e-Business Opportunities for the Electricity Industry:

An Exploratory Study of the UK Deregulated and Malaysian Regulated Electricity Environments

Siti Salbiah Mohamed Shariff

Department of Computer and Information Sciences

Submitted in accordance with the requirements for the degree of
Doctor of Philosophy

January 2004

Declarations of Author's Right

Acknowledgement

My deepest gratitude to the following individuals, companies, and departments who has helped me in conducting my research and completing this PhD thesis:

- My supervisor, Prof. Forbes Gibb
- My external examiner Dr. David Edgar
- My internal examiner Mr. Crawford Revie
- My sponsor, Tenaga Nasional Berhad (TNB), Malaysia
- All companies participated in this research: ScottishPower, Scottish and Southern Energy, Powergen, GPU Power UK, LE Group, and TNB
- Strathclyde University, particularly the Library and Centre for Academic Practice
- All staff of the Computer and Information Sciences Department, especially, Monica, Linda, Zakia, Catriona, Duncan, and Ruth.
- My PhD colleagues and friends in the Department
- My husband, Amir Hisham
- My family and friends

My heartfelt thanks to all of you for your support, guidance, insights, encouragement, help, cooperation, understanding, love, and friendship.

Abstract

The increased use of the Internet and web technology has introduced various web based applications and strategies for businesses such as the e-Business developments. The move to an information-based economy where information has become an important value added resource, has also helped to accelerate the e-Business adoption process. In this research, e-Business is regarded as more than just technology; it encompasses a concept, ideas, and strategies to integrate individual information systems in order to create knowledge management systems for an organisation's internal processes and their activities in the supply chain.

The impact and strategic significance of e-Business has been discussed widely for industries such as finance, advertising, entertainment, and travel. However, its impact on large traditional, hierarchical, monopolistic enterprises that were formerly owned by government, such as electricity, gas, and postal companies, has only had limited analysis. In order to investigate the effects of e-Business on these types of enterprises, this research has chosen the electricity industry as its focus. This research discusses the background, models, and theories of e-Business in general. Subsequently, it looks at the current structure and dynamics of the electricity industry, in particular deregulation, and analyses how industry players have adapted to the new deregulated environment. This research then investigates e-Business opportunities within the electricity industry by exploring current e-Business perceptions, approaches, barriers to implementation, and strategies of the companies operating in both the deregulated and regulated electricity environment.

Using a mainly qualitative method, this research presents the findings from five UK case companies (representing electricity companies operating in a deregulated environment) and one case company from Malaysia (representing a traditional and monopolistic electricity company operating in a regulated environment). This research then provides a framework for current e-Business implementation in the electricity industry and its future potentials based on the UK and Malaysian experiences. It also provides a point of reference for other companies planning to implement e-Business as one of the ways to compete successfully in the deregulated environment.

Table of Contents

CHAPTER 5: CONCLUSIONS AND IMPLICATIONS

List of Tables

List of Figures

Chapter 1: Introduction

1.1 Research Background

This research focuses on the electricity industry with emphasis on the UK and Malaysian environment and has been conducted against the backdrop of an economy that is based on companies' effectiveness in gathering and utilising information and knowledge (Clarke, 2001). This economy is referred to as the information-based economy, in which e-Business has become an increasingly important approach to dealing with customers, suppliers, and employees. In this information-based economy what you know and not what you own plays an important role in determining success (McGee et. al, 1993), where the strengths of an organisation lie in its intellectual assets rather than in its land, capital, or raw materials (Gibb, 2002). The rapid pace of technological development, which includes electronic connectivity such as the introduction of the Internet and web applications, is perceived to be one of the drivers for this change (Clarke, 2001; Morrill, 2001). These new technology applications help speed information and knowledge flows (Clarke, 2001) and open new channels to customers and business partners (O'Brien, 1999) as businesses become more adept at harnessing the power of technology in order to deliver new information-based products and services.

The effect of the Internet and web technology on business is widespread and has significantly revolutionised the business environment. It has allowed new players to enter the marketplace and compete in a virtual environment. In order to survive in this new business environment, companies need to re-assess their capabilities, business strategies, and current technologies, and conceive their own appropriate unique plan. The information-based economy poses new challenges for organisations particularly for traditional corporate giants usually referred to as bricks and mortar companies who have been dominant in their fields in the last few decades. These companies are usually structured in a bureaucratic hierarchical manner, which according to Tapscott (1996) is often a liability as compared to new smaller companies that promotes innovation, agility, and organisational learning that are perceived as the key factors for success in the information-based economy. Among these large

traditional companies are the utilities with business interests in the areas of electricity and gas, communications such as telecommunication or the postal service, or transportation such as the railway services. These utility companies used to be government or publicly owned and have gone through the privatisation process. Their common characteristics were that they were monopolies in their business area, they received subsidies from the government to operate and expand, and their styles of management were similar to any other government body (Stoft, 2002). Due to these characteristics, even when these companies were privatised, some of them still could not deliver the level of service expected by the customers and targeted by the government as can be seen happened for example in the UK electricity industry (The Electricity Association, 1999) and had not brought about efficiency levels to reduce service costs to consumers or taxpayers. One of the reasons for this may be due to the lack of experience in operating as private businesses. Another reason is, although privatised, these companies may not have the urgency to improve services due to a lack of competition in a regulated environment.

As a result of the above, in some countries such as the UK, the government then realised that privatisation alone was not enough to change management attitudes and methods in order to make these organisations more efficient. The UK government and regulators then decided that the next step should be implementing deregulation. Deregulation was introduced to promote free competition in the form of new service providers (Lo and Yuen, 2001). With competition customers are free to choose the services from a company that best meets their needs. At the same time, the Internet has allowed a free flow of information at a level that was unseen before and had increased the expectation of customers. When deregulation was added to the arrival of the Internet and e-Business, these ex-monopoly and hierarchical corporate giants encountered significant problems as the new competition started taking away market share from them.

Based on the above setting, this research focuses on the electricity industry, and the application of information systems in a deregulated environment. In particular, it looks at how e-Business has and is being applied to help respond to the effects of deregulation and whether it has significant potential in this industry. In the regulated era, the industry was controlled by a few government owned privatised entities such

as the Central Electricity Generating Board (CEGB) in England and Wales, and ScottishPower in Scotland. Once privatised and deregulated, the CEGB was broken up into smaller companies that compete against each other. Now, the industry has four main sectors, which consists of power generation, transmission, distribution, and supply. Each sector have been analysed separately as they each operate in different market environments and have different needs. The UK electricity market has been chosen as the main model for this research due to the fact that the UK market was the first to deregulate (The Electricity Association, 1999) and is recognised worldwide as one of the most advanced and mature deregulated models. At the same time, the Malaysian electricity industry was also investigated, as it will be deregulated in 2005. In fact, it can be seen in the Malaysian market that steps towards having a fully-fledged markets are already underway with the increasing number of Independent Power Producers (IPPs) tapping into the market. Further reasons and justifications for the selections of these examples are discussed in the following chapters.

There have been numerous researches in the area of e-Business since the end of the last century (Berryman et. al, 1998; Amor, 2000; Evans and Wurster, 2000; Hackbarth and Kettinger, 2000; Andrea, 2000; Kalakota and Robinson, 2001; Barua et al., 2001). However, the focus on large companies and especially on those operating in the electricity sector has been very limited. It is hoped that the examination of the UK experience in the area of e-Business applications in the deregulated electricity market can yield new findings on current e-Business perceptions, level of implementations, and successes and failures for this industry. Further, this research attempts to develop new frameworks of reference for emerging electricity markets worldwide in general, and in Malaysia in particular.

1.2 Research Problems, Questions and Propositions

As mentioned above, various researches have been conducted to examine the impact or potential of information technology, the Internet, and e-Business on small and medium size businesses. However, the impacts on traditional and large organisations that may have been previously owned by the government have not been looked into to any extent. There is therefore a research gap in terms of e-Business applications in

areas such as the electricity industry. This is a fundamental issue as it can be seen that there is a disparity among electricity companies in their approach in implementing e-Business. Since this research focuses on the electricity industry, the main research problem, which provides the overall focus for this study, is the question:

> *'What are the potentials of e-Business on the electricity industry, both in the regulated and deregulated power markets?'*

The research problem is the core idea of this research and has been examined more precisely in the research questions and propositions discussed below. The problem addresses the potential of e-Business in the electricity companies and asks if e-Business will become one of the more important if not the main strategy for electricity industry in the near future. Finally, the problem includes the analysis of current e-Business experiences in the electricity companies who participated in the study.

In order to satisfactorily unravel the research problem, data has been gathered based on specific research questions, which are developed in Chapter 2. These questions explore current practices and approaches of e-Business strategy in electricity utilities with an emphasis on the UK and Malaysian environment, and are organised into general and specific questions. The following lists the general questions:

- *What is e-Business?*
- *What is the structure and current status of the electricity industry specifically in the UK and Malaysia?*
- *What are the impacts of deregulation on the power markets?*
- *What are the implications of e-Business for the electricity utilities?*
- *What are the current approaches and practices with regards to e-Business strategy and implementation in the electricity industry?*
- *What are the important issues regarding the way in which the management and administration of the e-Business implementation process contributes to the success or failure of the implementation as a whole?*

- *What are the factors considered as barriers to the effective use of e-Business with customers, business partners and internal processes in the electricity industry?*
- *What could be the impact of e-Business on organisational performance for the electricity industry and in general?*

These eight general questions were formulated through the discussions that are presented in Chapter 2. Further sub-questions from each general question are synthesised and listed in both Chapter 2 and Chapter 3. Their rationale is also presented in these chapters to further validate this research. Unlike quantitative research that usually formulates hypotheses for testing, this research was done qualitatively and is more of an exploratory nature. Therefore, this research presents several propositions, rather than hypotheses. The propositions developed are used to help focus the research and set the research boundaries. They are listed below and discussed in more detailed in Chapter 3:

- *e-Business strategy offers a possible business solution that can help electricity utilities improve their organisational performance in order to survive in deregulated power markets.*
- *Organisation preparedness towards successful e-Business implementation can be analysed based on management attitudes and perceptions of e-Business.*
- *One of the reasons that impact success or failure in an e-Business implementation is the way e-Business resources are managed*

The research questions and propositions above have been used to develop the interview structure and the questions for the case companies who operate in both regulated and deregulated power markets. Data from the interviews was analysed and follow-up questions were asked depending on the initial answers from the initial interviews. Findings from the propositions listed above form the final analysis of this thesis and are discussed in detail in Chapter 5.

1.3 Significance of the Research

This research was conducted in order to look into current management approaches and practices toward e-Business in the electricity industry. The results and findings of this research are intended:

- *To present a set of frameworks for electricity companies with regards to e-Business implementation.* These frameworks or models can help electricity companies to better understand their e-Business targets and the issues that surround them. They can also identify critical areas. For instance, companies already operating proprietary systems may experience systems integration problems when trying to link with newer networks. Identification of these issues can result in better planning and resource allocation prior to the implementation of their e-Business initiatives

- *To establish a point of reference for TNB management in particular with regards to deregulation and e-Business issues.* Like most UK electricity companies prior to deregulation, TNB cannot fully appreciate how competition and the industry structure in the competitive market will affect them. An example would be the emergence of brokers who can buy electricity in blocks from other IPPs and offer cheaper prices to customers. In this new environment, TNB needs to assess new tools and strategies in order to survive Malaysian electricity deregulation in 2005.

- *To establish a point of reference for other parties in the electricity industry in general, who will be involved in e-Business implementation in the future.* This research can also help other parties understand the current trends and focus of e-Business implementation in electricity utilities. Consequently, parties such as utility company partners, suppliers, system integrators, and consultants can make adjustments, if necessary, on their business focus and strategies.

In summary, research in this area is believed to be valuable as it looks into a new application area of e-Business strategy and the findings can help contribute to the body of knowledge. These outcomes can be used by academics and industry to gain further understanding of e-Business in electricity companies in a variety of settings.

1.4 Overview of Methodology Used

Originally, both qualitative and quantitative methodologies were selected but due to reasons that are discussed in detail in Chapter 3, such as the type of respondents and their views, and difficulty in getting access to the other levels of employees within organisations, the research methodology was restricted to a mainly qualitative approach. The methodology used has also been selected not only due to these circumstances, but also based on its capabilities to look into the depth of the information collected, as it is more suited to the exploratory nature of the research problems. According to Patton (2002), qualitative inquiry can be used to discover, capture, present, and preserve the stories of organisations, programmes, communities, and families more appropriately.

Following the qualitative method, data was collected using three approaches. Firstly, it involved information gathering from respondents through interviews, which provide the main input to this research. Interviews were carried out at the premises of the UK case companies and through email correspondence for Tenaga Nasional Berhad (TNB), Malaysia. Interviews were chosen as it allows the research to proceed quickly as it does not require several levels of initial work (Patton, 2002). By comparison, experimental, deductive, and hypothesis-testing approaches can require a lot of front-end work. Using these strategies, there is a need to be quite certain about design and instrumentation before data collection because once the study is underway, changes in design and measurement undermine both internal and external validity (Patton, 2002).

On the other hand, due to the exploratory nature of the qualitative inquiry, the researcher can enter the field with relatively little advance conceptualisation, allowing the researcher to be open to whatever becomes significant to pursue. The design is mostly emergent and flexible. Respondents were also given a free rein where they could talk about the issues being researched in a more open manner. This approach encourages flexibility as the researcher can gain insights very quickly and can pursue what makes sense during the interview process (Patton, 2002). The very nature of the qualitative method, makes it possible to get into the field quickly to

study emerging phenomena, which e-Business can be classified as, and access quickly developing situations in a world of rapid change (Patton, 2002).

Secondly, data was also collected through documentation analysis. This included analysing documentation provided by the case companies and also collected through media such as newspapers, journals, magazines, company websites and newsletters. Documentation is valuable post interview as it gives further insights, support and links the answers given. Prior to the interview, documentation also allows the researcher to better understand critical areas of the case companies and make adjustments to the research questions if necessary. Finally, data gathering through observations method were also made to gain further insights into the operation of the company researched. The researcher visited the case companies' facilities such as call centres and warehouses to observed and gain further understanding of how the company is run. Even the observation of the online visitor handlings protocol of one case company provided inputs to the level of e-Business implementation of a company.

