortune. In principle, all groups get access as soon as the website is made available on the Web. In practice, it cannot be assumed that all members of the relevant groups will take advantage of that accessibility.

The issue of access is as important to a website as it is to a CT tool. My simple renaming of this category has allowed categorisation of a significant set of website technology misalignments, appropriations and adaptations.

"2. What knowledge is captured (what knowledge is captured, how is knowledge captured)"

The Club website began as an "electronic brochure": It provided information (knowledge) that could as easily have been printed. (Note that, for the purposes of this paper, the words knowledge and information are used interchangeably, as though they had the same meaning.) Since the Club continues to cater for members who may not wish to use the Web, all information on the website has also been made available as hardcopy. The first version of the site was created from information copied from existing, printed material; subsequent versions used and improved on this material. (Interestingly, some hardcopy printed material has also been adapted, as a result of the work on website development.)

Version one of the site allowed some information to be updated (captured) by staff, through a password-protected area of the site. Version two restricted update to the Web developer. This resulted in delays in the update process. Captured knowledge was then restricted to information that did not easily become dated, so the website lost its timeliness in order to not appear to be out-of-date. Version three reintroduced staff updates, however, there were still areas that required regular update by the developer.

None of the four website versions allowed knowledge capture by or from customers or visitors. Versions two and three allowed email from site visitors to Club staff but there was no automated transfer of this information from email to the Web site.

An organisational website is typically replacing or providing an alternative means to capture and transmit knowledge. It may be an important means of communication between the organisation and its customers and potential customers. At the same time, there may be a need to maintain more traditional means of knowledge transfer, such as printed hardcopy and face-to-face communication.

There is an effort involved in the capture of knowledge for a website. This effort will cost the organisation – or the customer – time and money. If the website provides a duplicate of knowledge available through some other medium then the effort of knowledge capture will be required for each medium; this will require increased levels of effort.

The category of knowledge capture is as important for website technology as it would be for the CT studied by Majchrzak et al.

"3. What helps knowledge sharing (what is shared, what helps sharing)"

All knowledge on the website is available for sharing with any Web surfer. The Club website has been through four major versions. All versions have allowed any Web surfer to have read-access to the bulk of the site. One "members only" area is password protected but there has been little information within that area of the site. At present nearly all information is shared, yet the password-protected area indicates an intention to restrict access to selected information. This could include, for example, members' personal and account details.

Consideration of "what helps sharing" covers two broad concepts. First, the website uses various techniques to simplify access to information. These include technology features such as hot links, and design features such as clear layout and simple site structure. Some features have come and gone with the various versions of the site. For example, version two ensured that the bulk of the text could be viewed with a larger font size by selecting the relevant option from the Web browser software. The Club has many older members, many would have weak eyesight, viewing with a larger font size would help the sharing of information with these older members. Versions one, three and four have a fixed, and rather small, font size.

This has led me to rephrase the sub-category "what helps sharing" to become "what features help sharing".

The second sharing-related concept could increase the complexity of the AST model.

The virtual team studied by Majchrzak et al used a CT; other means of communication were discouraged. Nevertheless, there was some non-CT communication. The Club website supports communication between the Club, its members and non-members. At the same time, most information is also available as hardcopy. In fact, there may be more Club-related information available as hardcopy than is available on the Club website.

In effect, there are two communication technologies in use simultaneously: Paper and Web. (Three technologies, if the spoken word is included.) At the heart of adaptive structuration theory is the technology. At the Club, as with the majority of existing organisations developing a website, there are more than one communication technologies. Where a project team may try to limit its communication to just one technology, an organisation may wish to communicate by as many technologies as possible. For some information, Web communication may replace paper. For other information, both web and paper will be used.

- Does this mean that the AST model should be extended to deal with two or more technologies? I discuss this question in a separate section of this thesis, *Technology Structures*, above.

The "what helps sharing" sub-category could be further extended, to become, "what technologies and technology features help sharing".

The Club website includes a "members only" area which is password protected. This area contains information which is available to Club members but not to other Web surfers. This restriction into public and private areas is a common feature of websites. It is a feature which reflects the underlying spirit, to provide some benefits that are only available to existing customers. (Club members are equivalent to existing customers of a commercial organisation.)

To match this aspect of the spirit of website technology, the sub-category "what is shared" will become, "how does the technology spirit determine what knowledge is shared". Changes which affect what knowledge is shared will be categorised as changes to the spirit of the website technology.

Thus the categories of adaptations related to website sharing of knowledge are going to cover a broad range of important concepts. My extended category will offer a useful and relevant grouping for the extended AST model.

"4. How are decisions made (who participates in what decisions, are technical requirements questioned)"

This final adaptation category has its basis in the underlying spirit of the technology. The spirit, or purpose, of a CT (collaborative technology) is to support decision-making. The underlying purpose of the Club website, however, is to support communication.

When the case study involves application of AST to an organisational website, the equivalent grouping of appropriations would be: How information is communicated (who participates in what communications, are technical requirements questioned)?