Multiple sources of information are used to help provide a comprehensive perspective on the issues researched. By using a combination of interviews, document analysis, and observation, this research used different data sources to validate and crosscheck findings (Patton, 2002). Together, all three approaches make up the qualitative assessment of the research. The latter two approaches helped the research process gave more confidence to the results and supported the final findings. Discussion on the selection of the qualitative methodology is elaborated further in Chapter 3.

1.5 Outline of the Thesis

This thesis is structured in five chapters. Chapter 1 introduces the research and the thesis. Chapter 2 discusses the literature review relevant for the research. Chapter 3 explains the methodology used for this research and its justifications as well as its limitation. Chapter 4 looks at the research findings and its analysis. Finally Chapter 5

concludes the findings and discusses the implications. Each of these chapters is further described below:

Chapter 1 – Introduction. This is an introductory chapter, which discusses the topic of the research, highlighting the research background and stating the research problems and research questions. This chapter also states that there are research gaps in the area and talks about the relevance of the research. It then proceeds to give a brief overview of the methodology to be used in the research process. Finally, the chapter defines the limitations and some of the key terminology used in this thesis.

Chapter 2 – Literature Review. This chapter explores the relevant subjects and issues of the area of research. In this chapter, e-Business and its many models are described and its evolution is illustrated by using existing research material. The factors that interact with e-Business are identified and their relationship examined. Subsequently, theoretical models are also investigated to see how they can be applied for e-Business strategies and implementation. Furthermore, the electricity industry in the UK and Malaysia is discussed to reveal the new challenges that companies face in the deregulated and digital age. Finally, the discussions from the literature review are used to develop the research questions.

Chapter 3 – Methodology. This chapter presents the methodology used in this thesis and the justifications for choosing the methodology. The methodology was selected based on the nature of the research that is exploratory and the form of the feedback from case companies. The synthesis of the exact research questions is illustrated. The chapter also discusses the fieldwork and the observations from the interviews.

Chapter 4 – Data Analysis. This chapter systematically analyses, presents, and summarises the case study reports based on the data collected from each case company. These data are analysed based on the business analysis frameworks presented in the literature review in Chapter 2 to form the research findings.

Chapter 5 - Conclusions and Implications. This chapter concludes the thesis. Each of the main research questions posed is answered here. This leads to the conclusion of the

research problem and discussion on the implications of the findings on both theory and practice.

1.6 Definitions Used

Definitions adopted by researchers are often not uniform, therefore key and controversial terms are defined below to establish the positions taken in this research. The definitions used are explained in more detail in Chapter 2. Table 1.1 provides a summary of definitions of the key terms used in this research.

Terms	Definition
e-Business	A holistic business culture, structure and mindset, which is not just about buying and selling on the Internet or implementing new technology but integrates core business processes electronically using network technologies to create added value such as enhanced customer services and increased efficiency.
e-Commerce	e-Commerce is a subset of e-Business and refers to buying and selling via the Internet or defined narrowly as "*commercial transactions over the Internet only*".
e-Business Strategy	A plan and activities to synchronise an organisation's business processes and resources, to embrace e-Business, in order to create value and form a sustainable business strategy
e-Business Model	e-Business models can be described as the way companies do business electronically (Weill, 2001) and explain why and how an e-Business case works from an economic perspective, where an e-Business model defines how economic value is created and exchanged within a network of actors (Gordijn and Akkermans, 2001). Furthermore, e-Business models also frame the business requirements that IT systems and networks must satisfy.
Management Styles	The way management implement or execute business strategy and utilise organisational resources
Organisational Performance	The ability of the organisation to meet its business targets.
Customer Service	Providing service such as on-line billing and payments, price structure transparency, help desk or help centre to handle customer requests and queries.
Customer Relationships	Understanding customers' needs, wants and aims in order to build a long term relationship and a shared future with customers
Management Preparedness	The degree of the management's ability to implement a business strategy

Table 1.1 Definitions of Key Terms Used

1.7 Research Assumptions

In conducting this research, some assumptions have been made to ensure a uniform environment. This allows standardised data to be collected and valid comparisons can be made. These assumptions are divided into two areas as follows:

- **Explicit Assumptions:**
  - The study has been conducted with the assumption that there is no major economic downfall or recession that has had a major effect on the organisations.
- **Implicit Assumptions:**
  - The management strategies of the organisations directly affect the organisational performance.
  - UK energy industry is one of the most advanced in terms of electricity deregulation and in terms of e-Business adoption and implementation.
  - Malaysian electricity environment is still in its very initial state of e-Business awareness.

1.8 Conclusion

This chapter has laid the foundations for the thesis. It has introduced the research problems and the research questions. Definitions were presented, the methodology was briefly described, the thesis was outlined, and finally, the research assumptions and some limitations were introduced. On this foundation, the report proceeds with a detailed description of the research in the following chapters.

Chapter 2: Literature Review

2.1 Introduction

This chapter aims to build a theoretical foundation upon which this research is based by reviewing the relevant literature to identify research issues and research questions. It will highlight the main topics, which were considered during the research, and describes the context within which this research was conducted. These topics include e-Business in general and the role it plays in the new economy, traditional business strategy, the electricity industry (focussing on the UK and Malaysian environment) and the impact of e-Business on the electricity industry. In order to understand and proceed with the research into e-Business strategies for the electricity utilities, the above areas and topics were initially analysed separately before connecting the related issues together.

More specifically, this chapter discusses the move to the new information-based economy and the development of business models and strategies based on the capability of the Internet. The combination of these strategies, business models, information, and related technologies are referred to in this research as e-Business. The new economy poses new challenges for organisations. There are particular challenges for big, traditional organisations that have been dominant players for a considerable time and which also have been government owned monopolies. Many of these companies have now been privatised, in particular those dealing with transportation, power, and communications. The privatisation process has transformed organisations that used to be government owned and subsidised into corporate giants. According to Tapscott (1996), being a big organisation was what made companies successful in the old economy, but today big is often a liability. In order to survive, these big, traditional and hierarchical organisations need to be transformed into much flatter, agile, and innovative organisations, which according to Tapscott (1996) are the key characteristics for success in the information- based economy, This transformation is not an easy task to perform.

Interestingly, however, the potential of e-Business is thought by some business analysts to be most apparent in big companies such those as in the utilities sector, given the significant changes due to deregulation (Quest, 2000; Mullen, 2000; Treadway and Valocchi, 2000). Deregulation was introduced to provide competition, which in turn has pressurised companies to be more efficient, reduce operating costs and hopefully create healthy competition that will reduce the price of services for consumers.

This research focuses on the deregulated electricity industry, which has been introduced in the UK, Scandinavian States, Australia and most states in the US such as New York, Pennsylvania, New Jersey and California (Read, 2001).One of the reasons for selecting the electricity industry is because of the researcher's background as an employee of Tenaga Nasional Berhad (TNB), the main electricity company in Malaysia. Due to the future deregulation of the Malaysian electricity industry, the researcher and TNB are therefore keen on exploring deregulation issues and development of other countries, and potential strategies, which can be applied effectively in the electricity industry to enhance organisational performance and ensure competitiveness. This research looks at e-Business as one of the strategies to help companies respond to the effects of deregulation.

The UK was one of the first countries to embark on electricity deregulation (The Electricity Association, 1999). In the deregulated electricity market, there is a fundamental change in the way that the commodity is traded. For instance, instead of a single seller, multiple buyers model, there are multiple sellers and multiple buyers leading to an increase in the number of business interactions. Business interactions are defined in this research as the exchanges of services, products or information between relevant parties, which includes financial transactions between companies and their customers.

For example, in the single seller, multiple buyer model, there are two types of player: the utility company and the consumers. Power transactions are carried out directly between the utility and the consumers. In the deregulated environment, brokers and supply companies make up a third type of player. They act as middlemen and deal with generators and consumers of electricity. This arrangement has effectively

increased the number of business interactions where generators, for example, have to deal with domestic and large power consumers, and the electricity supply companies. The broker and the supply companies' existence are based on their ability to buy large blocks of power from generators at discounted prices. This is achieved through firm power purchase contracts. However, there are times when the amount of their contracted power does not match the actual customer demand. These mismatches are dealt with in the Balancing Market (Please refer to section 2.3.1.5 page 76 for the explanation of Balancing Market). If these mismatches are predicted well before the delivery period, supply companies can even negotiate amongst themselves without going to the Balancing Market. These power contract mismatches have also contributed to the increase in business interactions.

Therefore, electricity utilities need to have real-time data on many aspects of their business such as their own current generation capability and generation cost, competitor's pricing structures and current generation capability, customer's power demand, line congestions and network constraints, financial transactions, and competitor bidding strategies. A lot of information must be collected, sorted and analysed for sound business decisions. This has led many electricity companies to look at e-Business for solutions to allow information to be disseminated quickly and business operations to be more streamlined and efficient.

The aims of this review and analysis are to define e-Business and describe the evolution of, and current trends in e-Business strategy and implementation; to describe and discuss traditional business strategy and management in comparison with e-Business strategy; to describe trends in and evolution of the electricity industry; to look at e-Business as a possible business strategy for electricity companies; and to assess its impact on organisational performance. The findings and discussion of this review are important in order to understand and to show the significance of the research issues.

The following section 2.2 and its sub-sections looks at e-Business in general and discuss related topics.

2.2 e-Business

The purpose of this section is to define e-Business in general and in order to further understand what e-Business is, this section also discuss the context within which it exists. This section starts with a brief overview of the e-Business evolution and is followed by sub-sections discussing individually: the environment and the new economy that led to e-Business adoption; various e-Business definitions and concepts; formulation of e-Business strategies and models; and the role that e-Business plays today and in the future.

The increasing pace of business change, often driven by technology in recent years (Morrill, 2001) and the development of the digital environment, is creating a new landscape for companies. Information technology (IT) is said to have played an important role in redesigning the basics of business activities including customer service, internal operations, internal communications, and product and marketing strategies (O'Brien, 1999). Among the many applications of IT to business activities, Internet-based e-Business systems appear to be the most significant (Amor, 2000; Hackbarth and Kettinger, 2000; Kalakota and Robinson, 2001). The Internet offers an open systems concept, which is defined as the *"approach to IT which aims to remove constraints on the way systems can be put together, and on the way information is communicated between systems"* (Perman and Poulter, 2002). This concept help the Internet to rapidly becoming the chosen technology and platform for electronic business activities because it can offer businesses an open and standard way to link with other businesses and individuals and at a much lower cost when compared to the proprietary systems that dominated the commercial sector in the past.

Handling transactions electronically has been shown to be able to reduce transaction costs and delivery time for certain types of good, especially for pure digital items such as software, text products, images or videos. For example, printer manufacturers such as Canon or Epson are using the Internet to distribute printer drivers and updates instead of using floppy disks or CD-ROMs in order to reduce their transactions costs (Amor, 2000). Further financial benefits are predicted by companies such as BT, the UK telecommunications company, who estimate they will achieve $1

billion cost savings through an online marketplace for its procurement activities (Gibb, 2002). It is estimated that over US$300 billion in goods and services will be exchanged over the Internet by the end of 2002 (Laudon and Laudon, 2000).

The promise of e-Business offers businesses the potential of generating more revenues and wealth than was possible before. However, like any revolutionary trend the e-Business phenomenon has resulted in some businesses being rewarded, some gaining no significant improvement, and some that have completely failed. There are therefore lessons to be learned. Based on the success and failure of these e-Business endeavours, companies now have more than mere speculation upon which to base their future projections.

The first generation of e-Businesses, which is generally recognised to have emerged between 1997, when the term e-Business was first introduced by IBM (Viehland, 2000), to the end of 2000 are thought to have *"passed into history"* following the widespread crash of dot-com (Internet-enabled businesses) stock prices and are now entering the second generation (See Figure 2.1) (Brynjolfsson and Urban, 2001; Osborne, 2001). After the burst of the dot-com bubble, the new Internet based economy was confronted with the need to deliver real value to customers and profits to investors. In the first generation of e-Business there was huge growth in business interest in the Internet and many companies rushed to build their own website as a way of keeping up with the competition. However, at this stage, emphasis was not placed on how the Internet could be used to improve business and create value. According to Lowson and Burgess (2003), the use of a website to conduct e-Business can be classified into six general categories: first, as a major sales channel for a product or service; second, as a supplemental marketing channel; third, as a technical support channel; fourth, as an embellishment channel for an existing service; fifth, as a processing channel for orders; and sixth, as an information channel to convey further details about the company and its products and services. At this early instance, companies' development of their websites is mostly centred on the sixth category.