Thus the final topic within the AST model requires rewording, yet the essence is the same. It is a topic that is based on the spirit of the technology. As the spirit differs, from GDSS to Web, so too does the wording of this topic. As the category was useful for CT adaptations, so it will be valid when the technology is e-commerce and the Web.

9.4 Further Dimensions of Adaptation

This section of my thesis presents dimensions of AST that have not yet been applied to my version of AST that has been extended to apply to web-based information systems. These dimensions appear minor when compared to the question of, for example, which structures need to be considered. They are, however, key concepts that lie at the heart of adaptive structuration theory; they describe important aspects of the ways in which adaptations occur.

In my extended AST, these dimensions are unchanged. For completeness, in this section I explain each dimension in terms of the website case study of the Club.

Selective Appropriation and Adaptation

Organisational outcomes, successful or otherwise, are not simply a result of the use of new technology. The outcomes are affected by the way in which the various structures appropriate the features of the technology and by the way in which the organisational structures adapt their own structures in response to the technology. The organisation both adapts and selectively adopts (appropriates) features of the technology.

The organisational website for the Club began with a simple set of features. In keeping with its projected image of, "a slightly conservative Club culture, modern but with a respect for traditional values", the site is conservative in the features that it offers. Online payment, for example, is not offered. Online payment is a Web feature that was not appropriated.

Interactive update by Club staff is another feature that was selectively adopted, yet for different reasons. Online update was appropriated for stage one and two of website development. It was removed from stage three simply because the then-developer was not able to implement those features. (I was acting as an interested member of the Club to finalise the overall website layout. My level of technical skills restricted the features that I could support.) Stage four adopted, again, the staff update feature.

Ironic, Faithful and Hyperfaithful Adaptations

Another means of measuring, or characterising, the adaptive structuration process is described by Gopal et al: "The process can be characterized by the modes of appropriation defined in AST: faithfulness of appropriation, attitudes toward the [technology], and level of consensus on appropriation." (Gopal et al., 1992-1993) These provide three dimensions for measurement of adaptive structuration.

Faithfulness refers to the extent to which an organisation keeps to the spirit of the technology being used. At one end of the faithfulness dimension, a faithful appropriation supports the spirit. At the other end, an ironic appropriation goes against the intended spirit. An appropriation would be ironic if it went against a recognized way in which the technology were supposed to be used, or if it resulted in an outcome inconsistent with the goals of the technology.

There may also be two less obvious categories of ironic adaptations: unintended and hyperfaithful. Unintended ironic appropriations act against the original spirit of the technology. Yet the unintended adaptations were neither deliberately appropriated nor intended to be ironic. Hyperfaithful appropriations provide an extreme reinforcement of certain intentions or features of the technology. This reinforcement of faithful usage may act against the original spirit of the technology. Or, the reinforcement of selected intentions may act against other intentions within the original spirit of the technology. (Scott et al., 1998)

One feature of Web technology in general is the ability for the Web surfer, the person accessing and reading a website, to alter the size of the font display. This is a feature of standard Web browsers. Only development stage three of the Club website allowed this feature to be used. Stages one, two and four were developed using packages that overrode the font size feature and imposed a predetermined font size on all displays.

The Club has many older members, people who would be expected to require reading glasses simply due to age. Stage three of the Club website included a specific intention to allow readers to increase font size if they wished. This was a deliberate part of the spirit of that stage of the website. This part of the spirit was lost in stage four, there was an unintended, ironic adaptation that returned the website to use of predetermined font sizes.

The original intent, or spirit, of the website was to provide an extra means of communication with Club members. There has been some adaptation of the way in which this has been implemented and there have been minor adaptations in other Club structures, in response to both the website and the lessons learned from its implementation. The website now exists, paper and voice communications have adapted a little but still exist. Website adaptations have been faithful to the original spirit.

At this stage the Club website does not appear to have undergone any adaptations that are either intentionally ironic or hyperfaithful. The proposal to create an online community, however, would be an ironic adaptation. The original spirit of the technology was, to provide a means of communication to support existing Club structures. A virtual community would be an unexpected and ironic change to the current Club spirit, of the physical community gaining benefits from use of Club premises.

A virtual community could provide benefits unrelated to the physical premises. As such, it would act well beyond the current spirit of Club structures. Whether the overall impact on the Club were positive or negative would depend on the way in which the online community were implemented: By offering additional "virtual" benefits, the Club could attract new members. On the other hand, the ability to gain worthwhile virtual benefits could reduce the number of members using the physical Club premises.

Identification of the change as being ironic is important. It highlights the need to carefully consider the overall impact before a new adaptation is approved. Given the emergent nature of the adaptations, a true picture may not be possible in advance. Nevertheless, those planning changes should at least consider the potential for emergent, flow-on adaptations to all structures.

It is useful to learn about and understand why technology gets used in both faithful and ironic ways. "Exploring such questions acquires increasing importance as these new innovations with their multiple uses continue to enter the workplace and other aspects of our lives" (Scott et al., 1998). An implication of AST is, that new technology will be used in new and unexpected ways. Some appropriations will have a positive impact on success, some impacts will be negative.

Attitudes and Consensus

Attitudes include organisation members' level of comfort with and degree of respect for the use of the technology. Level of consensus is the extent to which organisation members agree on the ways in which the technology should be appropriated. (Gopal et al., 1992-1993; Scott et al., 1998)

The Club presents itself as being "slightly conservative". The median age of members is between 50 and 60 and more than 12% are over 70 years old, although there are current efforts to attract younger members. Conservatism and age could act against support of the new Web technology, these are reasons that the website is presented as an extra benefit rather than as a replacement for existing facilities. Members may use the website or ignore it. Those who have used it have returned positive comments. Non-users have made no comments. There is a positive acceptance for the use (or non-use) of the website.

Similarly, there is general agreement – consensus – on the way in which Web technology has been appropriated: agreement by those who use it and silent acceptance by those who choose to not use the website.

Deeper analysis, however, reveals a more complex picture of comfort and consensus.

The organisation structure of the Club includes senior managers and a committee made up of Club members. In its initial stages of development there was difficulty getting feedback from the committee to the website developers. This difficulty was, in part, due to lack of understanding of the technology: committee members did not fully understand what was possible or what was being attempted, so they were reluctant or slow to become involved.

Decisions were left to the few people who were already comfortable with Web technology. Thus the comfort and consensus of committee members was not so much with the new technology as with the experience and ability of the few who became more closely involved. The final observed situation (development stage four) was similar: Development was being done by an organisation whose managers were Club members, the Club committee depended on the ability and shared purpose of those managers.

The organisational website for the Club is an extra facility for members. Use of the website is entirely optional. (Optional for Club members, that is. The staff who update information on the site are a separate issue.) In effect, comfort and consensus of members is achieved by allowing members to entirely ignore the website. The situation could be entirely different if, for some reason, use of the website became compulsory for all Club members.

In summary, the impact of adaptive structuration may be measured on a number of dimensions:

- Selective appropriation. Not all features of the new technology will be or need to be implemented. Features may be adopted now, adopted later, never used, changed or removed at various times.
- Ironic adaptation. An ironic adaptation acts against the spirit of the technology or it may change the spirit. An ironic adaptation may be intended or unintended.

- Faithful and hyperfaithful. An adaptation may be faithful to the spirit of the technology. It may even be hyperfaithful, a feature so faithfully implemented that it overrides other features that may be required to maintain the original spirit.
- Comfort and consensus. Members of the organisation may be comfortable with new technology and they may support the way in which it is implemented. This comfort and consensus may reflect factors not directly related to the new technology.

9.5 Patterns of Adaptation

Majchrzak et al found that their study group experienced the repeated need for adaptations as the project progressed. The adaptations were in response to changing task requirements, where a perceived change to the requirements of the task necessitated new adaptations. They also found that the adaptations were discontinuous. They were sporadic changes in response to discrepant events that were seen as being problems.

In the Club case study there have been, so far, four distinct stages of website development. Between stages one and two, the key discrepant event was that the development process had stalled. The work group structure was changed in order to restart development. Between stages three and four the selected Web technology was seen to be inadequate for the task. This resulted in adaptations to both the technology and the development work group.

There appears to be no means to accurately predict adaptive structuration. There are, however, broad patterns that may be anticipated.

"The socio-political process and the substance of the innovation have reciprocal effects, yielding the possibility of agreement on a 'working innovation' which, once institutionalized, modifies the existing system and structures in ways that constrain, in new modes, the behaviours of all of those involved" (Coopey et al., 1998). In other words, an innovation such as a new technology will affect existing systems and structures. The structures will, in turn, affect the new technology. Both technology structure and organisational structures will adapt to each other.

The Club case study provides a simple example. In order to ensure that information of the website is up-to-date, key staff have been given responsibility for maintaining the information. In order to make this possible, the organisational process for the design of new brochures has been adapted, to ensure that information from the brochures is available to the people responsible for maintaining information on the website: that is, organisational structures have been adapted.

The Web technology was implemented with features to allow information update by staff. As described later in this section, those technology features have been adapted several times, to meet the changing requirements of the other, "user" structures. Technology and user structures at the Club have, as described by AST, adapted to each other.

AST proposes a reciprocal and iterative relationship between technology and the context in which it is used (Chudoba, 1999). That is, the technology affects the organisation and the organisation affects the technology. Organisations may adapt in different ways in order to use the same technology; the technology itself may be changed to suit the organisation in which it is being used. "Instead of the predictable realization of a preprogrammed plan, implementation is a dynamic process of mutual adaptation between the technology and its (user) environment" (Leonard-Barton, 1988).

Although initial adaptations may be applied to the technology, these changes to technology may in turn lead to changes in the organisational structures. This process is referred to as mutual (or reciprocal) adaptive structuration.