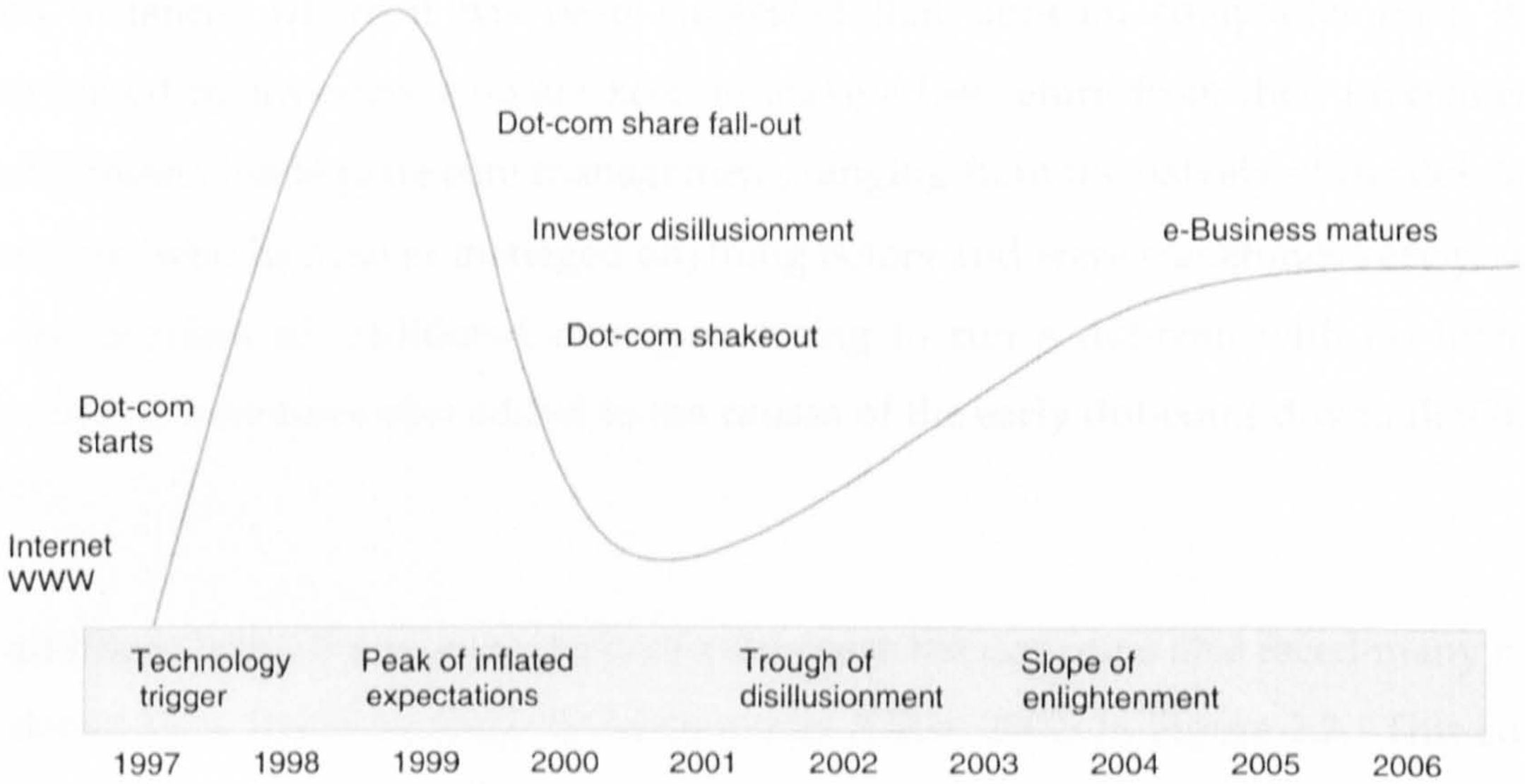

Figure 2.1 Dot-com market development and e-Business Phases

(Source: Osborne, 2001)

During this first generation, most of the attention and investor interest were focussed on start-up dot-com companies and on companies that provide e-Business infrastructure. Dot-coms, like Amazon.com and Priceline.com seemed to be rewriting the rules of business and traditional companies. Those born before the Internet and who did not pioneer e-Business, were considered dinosaurs and likely to lumber their way to extinction (Albrecht, 2002). These traditional companies found themselves at a comparative disadvantage. However, there then followed the crash of the dot-coms where it was estimated that by 2001, five hundred and nineteen (519) dot-coms had filed for bankruptcy or discontinued operations (Munoz et al., 2001).

The primary reason for the failure of the dot-coms was thought to be due to the lack of careful consideration and application of the basic business model and how it generates value and revenues (Albrecht, 2002; Osborne, 2001). Cash-rich investors who were attracted by the many promises and excitements of the dot-coms phenomenon, but did not know how to value such companies were believed to have contributed to the failure of these early ventures (Glass, 2001). De Figueiredo (2001) highlighted that it is *"extremely difficult to value these companies on their assets or profits, because most of these companies have little of either"*. He also added *"even multipliers of revenue are difficult to assimilate into any sensible financial valuation model"*. As it is difficult for investors to asses the long-term sustainability of the dot-coms, there have

been instances where it has been suggested that dot-com companies have been overvalued by investors who are keen to make a fast return from their investments. Furthermore, inadequate core management, ranging from the naivety of the dot-coms managers who had never managed anything before and were sometimes very young, to the problem of traditional managers trying to run a dot-com with no Internet experience, may have also added to the causes of the early dot-coms downfall (Glass, 2001).

In addition, being the first adopters of e-Business the dot-coms also faced many risks as depicted by the technology S-Curve model (Gibb, 2002) in Figure 2.2. This curve shows that a successful technology innovation will go through a period of slow adoption before experiencing a period of more rapid adoption and then a gradual levelling off. When depicted on a graph, the slow growth, rapid expansion, and levelling off form an S-shaped curve (Surry and Ely, 2001). The stages of technology adoption described in this model are also reflected in the e-Business phases illustrated in Figure 2.1 mentioned earlier. The technology S-Curve model suggests that the key phases of a company or an industry technology adoption consist of the initiation, contagion, control, maturity, and decline phase. During these phases a company or an industry will go through a process of determining what technology to adopt or reject and if it is selected how pervasively it should be adopted. As the technology expands there will be increased interest in the technology that will lead to implementation in other applications and businesses. The technology then matures and becomes the norm in the industry. At this stage companies need to find other new technologies or applications to gain competitive advantage (Gibb, 2002).

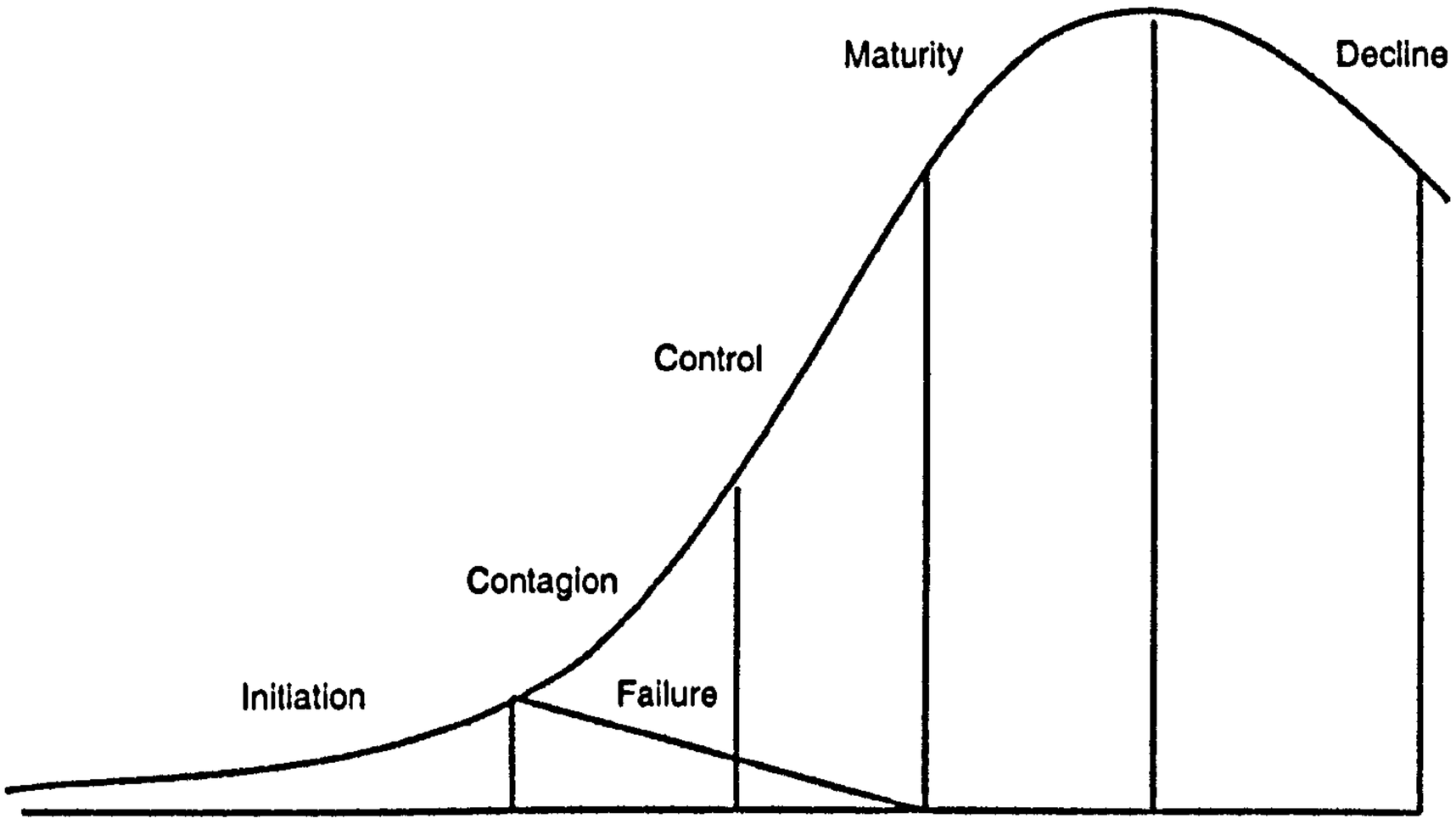

Figure 2.2 The Technology S-Curve

(Source: Gibb, 2002)

Normally the S-Curve shows gradual evolution. However, in the dot-com environment time is significantly compressed which exacerbated the problem. This is sometimes referred to as *dog years* where in the web environment change and product cycles are much faster, which makes it difficult to monitor performance and identify problems and potential failure. Glass (2001) point-out that one of the consistent and major causes of the dot-com failure in various sectors was that these companies *"grew too fast"*. The S-Curve also helps to understand the dot-com phenomenon as the period of rapid expansion for most successful technology innovations occurs when social and technical factors combine to permit an innovative technology to experience increased growth. As early adopters of the Internet-enabled businesses, many dot-coms may have also failed because the social and technical factors at the time of implementation have not yet converged.

The dot-com failure has highlighted that the need for physical assets such as *"shopfronts"* and *"warehouses"* is still important where it is interesting to note that Amazon.com has now purchased its own warehouses and is even opening a high-street store (Osborne, 2001). This is also happening with the online discount stock brokerage Charles Schwab, whose success has proved that shopfronts are needed to attract customers. Schwab believes that it is the combination of people and technology that investors want. The company continues to open new shopfront offices every year, because it has found out that, that is where customers feel most

comfortable signing up for their accounts with the company. But once the relationship is established, the majority of customers use Schwab's web site to monitor and to manage their accounts, where the customers costs less to serve (Kalakota and Robinson, 2001).

Combining the approaches of pure-play (online) companies with the brick and mortar (traditional) companies to develop into click and mortar companies seem to be the real success stories in this new economy. Traditional companies such as General Electric, UPS, Wal-Mart, Merrill Lynch, Tesco and ScottishPower are observed to have begun to take tremendous advantage of the efficiencies and new markets made available by e-Business (Brynjolfsson and Urban, 2001). The advantages that traditional companies usually have when compared to start-up dot-coms include a well-developed and/or receptive customer base, brand recognition, existing infrastructure of physical shops and warehouses, as well as people, policies and processes that have been built up over time. The existence of warehouses and physical shops for example, are evidence of the importance of *"fulfilment solutions"* as there are still plenty of customers who prefer to walk into a store to make their purchases. This is where so many of the dot-coms have fallen down and disappointed their customers (Osborne, 2001). Other advantages of having a physical presence include: a psychological feeling of solidity and stability; high street brand visibility even when the customer is not engaged in a transaction; capture of new customers who are already spending in other physical shops; and a limited amount of serendipitous purchasing.

However, even with these existing advantages, there are some drawbacks associated with traditional companies, which include: legacy of inefficient processes or single channel processes; inflexible legacy systems; and variable profitability depending on locations. With these negative aspects, to make the transformation to an e-Business will not be an easy task and requires radical re-thinking and changes in the overall company structure and culture. Therefore understanding e-Business fundamentals and determining the appropriate goals and objectives based on the company vision need to be considered in order to form the most suitable e-Business strategy for the company.

There is a general trend in this changing business environment to embrace e-Business strategies wholeheartedly (Morrill, 2001). However, e-Business means different things to different businesses and individuals. In some instances e-Business is viewed as simply utilising the Internet as a new marketing or sales channel that will help revolutionise the way products are sold to customers (i.e. Business-to-Customers or B2C) and how businesses will conduct business with one another (i.e. Business-to-Business or B2B). However, e-Business can be more than that. For instance it can also focus on other interaction patterns such as business to employees or B2E, business to government or B2G and business for business or B4B.

To ensure success in e-Business implementations companies need to understand that e-Business is not just about implementing new technology or simply having a Web presence or conducting online transactions with customers. It is more than business process reengineering which, according to Champy (2002), is no longer sufficient because it has primarily focused on the company's internal business processes (which is referred to by this research as the micro level of e-Business, see Figure 2.3). Rather, it involves a radical change in the organisational culture, and societal and market interactions, as well as economic rules and regulations. It is a fundamental shift in the way stakeholders, which include customers, employees, regulators, business partners and suppliers, interact and conduct business (Morrill, 2001) (which is referred to by this research as the macro level of e-Business, see Figure 2.3). Therefore companies need to extend their reengineering processes and activities to also include external entities, which Champy (2002) refers to as *"X-engineering"*, which *"stands for crossing boundaries between organisations"*. According to Champy, X-engineering focuses on improving internal efficiency as well as concentrating on major improvements in business operations and processes between companies and their suppliers, business partners and customers (i.e. looking at business network processes).