At stage three of the Club website development there was a clear problem: the selected technology did not allow Club staff to update variable data. User structures were adapted to allow update requirements to be passed from Club staff to the developer. The technology structure (the website) was adapted to minimise the need for regular updates. The problem still existed but its severity had been reduced. Stage four of development adapted the technology to allow updates by Club staff. Organisational structures were adapted to ensure that updates were made as and when required.

Over time, certain adaptations may be reinforced because the outcomes are acceptable to group members. Alternatively, adaptations may change if the group members want different outcomes. Early adaptations affect future adaptations. This is referred to as iterative structural adaptation. Contractor and Seibold referred to this iterative adaptation as "recursivity" (Contractor & Seibold, 1993) where similar processes of adaptation happen again and again.

Stage two of the Club website allowed data to be updated by Club staff but the overall features of the website were inadequate. Stage three corrected the overall features but removed the ability of Club staff to update data. Stage four maintained most of the correct overall features. Update ability was reinstated but some minor features were lost. For example, only stage three allowed the website user to increase the display size of the font.

In summary, these are aspects of the patterns of adaptation to new website technology:

- The technology may be adapted and user structures may be adapted.
- Adaptations to one structure may cause adaptations to another structure.
- An adaptation may be reinforced or reversed by subsequent adaptations.
- Adaptations will continue to occur but at irregular intervals.

9.6 Summary

This section of my thesis has discussed and adapted – where necessary – a number of dimensions of AST (adaptive structuration theory). The dimensions, as adapted to the extended AST model for e-commerce, are summarised below.

Categories of adaptations are reworded versions of the categories identified by Majchrzak et al (Majchrzak, Rice, Malhotra et al., 2000). For the extended, e-commerce AST model I have defined the following categories and sub-categories:

- Access to the website (who gets access, when should they get access)
- What knowledge is captured (what knowledge is captured, how is knowledge captured)

- What helps knowledge sharing (how does the technology spirit determine what knowledge is shared, what technologies and technology features help sharing)
- How information is communicated (who participates in what communications, are technical requirements questioned)

Selective appropriation and adaptation remains the same: the various structures may selectively appropriate and adapt aspects of the website technology.

Ironic, faithful and hyperfaithful adaptations are still an important consideration. Adaptations may act against the spirit of the website, they may support the spirit, or they may use selected features so exactly that there is no flexibility to support the underlying spirit.

Attitudes and consensus of website users will drive website appropriations just as surely as they drive appropriations of other new technology.

Patterns of adaptation for e-commerce information systems will be the same as for earlier forms of new technology. The key points are:

- The technology may be adapted and user structures may be adapted.
- Adaptations to one structure may cause adaptations to another structure.
- An adaptation may be reinforced or reversed by subsequent adaptations.
- Adaptations will continue to occur but at irregular intervals.

This section of my thesis has considered a number of dimensions of structural changes in response to new technology. I have reworded and slightly extended the categories of likely changes, to reflect the particular spirit and features of website and e-commerce technologies. Other dimensions have been included as is, providing valuable views from past research on the extended AST model.

9.7 Application of the New Theory to Practice

This section of the thesis has described and adapted a number of related AST dimensions to the extended AST model. Each dimension has been described and explained in terms of one small organisation. In order to provide some confirmation and validation of the theory, this section concludes with application of the new theory to other case studies which have been described in an earlier section, *2.4 Case Studies in e-Commerce Implementation*, above.

Only one dimension has been changed to suit the extended AST model: the categories and sub-categories used to group changes. Other dimensions have been transferred as is from the pre-e-commerce model. For this reason (and because the case study documentation provides insufficient information for analysis) only the change categories have been applied to these cases.

This dimension of the AST model has only been used in one major paper (Majchrzak, Rice, Malhotra et al., 2000); the categories were drawn from actual experience within that case study. Neither Majchrzak et al nor I have offered serious evidence that the categories could be universal. Nor do they – at this stage – offer more than convenience in grouping observed adaptations. For these reasons the following categorisations are offered but there is no further explanation of their possible value in practice.

Leonardo's Vineyard

Table 7 Categories of Change for Leonardo's (stage 1)

structure	change	category
<i>technology feature:</i> online tender	from manual to Web-based	how is knowledge captured
<i>technology spirit:</i> maximise sales price, minimise cost of sales	from satisfying orders by time received to satisfying orders by tender price	how does the technology spirit determine what knowledge is shared
<i>developers:</i> website developers	from clerical employees to technical specialists	what technology and technology features help sharing
<i>task:</i> sell wine through an online tender system	from order, deliver to tender, compare, deliver	what knowledge is captured
<i>staff:</i> vineyard staff	no change	
<i>management:</i> Leonardo	no change	
<i>customers:</i> wine buyers with online access	from cellar visitors and mail orders to online orders	how is knowledge captured
<i>visitors:</i> web surfers	from cellar visitors to website visitors	who gets access

Source: author's application of new theory

Tail and Dog Online Publishing System

Table 8 Categories of Change for Tail and Dog (stage 3)

structure	change	category
<i>technology features:</i> micro-site development and management	from display of e-zine articles to management of advertisers' websites	what knowledge is captured
<i>technology spirit:</i> an entertainment-related set of websites, supported by companies buying a location within the site	from publication to website support services	how does the technology spirit determine what knowledge is shared
<i>developers:</i> John's team	John's team: no change	
Marcel's team for micro-site sales and development	Marcel's team: from publication to sales and website development	who participates in what communications
<i>task:</i> develop and manage micro-sites within the website	from e-zine publication to website sales and support	how does the technology spirit determine what knowledge is shared
<i>staff:</i> Marcel's team and micro-site advertisers	no change	
<i>management:</i> Marcel (although John has some influence)	no change	
<i>customers:</i> advertisers	from providing advertisements to building websites	who participates in what communications
<i>visitors:</i> potential advertisers and web surfers	no change	

Source: author's application of new theory

10 Summary

There is published support for further research into AST. For example: "It is suggested that further research is undertaken into the 'adaptive structuration' theory" (Kim, 2000). And in a personal email, as I was beginning my research into AST:

I very much like the idea of applying AST to web technology. This is an application that hasn't been done yet so I encourage you to pursue it. ... Instead, your contribution can go in one of two ways: 1) you can decide to extend our current understanding of AST to improve upon it. ... 2) An alternative contribution is to argue that your technology and adapter group is fundamentally different than either GDSS or CT or hospital scanners or Lotus notes (which are the previous applications used with AST). (Majchrzak, 2002)

My DBA research thesis applies AST to web technology. I do some work to, "extend our current understanding of AST", largely through rationalisation of some aspects of the theory. A large part of this thesis, "is to argue that your [Web and e-commerce] technology and adapter group is fundamentally different". In addition to that, I also extend and apply two other areas of the model, to suit web-based technologies.

Section 4 *Objectives of the Research Project* stated the research question and set a challenge for the researcher. The question was, "How must adaptive structuration theory (AST) be extended in order for it to be applicable to the multi-organisational scope of Web-based e-commerce information systems?" My challenge was, "[to] develop an extended AST model that will be relevant to e-commerce." In this thesis I have answered the question and responded successfully to the challenge.

- The extended AST model – the major outcome of my research – is summarised below. Because the DBA is a professional doctorate, the summary is described in terms that will be applicable in a real, business environment.

This section brings my research clearly back to my desire to do *applicable* research: the theory has been developed and explained, now, How would this be useful in practice?

In some early notes on my research (after the first proposal but before AST was confirmed as the central topic), I wrote, as the problem area, "Relationship of websites and e-business to *organisational* success." This would have led into questions such as, "What is the relationship between e-business and organisational success?" My research interest has centered on the success of the organisation rather than the success of the information system; websites and e-commerce are only as successful as the support that they provide for the organisation. I have narrowed my focus to AST, but still with an overriding interest in the impact on success of the organisation.

A new website or e-commerce information system will result in change, and change needs to be managed. Change management will be more effective with a better understanding of possible planned and emergent changes. My extended AST model will support this understanding.

Given my new model, with structures that may adapt, categories of adaptation as a thought-starter, and a relevant impact scale... Here is what you can do...

This section provides a summary of my extended AST model. They also provide a suggestion as to how the new model may be used – and useful – in practice.

10.1 The e-Commerce AST Model – and How to Use It

The role of AST, adaptive structuration theory, may be summarised in the following *Figure 17 Adaptive Structuration as a Driver for Success*. As new technology is introduced to an organisation, changes will occur. These changes may be planned or they may be emergent, occurring as a result of the situation. Changes are incorporated in the various structures, including the organisation and the technology itself. The type of changes and their impact will influence the success or failure of the new technology.