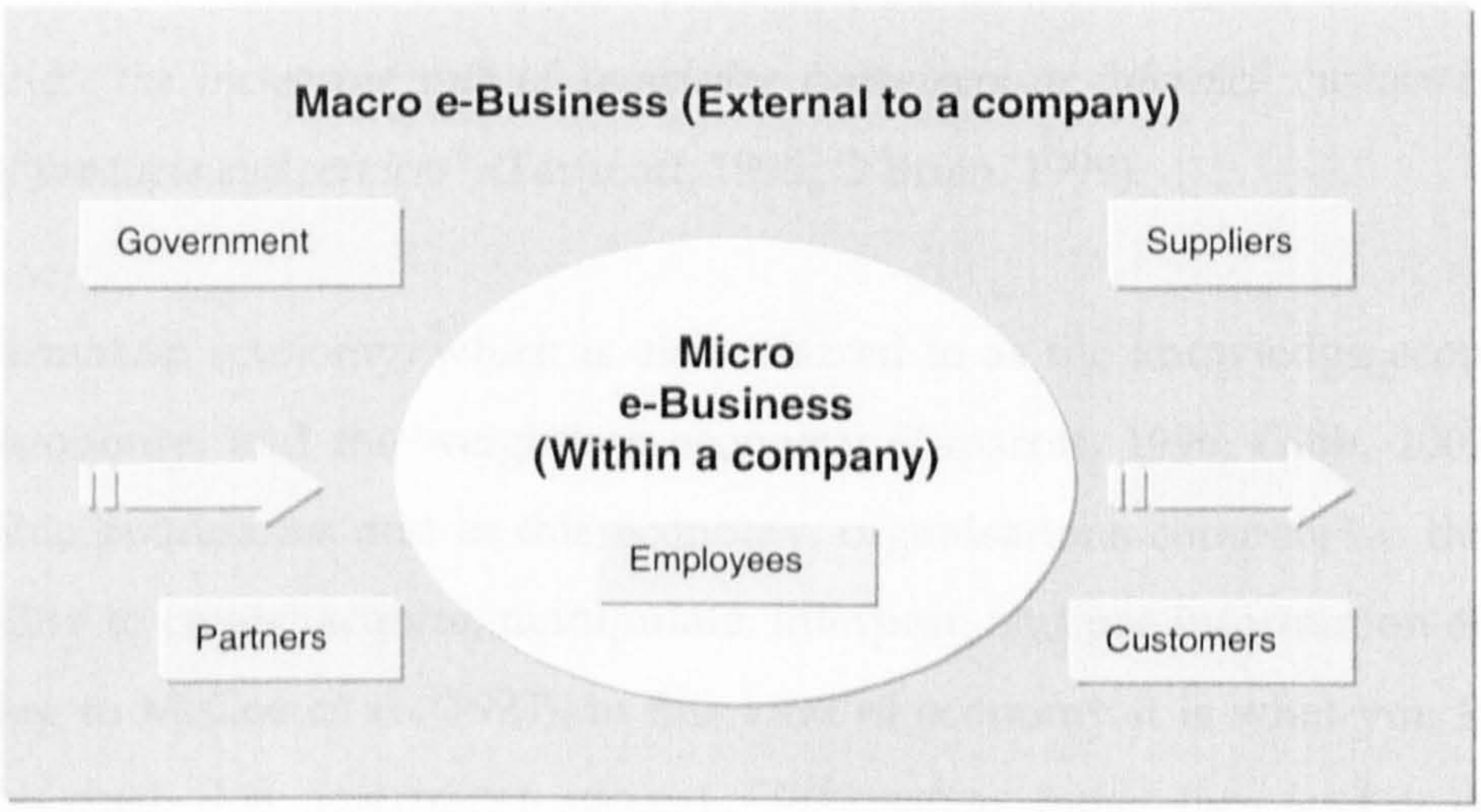

Figure 2.3 Micro and Macro Level to e-Business

The next sub-section discusses the new information-based economy in which e-Business strategies are being adopted as possible business solutions.

2.2.1 The New Economy

In order to provide a better understanding of the e-Business environment and to provide a more detailed e-Business definition, it is necessary to analyse briefly the new economy that has driven its adoption. This section then looks at how technologies have changed the way businesses and individuals interact and function.

The new economy is being shaped by developments not only in computer hardware and software, but also in electronic connectivity. Advances in the capability of information and communication technology (ICT) that *"help speeds information and knowledge flows"* (Clarke, 2001; Morrill, 2001; O'Brien, 1999), have made it possible for companies to reconsider the way in which they operate their businesses, which includes faster product development cycle, better response to customer needs, and significant savings through quicker paperless transactions. This has led the move from an industrial-based economy where machines dominated productivity, to an information-based economy where information and knowledge are the dominant sources of added value. This move is also driven by other inter-related causes such as: *"geographical dispersion associated with the globalisation of goods, capital, and technology markets"* (Clarke, 2001); *"the growth of networked organisations"* (Clarke, 2001; Tapscott,

1996); and *"the increasing rate of knowledge consumers or informed customers on their choices of products and services"* (Tapscott, 1996; O'Brien, 1999).

The information economy, which is also referred to as the knowledge economy, the digital economy, and the weightless economy (Tapscott, 1996; Gibb, 2002) has no geographic boundaries and in this economy, organisations compete on the basis of their ability to create, acquire, manipulate, interpret, and use information effectively. According to McGee et al. (1993), in this kind of economy it is what you know, not what you own, that determines success. *"Information, rather than land or capital will drive the creation of wealth and prosperity"*. In this economy there is a new basis for competition. According to Tapscott (1996), in the digital economy, competition does not necessarily come from existing competitors in the same geographical location only, but it can come from everywhere else in the world. Customers have a wider range of choices since markets are now global. Businesses must now move quickly to capture customers who are more mobile and more informed.

It is also important for organisations to understand that in order to compete successfully they must be prepared to transform the structure of their internal organisation. This structural change requires organisations to develop an innovative business strategy, with an infrastructure oriented toward continuous service improvement (Kalakota and Robinson, 2001). In preparation for this transformation, businesses need to first understand the characteristics of the new economy in which they will be competing. Tapscott (1996) provides a comprehensive description of the new economy by emphasising important characteristics that differentiate the new economy from the old in what he calls the twelve themes of the new economy:

- **Knowledge:** the new economy is a knowledge economy where information technology facilitates an economy based on knowledge. With the Internet, information is now more readily available and accessible, and there are knowledge consumers or informed customers that are more aware of their choices and can now make more informed decisions. Organisational success will be determined and measured by what a company knows rather that what it owns which has led companies to focus on the knowledge worker and other intellectual property, such as patents and brands, as its key resources or assets.

- **Digitisation:** the new economy is a digital economy where information, which includes data, text, picture, video and sound, are being created, captured, analysed and distributed in a digital format. It can now be stored and retrieved electronically in large quantities through the application of semiconductor technologies. Data manipulation is made easier through computer at a scale unthinkable within the last few decades. Digital technology has also allowed greater information exchange between parties. Multimedia information can be sent in the form of email, voice, or video across the network. This has enabled people to work from any location, negating the need for coming together for a meeting or even office space. Digitisation has enabled a whole new way of working by allowing companies to break down any spatial or temporal barriers.
- **Virtualisation:** Technology has evolved to allow certain physical entities to exist virtually or to replace elements of the physical assets with information. For customers, marketplaces, bulletin boards, government and shops no longer have to exist in their traditional forms. For instance eBay can run auctions on-line and is open to a bigger market than it could if it were a physical auction. Some companies, like Nike, use information to reduce inventory and eliminate the need for production capacity by employing third parties and coordinating them through information systems. Workers in the east have been labelled virtual aliens by providing data entry services for Western economies. The effect of virtualisation is that it changes the relationship of the parties involved and the nature of the economic activity.
- **Molecularisation:** Old corporations are being restructured into smaller teams, or units, or sections that form basic economic activities. This challenges the slow, bureaucratic command and control structures of the past and promotes flatter, more agile team based structures. Such structures could not have operated independently previously due to their inability to make decisions because of the lack of information. As technology evolves, the cost of distributing and sharing information drops and knowledge worker teams can be empowered to make local decisions and have greater opportunity to create value. The role of the organisation is no longer to instruct but instead to provide a base environment for the smaller units or teams to work in and interact between themselves and relevant external parties. Molecularisation to the economy as a whole introduced different kinds of relationships between companies, customers, and business

partners. As companies become restructured into clusters of economic activity, market segments are becoming increasingly focused through mass customisation of products and services (Perman and Poulter, 2002; Tapscott, 1996).

- **Integration/Internetworking:** The new economy is a networked economy based on a network of relationships that are formed in order to create value. These relationship models are formed at all level of business function and include the interconnection of business to customers or B2C, business to business or B2B, and business to employees or B2E. In this networked economy, companies can operate more efficiently, extend traditional to electronic markets, and create wider inter-organisational virtual structures that are composed of the company and its customers, business partners, and suppliers (Phan, 2002). For example, in order to better manage its suppliers and customers, Intel created a self-service extranet called *"e-Business Program"*, which focused on procurement and customer support for its products. In terms of customer connectivity, this system in its first run, has enabled around two hundred of Intel's customers in almost thirty countries to place orders for Intel products, check product availability and inventory status, receive marketing and sales information, and obtain customer support, all in real time twenty-four hours a day and seven days a week (Phan, 2002).
- **Disintermediation:** The advent of network technologies allows customers to directly communicate with suppliers or producers without the need for middlemen. This saves time and money and creates added value for both the customers and suppliers. A cheaper price can be a better value and can be achieved by contacting the customers with a minimum number of intermediaries in the supply chain (Alomaim et al., 2003). Companies will be able to pass on the savings to its customers and become more competitive. As a result, brokers, wholesalers, distributors and agents must change their business functions to stay relevant. They need to add value to the transaction by giving extra information or bulk discounts, thereby facilitating the closure of the deal. Government is also seen as a candidate for disintermediation where for example it can introduce systems to improve public services by eliminating layers of different government agencies and creating a single point of access for public interactions. For instance, small traders who may be interested in selling their goods may not necessarily

have to queue over and over again at different government departments to obtain a trading permit.

- **Convergence:** In the new economy, three sectors: computing, communications and content industries, have converged to create a new dominant economic sector also referred to as the *"new media"*. Together, they can help provide the infrastructure or solutions for wealth creation for other sectors. Convergence is seen as becoming the basis of most other sectors as well. The new media created with the initial major convergence have already transformed the way art is being presented, the way scientific research is carried out, and the way education is delivered. These have lead to changes in the way businesses are conducted, and the way people work, play and live. For example, viewing a museum's art display through the Internet, booking holiday packages online, and attending long-distance education lectures through video-conferencing systems.
- **Innovation:** The new economy is an innovation-based economy where companies need to make their own products obsolete before their competitors do. Businesses need to develop products that are better than their competitors. To do so, they must have a culture of innovation in their organisation, as the life cycle of many products is very short in the new economy. Innovative culture can be seen in companies, such as General Electric who in order to stay ahead of its competitors operates a *"destroy your own company"* programme on their Intranet to encourage employees to look for threats to their market dominance and opportunities to improve their offerings (Perman and Poulter, 2002). Innovation should not be limited to only an organisation's products but also in the way an organisation is structured, its management approaches, the strategies it employs and its marketing activities. In the information age human innovation, rather than productivity, labour costs, and production scale, becomes the premium.
- **Prosumption:** In the new economy the gap between consumers and producers blurs. Mass production is now being replaced by mass customisation. New technologies have enabled customer input to be processed and implemented by companies. For example, customers in the motor industry now have a say on what extras their vehicles should carry prior to their manufacture. Television viewers can pre-select the programmes that are of interest to them and watch them whenever they please. The customer effectively takes responsibility for the

product that it consumes. This effectively blurs the line between consumer and producer.

- **Immediacy:** In an economy based on bits immediacy becomes a key driver in economic activity and business success. As information is converted to bits its use, management, and transmission becomes effectively instantaneous. This has enabled companies to analyse real-time data and react accordingly. Companies have configured their operations based on real-time information to receive goods from suppliers and immediately ship them out just-in-time to their customers. For example, car manufacturers can share information internally between small teams, which has helped to reduce product cycles from the initial six years period from concept to production, which was typical in 1990, to two years (Tapscott, 1996). This ability to exchange information in real time is radically changing the way business is done and the internal and external relationships of companies. On the other hand, it can be argued that shopping online for customers still involves an element of time lag between order and delivery. If the goods were purchased in a shop, this would not be the case.
- **Globalisation:** The new economy is a global economy. The world has become smaller due to digital technology. As trade barriers have gone down, free trade zones such as NAFTA (North American Free Trade Area), EEC (European Economic Community) and AFTA (Asean Free Trade Area) have promoted economic growth in their respective areas. Companies need to reposition themselves to take advantage of these changes by forming alliances to benefit from the disparity in business costs between regions. It is no longer the case of a traditional joint venture jostling for business but rather a global group against another. On the other hand, smaller companies have the ability to sell their products worldwide through the Internet. On an individual level, it is no longer necessary for employees to work in a traditional centralised office. An organisation's workforce can now be spread across time zones to ensure continuous progress of a product or constant monitoring of investment portfolios across world markets.
- **Discordance:** All of the above may result in discordance as social and economic structures change. It is likely that, there will be increased disparity between the knowledge workers and blue-collar workers, the haves and the have-nots. The irony is that the great potential of the new technology makes knowledge workers

more marketable and those who are not, less marketable, thus increasing the economic and social gap between them. The disparity is not just between classes of workers but nations as well. It is now harder for third world countries to close the gap between them and the wired world. Internet technologies also allow organisations to monitor the behaviour of unsuspecting users, which infringes individual privacy.

Tapscott's twelve themes of the new economy discuss the environment as well as the advantages and disadvantages that come with it. Companies need to appreciate where they stand in this environment and in order to compete in this new economy, they need also to understand the relationships between the new economy, organisations and technology to help them form a sustainable business strategy. The potential of e-Business is perceived by some business analysts to offer a possible business solution for success in this new environment (Kalakota and Robinson, 2001). The next sub-section elaborates further on e-Business.

2.2.2 e-Business Concepts and Definitions

The term e-Business was first introduced in 1997 by IBM in its marketing campaign (Amor, 2000; Viehland, 2000) which defined e-Business as *"how network technologies can be used to transform key business processes conducted both within an organisation and externally with its customers, partners, stakeholders and suppliers"*. In this definition e-Business is perceived as a secure, flexible and integrated approach to delivering differentiated business value by combining the systems and processes that run core business operations with the ease and reach made possible by Internet technology. It is seen as a step forward from e-Commerce and refers to more than just buying and selling via the Internet where e-Commerce, as an element of e-Business, is defined more narrowly as *"commercial transactions over the Internet only"*. This research will adopt this separation of concepts by identifying e-Commerce as a subset of e-Business and involves primarily in the front-end transactions of e-Business (see Figure 2.4).