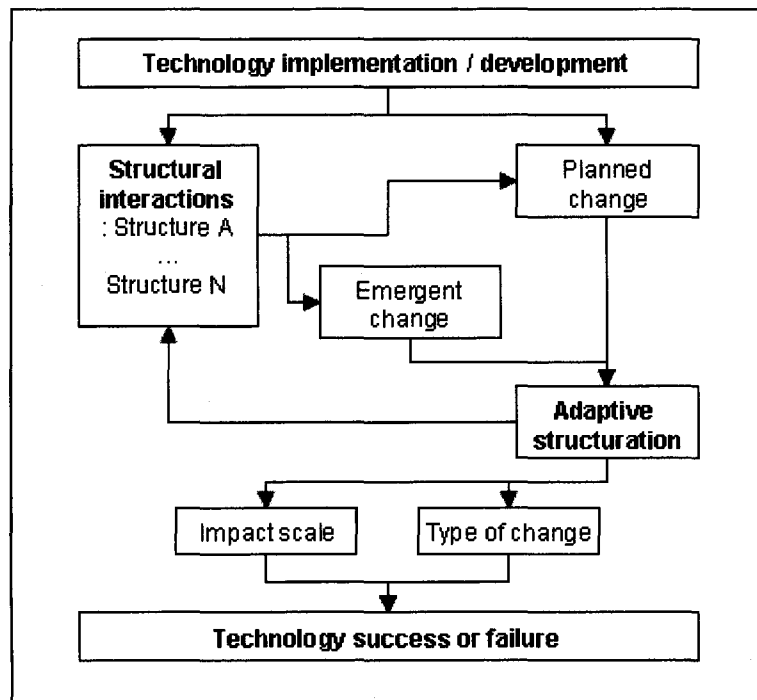


Figure 17 Adaptive Structuration as a Driver for Success

Source: author's research

Implementation of new technology involves risk: risk that the technology may not work, or that it may not be accepted by its users. A visible sign of this risk is the structuration that occurs – the changes that will affect the way that the technology is used and accepted. AST models this structuration. Application of AST will increase understanding of changes, before and after they occur. This understanding will allow management responses which will increase the chance of successful implementation of the new technology.

Prior to this research, AST had been applied only to technology with a limited scope for impact. AST had not been applied to organisational websites nor to e-commerce, where the potential impacts extend across multiple organisations and their customers. This thesis develops and presents my extended AST model, one which is applicable to Web and e-commerce information systems.

The intent of this research has been to develop an academically sound AST model which both applies to e-commerce systems and provides practical benefits for organisations which are implementing e-commerce systems. The research must be academically sound, since it is for a doctoral level degree. It must provide practical benefits, since the degree will be a DBA, a professional degree which supports the work of senior managers and professionals.

The remainder of this section restates key parts of the extended model. It also outlines how the model will be applied in practice.

Recognise which Structures may Adapt

Implementation of a new e-commerce system involves a change to the technology in use: from manual interactions between suppliers and customers, to Web-based interactions. Customers and suppliers also adapt: processes are changed to suit the new means of interaction.

Changes to technology, suppliers and customers is a simplified view of adaptation. AST (in the extended model developed in this thesis) identifies eight separate but interacting "structures" that may adapt; the structures and their interactions are represented in *Figure 18 Structures which may Adapt*, below. Almost all of the structures may be repeated: for example, each organisation involved in e-commerce will have its own management structure.

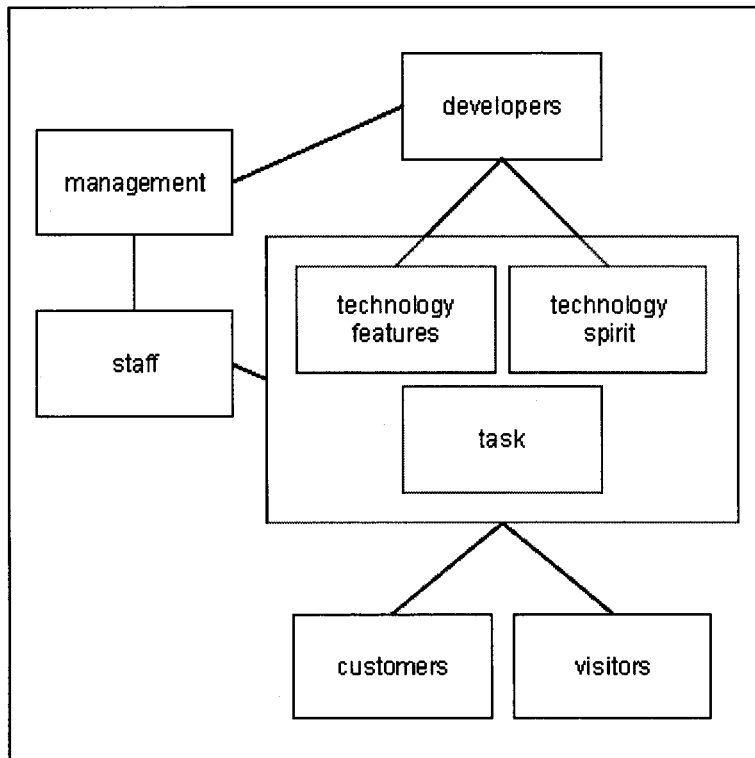


Figure 18 Structures which may Adapt

Source: author's research

For each of the structures, identify possible changes. (The process of structural change in response to new technology is referred to as "structuration".) Plan to manage those changes.

Accept that Change Will Happen

Every e-commerce implementation will involve change. Identification and anticipation of changes will allow the changes to be managed, either to support the changes or to minimise their impact. Effective change management will increase the chances of successful implementation of the new information system.

Managers must be aware of this propensity to change and must be prepared to deal with it. The extended AST model provides a number of dimensions of change that are relevant to e-commerce implementations. Use these dimensions as a framework or checklist to identify and anticipate change.

- Adaptations (changes) will occur at irregular intervals, during and after implementation of the e-commerce system.
- Changes may be planned and managed, or emergent, in response to perceived problems.
- Acceptance of and adaptations to the new system may apply to the entire system or – more likely – to parts of the system.
- Adaptations will be driven by the attitudes of system users.
- Adaptations will be stronger when there is consensus of the users.
- Adaptations may be faithful, ironic or hyperfaithful.
 - Faithful adaptations will support the intent of the new e-commerce system; users will adapt their own processes in a positive response to the new system.
 - Ironic adaptations act against the intent of the system; users will adapt to the new system but in ways that have a negative impact on success of the system.
 - Hyperfaithful adaptations appear to support the system but they are too restrictive; users take a narrow interpretation of one aspect of the new system and adapt in ways which have a negative impact on other aspects of the system.
- Users may request or implement system changes that affect the features, the ways in which the system operates. They may also make changes that affect the spirit, the underlying intent of the e-commerce system.

- Changes and potential changes may be categorised in order to more easily understand and manage them. A possible set of categories is:
 - Access to the website (who gets access, when should they get access)
 - What knowledge is captured (what knowledge is captured, how is knowledge captured)
 - What helps knowledge sharing (how does the technology spirit determine what knowledge is shared, what technologies and features help sharing)
 - How is information communicated (who participates in what communications, are technical requirements questioned)
- One adaptation may be reinforced or reversed by subsequent adaptations.

Assess the Possible Impact of Changes

This thesis provides a scale for the possible impact of changes. The scale ranges from low to high impact, with a simple means for determination of the position of any change on the scale. The higher the impact of a change, the more flow-on changes may be expected, the more effort must be put into managing the change.

The scale is shown in *Figure 16 Adaptive Structuration Scale of Impact*, the means of placing a change on the impact scale is summarised in *Figure 14 Impact of a Change on Related Structures*. Both figures are shown in the earlier section 8 *An Impact Scale for e-Commerce Adaptations*. The two diagrams are combined below (*Figure 19 Assessing the Impact of Changes*) in a summary of the method of assessment of the impact of changes on a structure.

For any planned or identified emergent change, the impact should be assessed against each of the structures. When assessing the impact against the new technology, "new ideas" implies that the spirit of the technology is being changed.

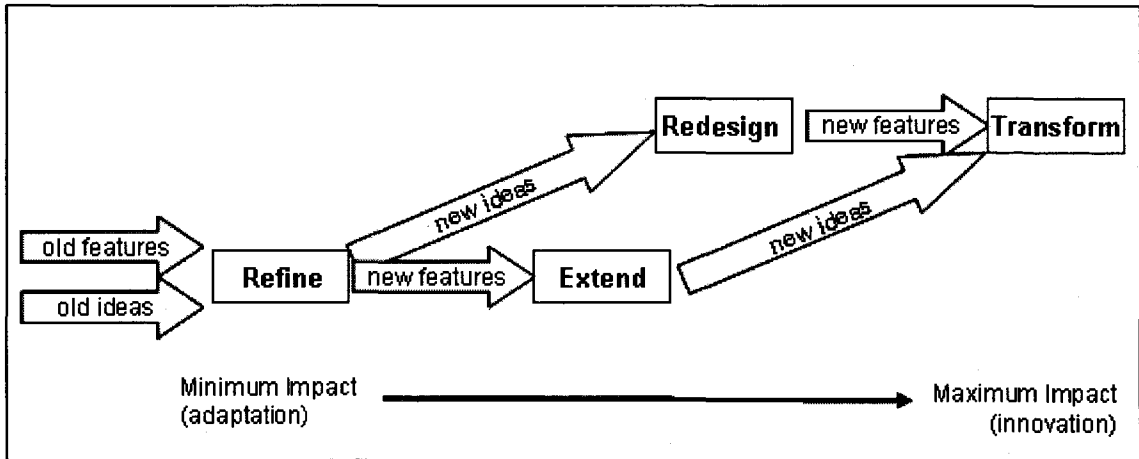


Figure 19 Assessing the Impact of Changes

Source: author's research

Manage Change

Planned changes will require effective change management. Emergent changes will need to be identified and then managed effectively. This thesis has developed my extended AST (adaptive structuration theory) model, which will help you to identify changes, the structures which will change and the potential impact of changes. AST has been extended, through my research, to be applicable to the situation where a website or e-commerce information system is to be implemented or changed.

Success or failure of the system will be influenced by effectiveness of the change management; this may, in turn, be influenced by effective use of the extended AST model. In this thesis I have developed a model of adaptive structuration for e-commerce systems; the model will help identify and anticipate changes. Effective change management is the subject of numerous other texts and journal articles.

10.2 Summary of My Research Contributions

Adaptive structuration theory, AST, provided a useful model for understanding the process of change as an organisation introduces new technology. Yet there was a clear gap in the theory: AST did not apply to e-commerce systems because of the multi-organisational nature of e-commerce technology. In this thesis I have extended the AST model so that it is relevant to and applicable to the implementation of websites and e-commerce information systems.

The extended AST model adds a major new aspect to existing academic theory. It will also provide a valuable tool for application in business. In order to develop the new model – within the constraints and requirements of the DBA course and target students – I also developed a new methodology. The Critical Insight methodology is specifically designed to suit the requirements of a professional doctorate.