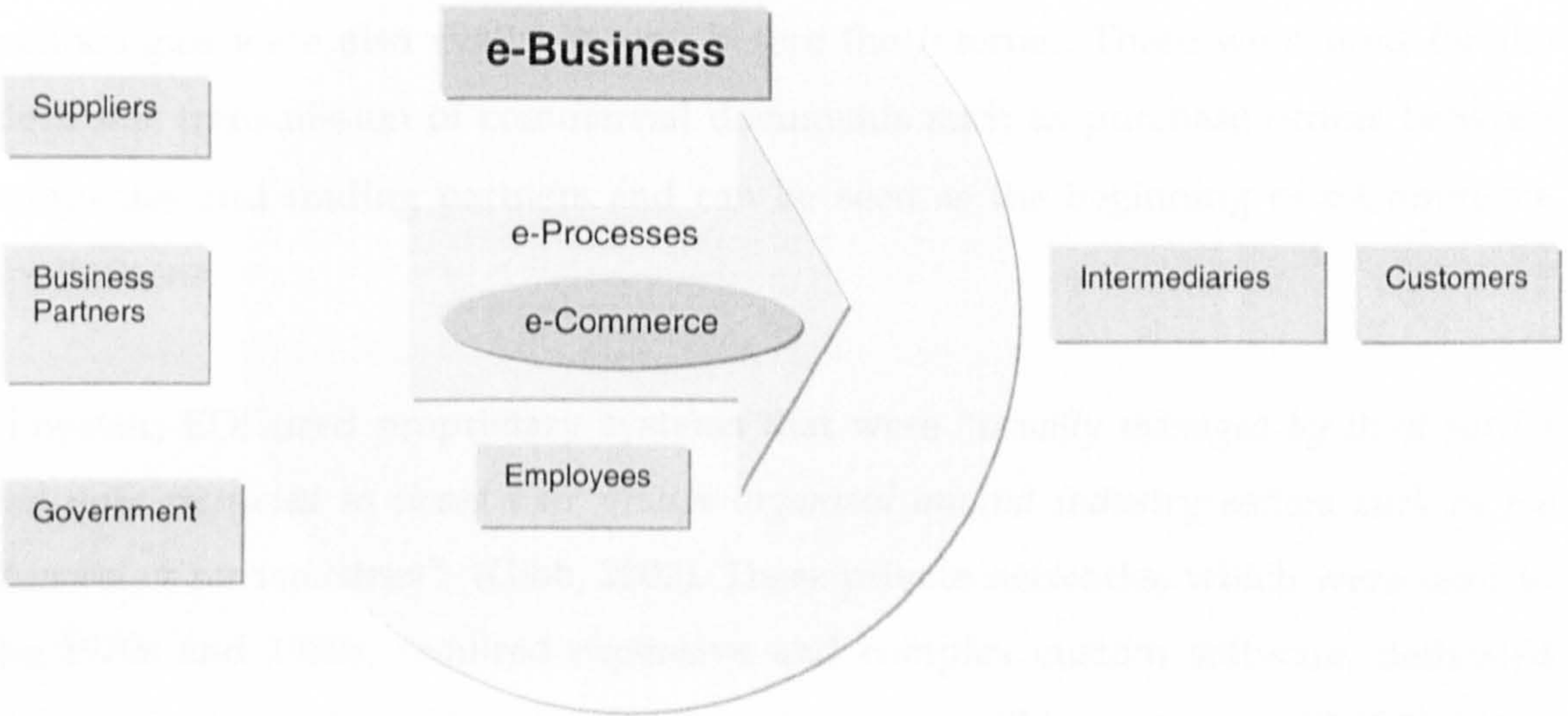

Figure 2.4 e-Business and e-Commerce

(Adapted from: Gibb, 2002)

Based on the definition used by IBM, this research defines e-Business as:

> ***A holistic business culture, structure and mindset, which is not just about buying and selling on the Internet or implementing new technology but integrates core business processes electronically using network technologies to create added value such as enhanced customer services and increased efficiency.***

In addition to e-Commerce another new concept of doing business on-line has emerged with the growth and development of the wireless environment. It is observed that e-Business planners have begun preparing for a growth in wireless devices that will be capable of accessing e-Business sites (Radding, 2000). This includes IP-enabled handheld devices, cellular phones, and other personal digital assistants. These other ways of doing business online are referred to as mobile e-Commerce or m-Commerce, which involves e-Commerce transactions over mobile communications networks and television-based e-Commerce, and t-Commerce, which involves e-Commerce transactions through interactive television (iTV).

The concept of e-Business is not new and had been in place for some years before the Internet became popular. In the 1970s e-Business was already popular for financial networks, which employed electronic funds transfer (EFT) using proprietary

hardware and software solutions (Amor, 2000). Electronic Data Interchange (EDI) technologies were also available long before the Internet. These were used for the electronic transmission of commercial documents such as purchase orders between companies and trading partners and can be seen as the beginning of e-Commerce applications.

However, EDI used proprietary systems that were *"usually managed by third parties and were restricted to closed user groups organised around industry sectors such as the chemical or car industries"* (Gibb, 2002). These private networks, which were used in the 1970s and 1980s, required expensive and complex custom software, dedicated communication links, and in many cases strictly compatible equipment (OECD, 1998). These technologies were also often too expensive for smaller businesses and were not accessible for private use. Therefore, their main users were large businesses and their first-tier suppliers who provided essential materials for them (for example a car manufacturer would have steel or tyres companies as their first-tier suppliers).

Increasingly, the Internet has facilitated changes in the way businesses operate and is creating new ways of conducting business electronically both inside and outside the company. The popularity of the Internet is mainly due to its open, non-proprietary protocol (Transport Control Protocol/Internet Protocol – TCP/IP), combined with the development of the World Wide Web (WWW) which uses a standard coding system (hypertext markup language, or HTML) for representing data, and the development and diffusion of browsers, that provide a standard interface for accessing WWW sites.

Other relevant standards and protocols include XML (Extensible Markup Language), a universal format for structured documents and data, designed to improve the functionality of the Web; WSDL (Web Services Description Language), an XML-based language used to define Web services and describe how to access them; UDDI (Universal Description Discovery and Integration), an industry initiative for a universal business registry of Web services designed to enable software to automatically discover and integrate with services on the Web; SOAP (Simple Object Access Protocol), a lightweight and simple XML-based protocol that is designed to exchange structured and typed information on the Web; and HTTP (Hypertext Transfer Protocol), an application-level protocol with the lightness and speed

necessary for distributed, collaborative, hypermedia information systems. It is a generic, stateless, object-oriented protocol, which can be used for many tasks, such as name servers and distributed object management systems (SOLON Consultants, 2002).

All of these technologies use existing communication systems to create a network that is independent of any one platform (Laudon and Laudon, 2000; OECD, 1998). The Internet combines and exploits almost the entire communication infrastructure including the telephone systems, computer systems and cable TV systems, so that it can be used with a minimal amount of new investment.

Businesses can use Internet networking standards and technologies to create private networks called Intranets, which are internal organisational networks that can provide access to data from multiple information systems across the enterprise. An Intranet uses the company's existing network infrastructure, supported by Internet connectivity standards and software developed for the World Wide Web, but is protected from public access by firewalls (a security system with specialised software to prevent outsiders from invading private networks (Laudon and Laudon, 2000)). An Intranet can be expanded so that it is also accessible to customers and business partners. Private Intranets that are extended to authorise users outside the company are called Extranets. Companies can use firewalls to authenticate users, and to ensure that access to its internal data is limited and remains secure.

In order to explore the capabilities and the impact of e-Business, it is essential to define e-Business and its related terms and concepts. This section reviews key definitions and also introduces the definition of e-Business used for this research. The following sub-section continues the e-Business discussion and establishes this research definition of e-Business strategy.

2.2.3 Formulating e-Business Strategies

Strategic thinking and strategic management are two of the most important activities undertaken by any business or public sector organisation. How skilfully these activities are carried out will determine the eventual long-term success or failure of

the organisation. The word strategy is used in many ways and has many definitions. Due to the variety of uses of the term Mintzberg (1995) proposed his *"five Ps"* of strategy in which he suggested that a strategy could be a plan, a ploy, a pattern of behaviour, a position in respect to others, and a perspective. According to Campbell, Stonehouse and Houston (1999), it is important not to see these Ps in isolation from each other because there is a possibility for an organisation to show evidence of more than one interpretation of strategy.

Johnson and Scholes (1999) define (business) strategy as the *"direction and scope of an organisation over the long term: which achieves advantage for the organisation through its configuration of resources within a changing environment, to meet the needs of markets and to fulfil stakeholder expectations"* where strategy can also be seen as the matching of the activities of an organisation to the environment in which it operates. Based on these definitions and the e-Business definition given in Section 2.2.2, this research defines e-Business strategy as:

> ***A plan and a set of activities to synchronise an organisation's business processes and resources to embrace e-Business, in order to create value (where value is perceived as the ability to find new markets, form new alliances, create new businesses, or establish superior customer services) and form a sustainable business strategy (that can help ensure the organisation's competitiveness, profitability, and future growth).***

According to Johnson and Scholes (1999), there are different levels of strategy within all organizations. They identify *"corporate strategy"* which is concerned with the overall purpose and scope of the organization, *"business unit strategy"* which focus on how to compete successfully in a particular market, and *"operational strategies"* that are concerned with how the organisation in terms of resources, processes, people and their skills, effectively achieve the corporate and business unit strategic goals. In this research, e-Business strategy is seen as a strategy that supports the overall organisation's strategy in which it should support the corporate strategy objectives and also support the operational strategies, which include marketing, supply chain management, human resources, finance, and information systems strategies.

In the late 1990s many e-Business projects were undertaken very rapidly as a way of keeping up with the competition. For example, it has often been the case that when a company heard about another competitor company preparing to launch an e-Business website, it would then immediately instruct its own IT department to do the same (Osborne, 2001). In many cases, the solution was done half-heartedly with no integration into the back-end systems and processes, leading to problems such as making online orders or enquiries difficult to fulfil or creating duplication in work processes by having to enter the requests twice. To avoid these situations, businesses need to understand that any technology decision must be made in conjunction with the overall organisational business strategy, otherwise there will be no clarity as to the role of the solutions, what they are supposed to achieve and how they will grow with the business in the future.

To develop an e-Business strategy, especially in an existing company, there will be various areas that have to be taken into account. In determining the right e-Business strategy, companies need to identify what the advantages and strengths of implementing the strategy are and what types of strategic opportunity are available to the company as well as identifying the criticality of the implementation and possible threats to the company if transformations towards e-Business are not undertaken or are delayed. To analyse and study these factors, van Hooft and Stegwee (2001) suggested adopting an existing comprehensive strategic information systems planning (SISP) process where SISP is defined as *"the process of deciding the objectives for organisational computing and identifying potential computer applications which the organisation should implement"*. e-Business was incorporated into the basic alignment model for SISP as illustrated in Figure 2.5.

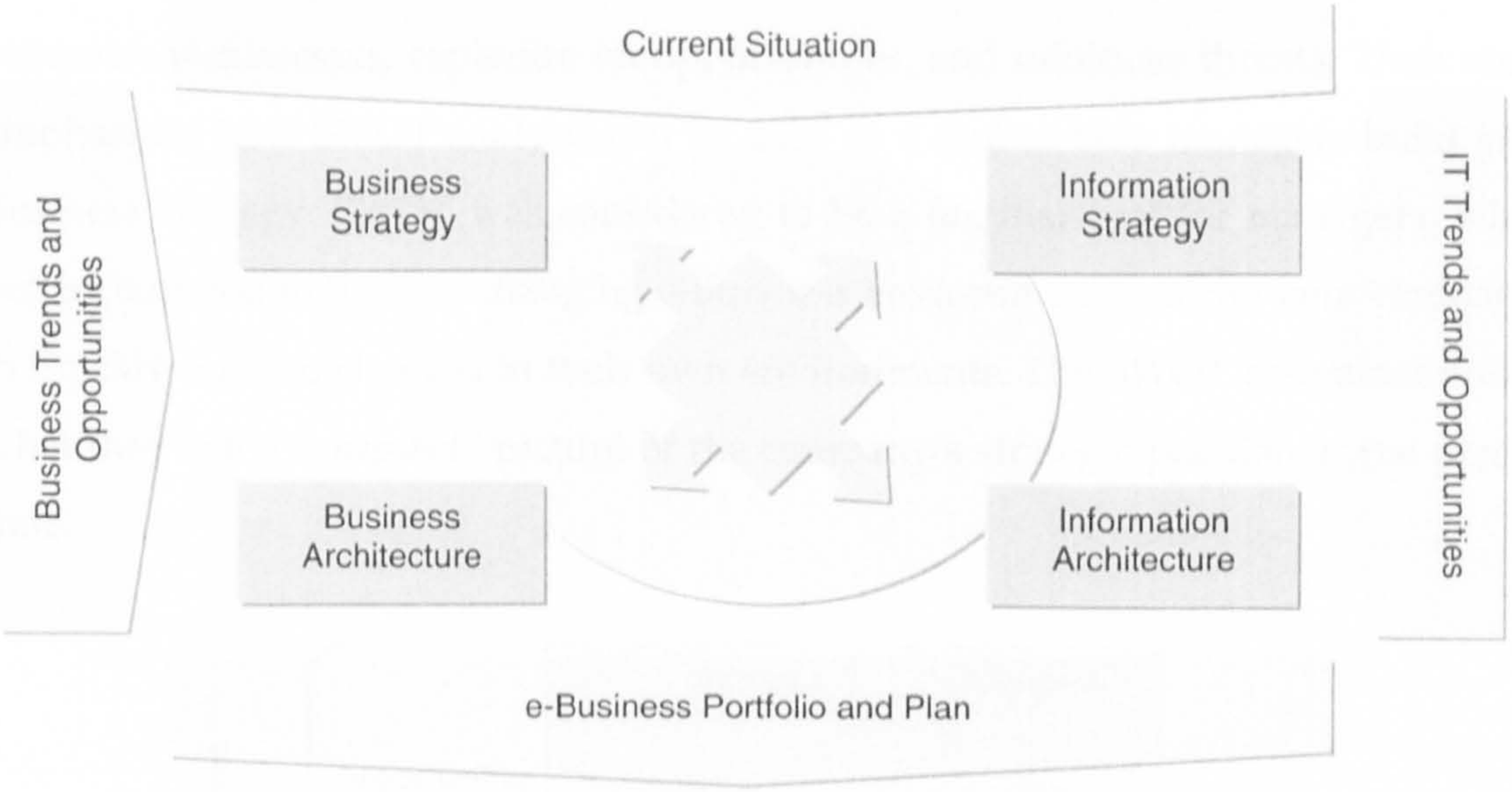

Figure 2.5 e-Business incorporated into the basic alignment model for SISP

(Source: van Hooft and Stegwee, 2001)

This model describes a series of tasks that companies can perform in order to develop their e-Business strategy by first identifying how e-Business influences the industry in which the company operates, followed by analysing the current situation of the company. Then, taking the current IT developments into account, companies can formulate their vision on how e-Business will affect their business in the future. The circle in the model illustrates the reach of the e-Business vision. In order to realise the e-Business vision, this model places emphasis on developing an information strategy to help companies arrive at an e-Business strategy, which will then be used as a guideline to investigate current business architectures to determine the areas where e-Business applications can be implemented. A portfolio is then created to evaluate the impact of the e-Business applications identified. This portfolio describes the necessary changes for the organisation in order to accomplish strategic goals set out by the e-Business vision, which will then be integrated with existing IT architectures.