Thus my research has made a significant contribution to both academic and applied business knowledge. I have defined a research methodology that suits the professional doctoral student; I have extended the AST model so that it supports implementation of an e-commerce information system. This focus on both theory and practice reflects the professional nature of the DBA course.

10.3 Future Research

Some areas for future research have been identified within this thesis, particularly within section 4.4 *Related Topics for Research*. Briefly, future research could involve:

- Technology as a "Giddens" structure: Although AST has been developed from Giddens' earlier Structuration Theory, technology in some ways contradicts Giddens' definition of "structure". It would be interesting to try to define a technology structure that did match Giddens' requirements.
- Spirit and features of structures: AST deals with the technology structure as being composed of features which are separate from the spirit (underlying intent) of the technology. I believe that there could be valuable understanding for organisational theory to apply that same features and spirit dichotomy to the other structures.
- Validation of the extended model: The extended AST model is useful as it stands but it lacks full confirmation and validation because DBA research is tightly constrained in both time and thesis length. Future research projects could verify the key, new parts of the extended model:
 - relevant structures for e-commerce technology
 - the impact scale for adaptations
 - categories of change for e-commerce implementation

Although I have given some thought to this future research, none of it has yet been started.

11 Conclusions

My DBA research project has been a journey of discovery, along several broad paths:

- I defined and explained my own Critical Insight research methodology
- I have added to our understanding of websites, e-commerce, and their effects on organisations
- I have provided practical benefits, as suited the overall DBA concept
- I extended the AST (adaptive structuration theory) model so that it is now relevant to websites and e-commerce information systems.

This thesis documents the results of my doctoral research. My focal point has been the introduction of web-based systems, the theme has been structural change, the result is an improved model of the change process.

This thesis is for a "professional" doctorate in information systems, the DBA(IS). I had several requirements of a methodology: it must suit the research question, it must suit the professional doctorate, it must suit me. The DBA included coursework; one of the five units was devoted to research methodologies. None of the methodologies seemed to suit my requirements.

As a DBA student – and as a professional – I was looking for a practical result: research findings that would have some value in the workplace. I needed a straightforward methodology that would allow me to spend most of my research time gaining practical, new knowledge. The research component was, at that time, less than half of the total doctoral course. I did not have the luxury of taking several years to build an impregnable framework.

My own strengths are in ideas and understanding, in drawing broad and coherent conclusions from an tangled mass of detail. I defined my Critical Insight methodology to suit my own requirements within the overall context of DBA "professional" doctoral research. As a result of my research effort, I have developed an "initial bold generalization".

- I have used logical analysis – my critical insight methodology – to develop new theory: the AST model extended in order to be relevant to web-based technology.

AST (adaptive structuration theory) provides a model of the ways in which organisations, and groups within organisation, adapt to new technology. AST points out that the new technology itself is also adapted, either by being changed or by being used in different ways. Prior to my DBA research (as documented in this thesis) AST could not be applied to the technology of web-based information systems.

What is the value of understanding the structural change process? To minimise potential problems and to maximise potential benefits of system implementation, changes should be effectively managed. My extension to AST provides a model for use in identification and anticipation of changes. A change which is expected and understood may be more effectively managed.

In summary, I have developed a model for structural changes which may result from introduction of a website or e-commerce information system. This will provide support for effective change management. Before my research, AST did not cater for e-commerce: it considered only structures internal to a single organisation. My research has extended AST to external groups: customers, for example, may also affect and be affected by a new e-commerce system.

I divided the AST model into sections, so that I could build my model in stages. The essential features of two of the three sections have already been published and presented at an international conference. The methodology has also been published and presented at an international conference. Feedback and further analysis has allowed me to refine all of these sections of my thesis.

I have researched a relevant and interesting topic and I have extended the AST model so that it may be applied to e-commerce systems. I have shown that the extended model is valid, applicable and useful in at least a small number of actual situations. This is, however, only a beginning.

I have completed the initial step: development of a model which extends our knowledge and understanding, a model which is useful in practice.

Within this document I described a number of interesting areas for further research. A further extension of one aspect of the model, for example, could lead to a better understanding of intra-organisational conflict, where two organisational structures have contradictory "spirits". Other major areas for continuing research are in validation of the model.

This thesis documents my DBA research. It will not complete all related research, it will not answer all related questions. The model is valuable and tested but not proven. My research has successfully opened up a broad area for further research; I have allowed for the application of the AST model – of adaptive structuration theory – to the still developing technologies of websites and e-commerce.

My first stage of research is complete. The journey of discovery continues.

12 References

This may be standard practice, but I believe that it deserves a mention: The References section does not include details of references where I have not sighted the original.

Many of the references are second-hand, "as cited in" an article that I did, in fact, read. According to the university standard referencing guide: "the reference list will show only the name and title of the work actually read" (Jongeling, Forlin, & Daymond, 2004) (p.8).

Also, there are very few page numbers in the in-text references because most references were found via electronic sources, where page numbers are generally not included.

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