Existing business models, analytical frameworks and theories can be applied to study the position of a business and its environment to identify the above factors. For example, in a study conducted by Hackbarth and Kettinger (2000) they outlined how organisations can be transformed into e-Businesses using SWOT (strengths, weaknesses, opportunities and threats) analysis (see Figure 2.6), which is an analytical approach used to identify areas in which one can exploit strengths,

minimise weaknesses, capitalise on opportunities, and minimise threats. Their study emphasised how SWOT analysis can be used as a tool to help managers build an e-Business strategy. SWOT was considered to be a familiar tool for managers, which can be targeted to the fast-changing e-Business environment and can help companies to quickly react to changes in their own environments. The SWOT assessment offers what they call a *"snapshot"* picture of the company's strategic position at the present time.

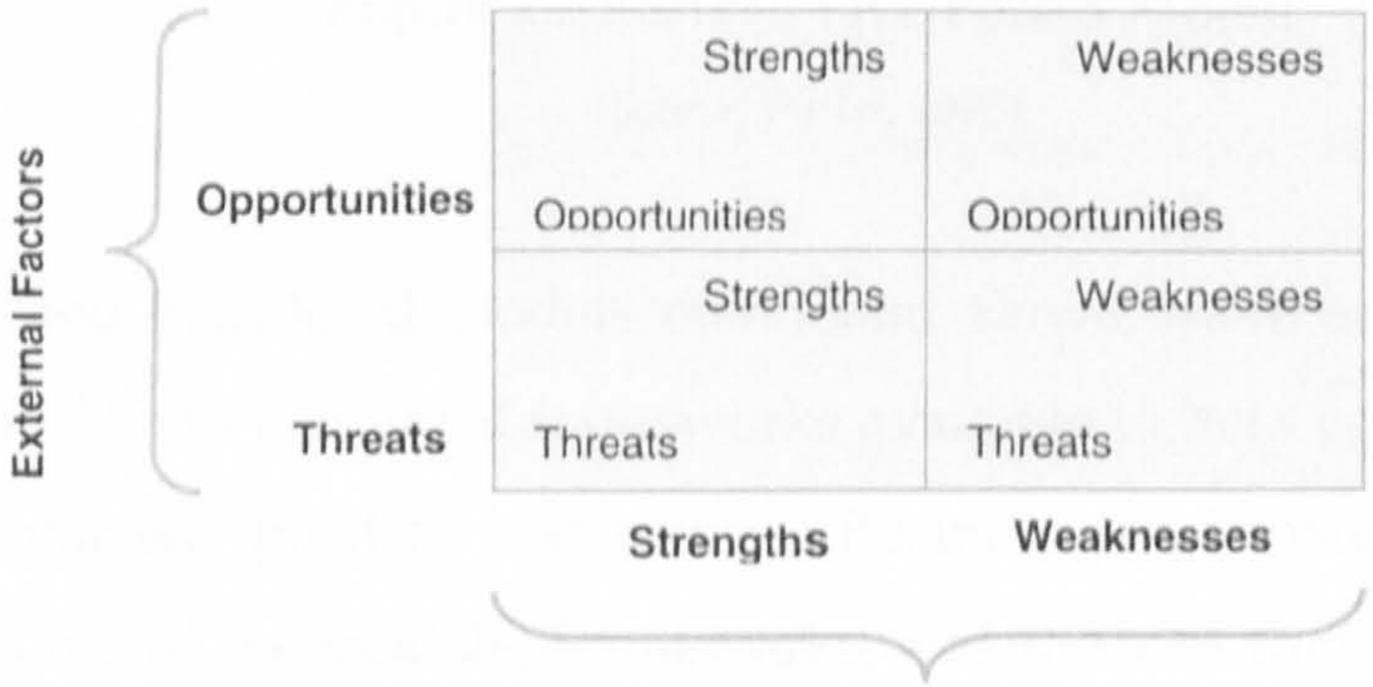

Figure 2.6 SWOT Matrix

(Adapted from: Robson, 1997)

van Hooft and Stegwee (2001) also used SWOT analysis in their study to examine a company in its present state, in order to identify where e-Business can affect a company and ensure that all relevant aspects are covered. They felt that this is because each assessment in SWOT focuses on a specific area and can give an overview of both the company and its products or services regarding aspects relevant to e-Business issues. To investigate both the organisation and its surrounding environment, they also used another business model adopted from Porter's Five Forces Model (Porter, 1985) illustrated in Figure 2.7, which describes the rules of competition. The combined results from both these models are then used to help a company construct its e-Business vision that it will subsequently utilise to help formulate the company's e-Business strategy.

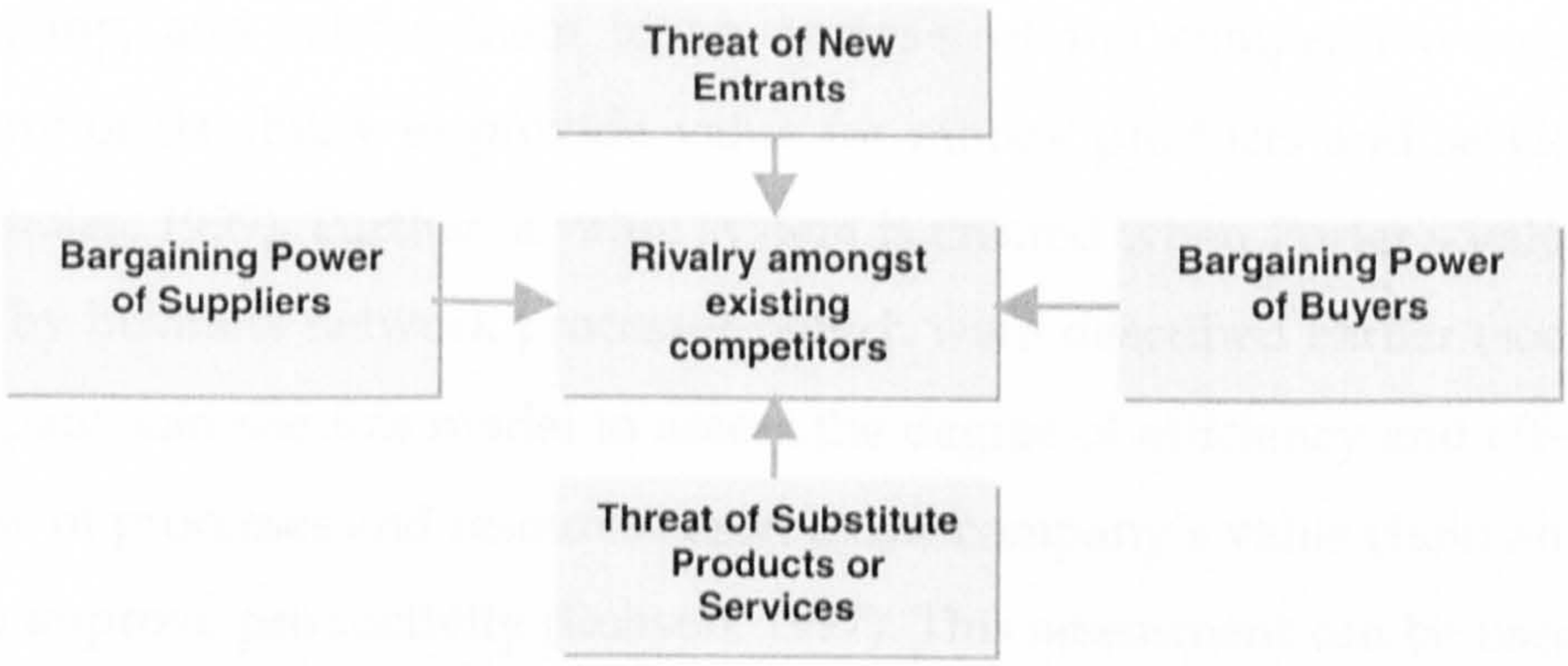

Figure 2.7 Porter's Five Forces Model

(Source: Porter, 1985)

Besides the two traditional models mentioned above, there are a number of other business models and analytical frameworks available to help companies analyse and study their current position regarding e-Business implementation. This research focuses on some of the models, frameworks, and theories that have been used with information strategy development, which can also be applied to formulating e-Business strategies. These models or frameworks are frequently used tools and most commonly presented in the form of 2x2, or occasionally 3x3 matrix (Gibb, 2002). There are based on a fixed and straightforward classification, which allows the user to create a summary of complex issues in a graphical form and are intended to be conceptual, educational, as well as analytical. Some of these models and frameworks include Porter's Value Chain Model, The Boston Consulting Group Model, Nicholls MCC Decision Matrix, Strategic Options Generator, McFarlan and McKenney Strategic IS/IT Importance Matrix, Risks and Returns Portfolio Matrix, Earl's IS Strategy Formulation –A Multiple Methodology, Miles and Snow's Strategic Fit Framework, Benefit Level Matrix, Cost Risk Matrix, Systems Audit Grid, Hammer and Mangurian's IT Value-Impact Analysis, Riggins's e-Commerce Value Grid, and Riggins's e-Business Value Grid (Nicholls, 1995; Robson, 1997; Johnson and Scholes, 1999; Riggins, 1999; Riggins and Mitra, 2001; Gibb, 2002). The approach taken in this section is to briefly review a representative sample of these frameworks and models where some of them will be used in the analysis section of this thesis.

Porter's Value Chain model represents a company as a connected chain of related activities, which are concerned with the provision of the company's products and services to its customers (see Figure 2.8). It describes the activities within and around

a company, and relates them to an analysis of the competitive strength of the company or its ability to provide value for money products and services (Johnson and Scholes, 1999). Further, a value system is created when Porter's value chains are linked by business network processes, which were described earlier (see Figure 2.3). A company can use this model to assess the degree of efficiency and effectiveness of the flow of processes and resources used in the company's value chain and to analyse how to improve productivity (Robson, 1997). This assessment can be used to identify where e-Business opportunities could be exploited for the company.

Figure 2.8 Porter's Value Chain Model

(Source: Johnson and Scholes, 1999)

The Boston Consulting Group (BCG) model (see Figure 2.9) is regarded as a complementary tool to SWOT analysis for analysing an organisation by using a two by two matrix, which categorises *"businesses, divisions or products according to the present market share and the future growth of that market"* (Robson, 1997). The objective of this model is to differentiate between *"cash generators"* and *"cash consumers"* and summarises the expected profit and cash flow, which can then be used as a guideline to form appropriate strategies for companies. This model can be used as a predictive device since positioning a business element in a particular quadrant gives some advice as to how to manage that business element appropriately (Robson, 1997; Gibb, 2002), which can be useful to help companies formulate their e-Business vision and mission.

Figure 2.9 Boston Consulting Group (BCG) Matrix

(Source: Robson, 1997; Gibb, 2002)

Complementing the BCG model, Nicholls (1995) suggested that organisational resources should be allocated to activities that support companies' core competencies and help to achieve companies' missions by using the Mission and Core Competencies (MCC) portfolio decision matrix (see Figure 2.10). The MCC decision matrix *"looks at the fundamental health of the entire organisational tree by linking the organisation's mission and its core competencies when making strategic decision"*. This model is based on regarding a company as a tree with its mission and vision providing the nutrients that feed the tree, the core competencies as its roots, and through core processes produces fruits in terms of projects and products (Nicholls, 1995; Robson, 1997). The advantage of this model is that it can be used for strategic assessment to support making holistic company decisions, at any level within a company including smaller units.

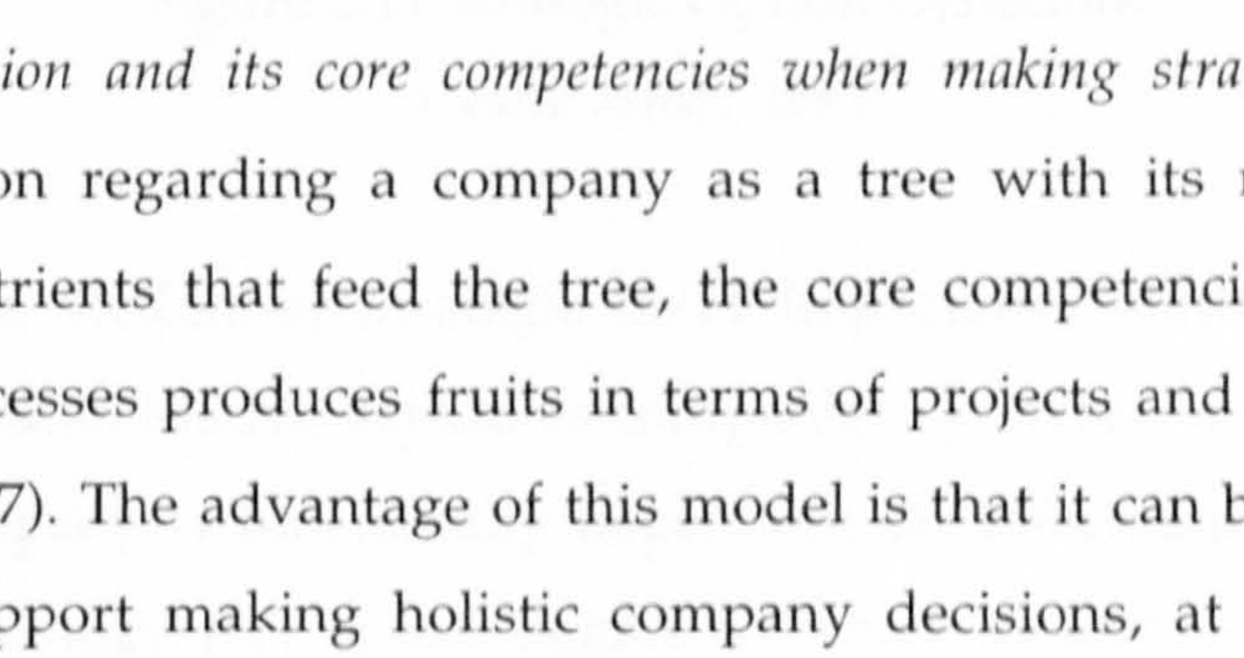

Figure 2.10 Nicholls's Mission Core Competencies (MCC) Decision Matrix

(Source: Nicholls, 1995)

Rackoff's Strategic Options Generator framework has expanded Porter's work on competitive strategies and proposes a more comprehensive model of industry competition (Robson, 1997). According to this model *"strategic thrusts"* are *"the major*

moves, or actions, that a company takes and these can be offensive or defensive in nature" which can be applied to three possible *"strategic target"* categories (see Figure 2.11) This model provides a framework for determining strategic opportunities, which can be used to identify e-Business opportunities for companies.

	Strategic Target		
Strategic Thrust	Supplier	Customer	Competitor
Differentiation			
Low Cost			
Innovation			
Growth			
Alliance			

Figure 2.11 Strategic Option Generator

(Source: Robson, 1997)

The McFarlan and McKenney Strategic IS/IT Importance Matrix (see Figure 2.12), derived from the BCG Matrix, separates companies by virtue of the different degree to which the company is functionally dependent on Information Systems (IS) and Information Technology (IT) or the degree to which IS and IT developments will create competitive edge. IS and IT systems can also be positioned according to the importance they hold to the business under review (Robson, 1997). The four quadrants in this model consist of *"Strategic"*, *"Factory"*, *"Turnaround"* and *"Support"* and *"can be used for assessing a company's or business unit's total IS/IT application portfolio in order to determine the importance, and therefore the management approach required of IS/IT in the business"* (Gibb, 2002). This in turn will be useful for companies as a guideline to help them identify the appropriate e-Business applications and formulate their e-Business strategies.

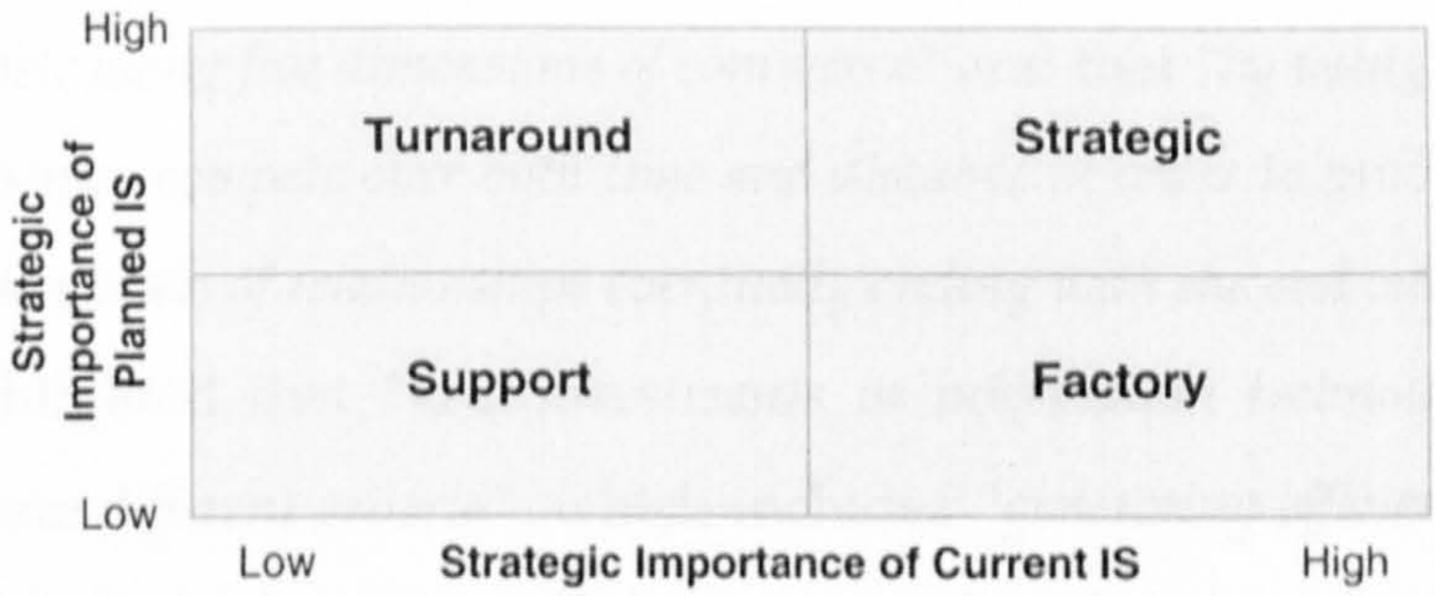

Figure 2.12 McFarlan and McKenney Strategic IS/IT Importance Matrix

(Source: Robson, 1997)

Another model that is more specific to the impact of IS and IT in a company and an industry is Hammer and Mangurian's IT Value-Impact Analysis (see Figure 2.13), which *"suggests the potential impact areas that management should focus on to exploit IS and IT opportunities"* (Gibb, 2002). This model describes the impact of IS and IT on the time, space and relationships of a business which can be measured in terms of efficiency, effectiveness and innovation.

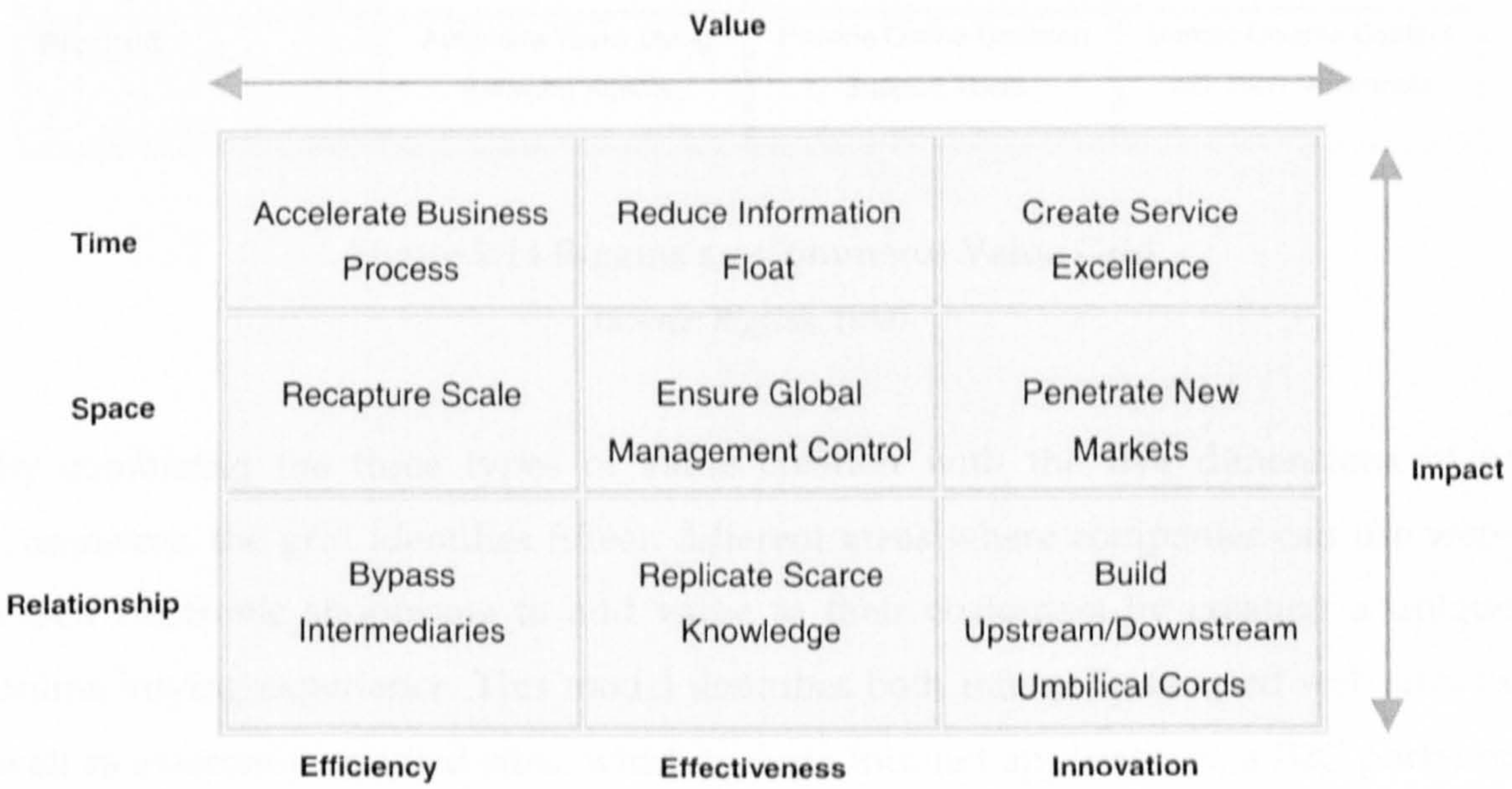

Figure 2.13 Hammer and Mangurian's IT Value-Impact Analysis

(Source: Gibb, 2002)

In an effort to provide more specific models and frameworks for an e-Business environment, Riggins (1999), developed the Electronic Commerce Value Grid (see Figure 2.14) based on Hammer and Mangurian's IT Value-Impact Analysis model, to categorise different e-Commerce applications. This grid is based on the concept that

"businesses compete along five dimensions of commerce" and that *"by using various modes of interaction, companies compete over both time and distance in order to provide some product or service through a chain of relationships eventually ending with the end customer"*. Riggins (1999) also highlighted that *"new investments in information technology are typically justified using three different criteria"*, which includes *"generating efficiency, effectiveness, and/or strategic benefits"*.

Dimension	Value Creation		
	Efficiency	**Effectiveness**	**Strategic**
Time	Accelerate User Tasks	Eliminate Information Float	Establish 24/7 Integrated Service
Distance	Improve Scale to Look large	Present Single Gateway Access	Achieve Global Presence
Relationships	Alter Role of Intermediaries	Engage in Personalisation to Look Small	Create Dependency to Lock-in User
Interaction	Make Use of Extensive User Feedback	User Controls Detail of Information Accessed	Users Interact via Online Community
Product	Automate Tasks Using Software Agents	Provide Online Decision Support Tools	Bundle Diverse Content with Rich Multimedia

Figure 2.14 Riggins's e-Commerce Value Grid

(Source: Riggins, 1999)

By combining the three types of value creation with the five dimensions of e-Commerce, the grid identifies fifteen different areas where companies can use web-based electronic shopfronts to add value to their customers by creating a unique online buying experience. This model describes both internally focused web sites as well as externally oriented sites, which include Intranet applications, a B2C portal or community site, a web-based information news site, and an online shopfront selling physical or information goods (Riggins, 1999). However, for many e-Business applications, particularly many B2B applications, the e-Commerce Value Grid model is still not sufficient to represent a comprehensive e-Business strategy for companies. Taking into account the activities of a company's value chain as described in Porter's Value Chain Model (see Figure 2.8), which include inbound logistics, operations, outbound logistics, marketing and sales, and service, the e-Commerce Value Grid may be useful for defining marketing, sales and service applications because it is

primarily concerned with the functionality of the web browser interface, however, it does not address issues related to the activities further up the value chain (inbound logistics, operations, and outbound logistics) (Riggins and Mitra, 2001). Riggins and Mitra (2001) later introduced a complementary e-Business Value Grid (see Figure 2.15) that takes into account these upstream activities.

Dimension	Value Creation		
	Efficiency	**Effectiveness**	**Strategic**
Plan	Implement Rich Media for Company Wide Interaction	Provide Online Executive Information Systems	Facilitate Knowledge Management Between Partners
Develop	Standardised Platform for Cross-Functional Design	Achieve Design for Manufacturability	Enable Concurrent Design Across Virtual Organisation
Inbound	Support Electronic Transactions with Suppliers	Generate Supply Flexibility Through E-Hub Communities	Offload Replenishment Responsibility to Suppliers
Produce	Integrate Shop Floor with ERP System	Exchange Production Data Between Partners	Optimise Utilisation of Global Production Capacity
Outbound	Support Electronic Transactions with Customers	Furnish Online Order Status Information	Institute Seamless Integration with Fulfilment Partners

Figure 2.15 Riggins's e-Business Value Grid

(Source: Riggins and Mitra, 2001)

In the e-Business Value Grid, Riggins and Mitra (2001) introduced five additional dimensions related to activities further up a company's value chain, which include inbound logistics, internal production systems and outbound logistics as well as two preliminary support activities that consist of planning the overall value chain strategy and technology development through a company's research and development function (R&D). In this grid, fifteen additional back-end Internet applications were identified.

Riggins's e-Commerce and e-Business Value Grids provide a comprehensive set of Internet-based applications that encompasses all aspects of the value chain, which could be used by managers to consider their business environment. The *"functionality*

interaction" (which is *"based on the idea that a given e-Business application is enabled and made more effective by interaction with other e-Business applications"* Riggins and Mitra (2001)) described in these frameworks could be used to plan a company's overall e-Business strategy as well as to evaluate gaps in a company's current strategy by focussing on the key dimensions suggested.

Knowing the importance and structure of e-Business is not enough. Companies need to create and implement a plan that allows them to make the transition from an old business strategy to a new e-Business strategy. The above studies have highlighted that in planning for a successful e-Business strategy, companies need to have a clear idea of where they want to go and what they want to do. To get started they need to ask themselves some preparatory questions such as:

- *What role will e-Business play in the company today and over time?* They need to take a long view of how they want their company to manage its e-Business initiatives. They need to consider overall goals and how e-Business can help them achieve those goals. In addition, they also need to look at trends in their market and industry in relation to e-Business.
- *What resources do they need to allocate in order to implement e-Business?* They need to consider the time, money and energy necessary to get involved in e-Business. They need to analyse their IT budget to see what areas require financial investments. Up front costs and ongoing costs that may be related to their technology investment also need to be considered. They will need to take a look at their personnel and identify who will oversee the e-Business projects. What kind of return can they expect on their e-Business investment? It is important to have some kind of way to measure the success of e-Business investment, for example by looking at the percentage of a company's total business that has been transacted online; percentage of goods purchased online from suppliers; number of existing customers doing business online; number of new customers acquired online; and the percentage of customer service requests handled online. (Barua et al., 2001). Companies can also use traditional measures such as reduction in operational costs; increase in revenue; reduction of product development cycle; increase in employee motivation; and improvement in customer satisfaction. The measures used will depend on the company's specific goals, which might relate to revenue, customer retention, costs or employee satisfaction.

- *What will the impact of e-Business be on their companies?* They need to consider current business processes and how getting involved in e-Business will affect them. For example, getting involved in customer relationship management will affect how customer service, marketing, sales and even product development departments operate. How will they encourage employees to use the new tools and applications?
- *What should they develop in-house and what should they outsource?* A careful examination of the internal resources may help determine what can be done internally and when it is appropriate to use the services of an outside expert.

The e-Business planning process may look like common sense, but doing it right requires an ongoing and firm commitment of time and energy. Transformation from traditional businesses to become e-Businesses may involve a number of phases or levels and usually evolves from initial experimentations with Internet-related technologies to a transformation of the company into an enterprise prepared to compete successfully in the new economy. According to Hackbarth and Kettinger (2000) as companies evolve they will go through three distinct levels of e-Business strategy development and competence (see Table 2.1) which can be compared with McFarlan and McKenney's model's (see Figure 2.12) four degrees of companies' dependency on IS and IT.

	Level 1 Experimentation	Level 2 Integration	Level 3 Transformation
e-Business Strategy	No e-Business Strategy	e-Business strategy supports current corporate strategy	e-Business strategy supports breakout (to be) corporate strategy
Corporate Strategy	e-Business strategy not linked to corporate strategy	e-Business strategy subservient to corporate strategy	e-Business strategy is a driver of corporate strategy
Scope	Department or functional orientation	Cross-functional participation	Cross enterprise involvement (interconnected customers, suppliers, and partners)
Payoffs	Unclear	Cost reduction, business support and enhancement of existing business practice, revenue enhancement	New revenue streams, new business lines, drastic improvements in customer service and customer satisfaction
Levers	Technological Infrastructure and software applications	Business processes	People, intellectual capital and relationships, cooperation
Role of Information	Secondary to technology	Supports process efficiency and effectiveness	Information asymmetries used to create business opportunities

Table 2.1 Three Levels of e-Business

(Source: Hackbarth and Kettinger, 2000)

The three levels consist of *"experimentation level"*, *"integration level"* and *"transformation level"*:

Level 1 (*"Support Quadrant"*): At the experimentation level, individual departments in the company will have taken a technological lead in developing isolated Internet or information systems applications that lack integration with the corporate strategy or a company-wide e-Business strategy.

Level 2 (*"Factory Quadrant"*): At the integration level, companies will have progressed to incorporating e-Business to support their current business strategies by integrating business processes across functional departments. Their focus is on the direct support of existing business processes.

Level 3 (*"Turnaround and Strategic Quadrants"*): At the transformation level, companies empower themselves by using e-Business strategy to drive the corporate strategy and will have created a transparent communications network between customers, suppliers, and business partners. The value chain becomes interconnected and new revenue streams are identified and developed, customer satisfaction

increased and customer service improved. Level three strategies recognise that people and their intellectual capital give an e-Business its strength and flexibility.

To move from the first level to the higher levels, companies need to overcome many challenges. Becoming a level three company symbolises the transformed businesses of the new economy with characteristics such as having stronger customer relations, being capable of utilising intellectual capital and having established cooperative relationships with competitors. To reach this position, companies need to continually respond to strategic threats and capitalise on market opportunities (Hackbarth and Kettinger, 2000).

Once the strategy has been formulated, companies need to look at possible e-Business models that help determine how to implement the strategy and achieve the company organisational objectives. The following sub-section will elaborate on the various e-Business models used currently.

2.2.4 e-Business Models

The global reach and interconnectivity of the Internet have led to the creation of new business models and radical transformation of existing ones (Pant and Ravichandran, 2001; Kalakota and Robinson, 2001). Rappa (2002) commented that while there is much discussion on how the web and the Internet change traditional business models, there is less straightforward verification of exactly what this means. Some of the growing literature on e-Business models by academics and consultants refer to *"Internet business models"*, *"business models for the web"* or *"online business models"* (Osterwalder and Pigneur, 2002; Rappa, 2002; Pant and Ravichandran, 2001) and discuss various classifications of these e-Business models. However, currently there is no one comprehensive and commonly accepted e-Business model for each industry. This section will therefore discuss some of the e-Business models that are currently being used as well as looking at the relationships between businesses, their partners and customers.

Rappa (2002) defines a business model as *"the method of doing business by which a company can sustain itself and generate revenue. It spells-out how a company makes money*

by specifying where it is positioned in the value chain". According to Rappa, some models can be quite simple. For instance, where a company produces goods or services and sells them to customers and if it is successful the revenues from sales exceed the costs of operations and the company realises a profit. While other models can be more complex. Osterwalder and Pigneur (2002) define a business model as *"a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams"*. This definition emphasises that a business model encompasses several activities including product innovation, customer relationship management, infrastructure management, and financial matters.

This research has adopted the above definition by breaking it down into three components as suggested by Timmers (1998) where a business model is defined as:

- An architecture for the product, service and information flows, including a description of the various business actors and their roles;
- A description of the potential benefits for the various business actors; and
- A description of the sources of revenues.

Business actors include the companies, customers and business partners within the model.

Based on these definitions of a business model, e-Business models therefore can be described as the way companies do business electronically (Weill, 2001) and show why and how an e-Business application works from an economic perspective where an e-Business model defines how economic value is created and exchanged within a network of business actors (Gordijn and Akkermans, 2001). Furthermore, e-Business models also frame the business requirements that IT systems and networks must satisfy.

As mentioned earlier there are various classifications of e-Business models at present (Timmers, 1998; Rappa, 2001; Weill, 2001; Pant and Ravichandran, 2001). These classifications describe different aspects of e-Business models, which can be revenue and product specific, business actor and network specific, as well as marketing specific (Osterwalder and Pigneur, 2002). This research looks at some of these e-

Business models (see Table 2.2) that have been identified and classified by this research as the key e-Business models that are currently being used by companies.

Business Model	Description
e-Tailing, Merchant, e-Shop, Direct-to-Customer	In these models businesses provide goods or services to the customers on the Web. These range from businesses that operate only on the web, also known as pure e-tailers, to traditional brick-and-mortar companies with a web shopfront. They usually focus on B2C interactions. Example includes Amazon.com, Dell, Ryanair, Ticketmaster.com, and Tesco.
Infomediary, Information Brokerage	An infomediary is a body or a company that provides specialised information usually published using a website on behalf of producers of goods and services and their potential customers. The term is a combination of information and intermediary. Infomediaries can be divided into those intended for consumers and those intended for businesses. Some companies in these models serve as infomediaries by collecting and selling information to other businesses (B2B), for instance information on customer buying habits, or can also work in the other direction by providing consumers with useful information to help them make decisions (B2C). Examples include energywatch and Elexon.
Supply Chain, e-Procurement	e-Procurement is the business-to-business purchase and sale of supplies and services over the Internet. An important part of many B2B sites, e-Procurement is also sometimes referred to by other terms, such as supplier exchange. This model makes use of the ubiquitous connectivity of the Web to enhance and replace existing EDI linkages between business partners. Examples include Dell's supply chain with its partners and similar initiatives by Nike.
Advertising, Content Provider	The web-advertising model is an extension of the traditional media-broadcasting model. The broadcaster provides content via web sites that are usually, but not necessarily, free and services like e-mail, chat and forums, mixed with advertising messages in the form of banner ads. The banner ads may be the major or sole source of revenue for the broadcaster. The broadcaster may be a content creator or a distributor of content created elsewhere. Examples include Yahoo!, AOL/Time Warner, BlueMountain and Reuters.
Virtual mall, e-Mall	This model relies for its success on presenting to customers a number of products for sale from one portal. It provides a site that hosts many online traders. The Mall usually charges set-up, monthly listing and/or per transaction fees. Examples include Yahoo! Stores, Choicemall, and MarketStreetMall.
Virtual communities	This model creates and facilitates an online community of people with a common interest, enabling interaction and service provision (C2C). The ultimate value of virtual communities comes from the members, either

Business Model	Description
	customers or partners, who add their information to a basic environment provided by the virtual community company. Membership and advertising fees generate revenues for these companies. A virtual community can also be an important add-on to other marketing operations in order to build customer loyalty and receive customer feedback. Examples include ExpertCentral and The Classical Station.
Value Chain Integrator, Value Net Integrator	In these models, businesses coordinate activities across companies in a value net or value chain, by gathering, synthesising and distributing information. This focus on integrating multiple steps of the value chain with the potential to exploit the information flow between those steps as further added value. Revenues come from consultancy fees or possibly transaction fees. Examples include Cisco Systems Inc., and enableNet Data Integrator.
Value Chain Service Provider, Service	These models specialise in a specific function of the value chain, such as electronic payments, with the intention of making that their distinct competitive advantage. Businesses create portals that offer different services including stock brokerage services, online banking, travel services and education. Examples include e-Trade, travelocity and ecollege.
Intermediary, Brokerage, Exchange, e-Auction	Companies in these models are called 'market-makers'. They bring buyers and sellers together and facilitate transactions. This model makes use of the universal connectivity of the Web to bring buyers and sellers of the goods together via the same portal. The portal works on the principle of matching buyer's demand with suppliers' supply in a two-way interactive manner. A broker or an intermediary or an exchanger makes its money by charging a fee for each transaction it enables. Examples include eBay, Chemical Exchange, CarsDirect, ConvergeTrade, AutoXchange, and Yahoo!.
Collaboration Platforms, Shared Infrastructure	These models provide a set of tools including IT infrastructure and an information environment for collaboration between enterprises. It can focus on specific functions, such as collaborative design and engineering or providing project support with a virtual team of consultants. Business opportunities are in managing the platform (membership/usage fees) and in selling the specialist tools (design, workflow, document management). Examples include Covisint and ABACUS International.
Full-Service Provider	These models provide a full range of services in one domain (for example finance, health) offering both its own products and those of others and attempting to own the primary consumer relationship. Examples include GE Supply Company, and Prudential Securities.
Whole-of-Enterprise/ Government	These models provide a company-wide single point of contact, consolidating all services provided by a large multiunit organisation. Examples include Colonial Limited and the State of Victoria (Australia)
Manufacturer	This model is based on the power of the web to allow manufacturers (i.e. companies that actually produce a product or service) to reach buyers directly and thereby compress the distribution channel by eliminating wholesalers and

Business Model	Description
	retailers. The manufacturer model can be based on efficiency, improved customer service and a better understanding of customer preferences. However, this model has the potential for channel conflict with a manufacturer's established supply chain. Examples include Intel and Apple.

Table 2.2 Classifications of e-Business Models

The various e-Business models described in Table 2.2 have also created many transaction or relationship patterns. These include: Business-to-Consumer (B2C), Business-to-Business (B2B), Business-to-Employee (B2E), Employee-to-Employee (E2E), Business-for-Business (B4B), Consumer-to-Business (C2B), Consumer-to-Consumer (C2C), Business-to-Government (B2G), Citizen-to-Government (C2G), and Peer-to-Peer (P2P), transactions and interactions patterns. This section will briefly describe and review the above models, however for this research emphasis will be given to the first three models, B2B, B2C and B2E.

Currently the primary relationship models of e-Business are seen to be centred around a company's interactions with its suppliers and other business partners (B2B model); its interactions and services with customers (B2C model); and the internal business processes including internal interactions and communications with employees (B2E model). The following reviews the three models:

Business-to-Consumer (B2C): The B2C model is more focused on e-Commerce issues and addresses the utilisation of a new channel for the distribution of goods and services to the end-user. It is the retail part of business on the Internet, also called e-tailing. In this form of e-Business, organisations must develop attractive electronic marketplaces to entice and sell products and services to consumers (O'Brien, 1999). For example, organisations may offer multimedia Web sites that provide virtual shopfronts and virtual shopping malls, interactive order processing, and secure electronic payment systems.

Business-to-Business (B2B): The B2B model involves the activity of buying and selling of products, services or information between businesses (for example between the organisation and its suppliers), rather than between businesses and consumers.

Therefore, for the purposes of this research, B2B companies are companies whose primary customers are other businesses. In this model, companies are normally more concerned with back-end e-Business issues such as new product development and integration, manufacturing and production capabilities, and back-end supply chain management.

Business-to-Employees (B2E): The B2E model is about using the Internet to develop the relationship between the business and its employees in a new way. B2E supports an organisation's internal processes where information is distributed through the Web and employees deal with more tasks on-line. It creates a common communication channel for communicating with employees, instantly, consistently and globally. It is a tool that moves work to the web, simplifies work processes, reduces cycle times, cuts costs, and increases revenues. B2E introduces self-service to employees, which is about convenience and access to information and internal processes, at any time and from anywhere. From an employer perspective, it is more about making employees more self-sufficient so that they can take ownership of their personalised information, thereby relieving the organisation of a key administrative burden while increasing customer-service levels to employees.

In addition to the above three models there are a number of other e-Business models that have been developed recently. The following will review briefly some of the other e-Business models mentioned earlier:

Employee-to-Employee (E2E): The E2E model connects employees with other employees and organizational groups. Usually based on Intranet and Extranet systems, this model enables individuals, and virtual and real teams, made up of employees from within the same or different companies to work together. The E2E systems must be able to provide these teams with services and spaces where they can collaborate, communicate, share knowledge and innovate. For example, project teams composed of employees from a company and its client will need to be able to share documents, discuss findings and results and build knowledge together in order to achieve the project goal. Appropriate E2E systems could help companies' build and conserve knowledge on these projects and ensure that it is not lost when team members move to new jobs, internally or externally.

Business-for-Business (B4B): The B4B model applies to companies, which provide infrastructure, intermediate or infomediary services to facilitate e-Business between companies. For example companies such as Oracle, Cisco and Netscape offer IT infrastructure such as the hardware, software and networking solutions including e-Business operations and consultation for other companies to move into the e-Business area. Other examples include specialist portals and on-line trading centres for goods and services.

Consumer-to-Business (C2B): In the C2B model, individual consumers can form groups to initiate transactions with businesses. As part of this larger group, consumers will then have more leverage to negotiate for discounts due to their bulk purchases.

Customer-to-Customer (C2C): In the C2C model, consumers are involved in transactions amongst themselves. The consumer is the initiator of the exchange process. For example a business entity may create a neighbourhood for its customers. Customers can then interact with each other to discuss their interests and transactions may occur.

Business-to-Government (B2G): B2G is a variation of B2B, in that businesses and government agencies can use central Web sites to exchange information and do business with each other more efficiently than they usually can without the Web. For example, a Web site offering B2G services could provide businesses with a single place to locate applications and tax forms for one or more levels of government (city, state or province, country, and so forth); provide the ability to send in filled-out forms and payments; update corporate information; request answers to specific questions; and so forth. B2G may also include e-procurement services, in which businesses learn about the purchasing needs of the government agencies and agencies request proposal responses. It could also support the idea of a virtual workplace in which a business and an agency could coordinate the work on a contracted project by sharing a common site to co-ordinate online meetings, review plans, and manage progress. B2G may additionally include the rental of online applications and databases designed especially for use by government agencies. B2G is sometimes called e-Government.

Citizens-to-Government (C2G): The C2G model involves commercial or administrative activities taking place between citizens and government agencies. This may enable citizens to renew licences, deal with immigration, pay income taxes, etc. electronically. This results in a government, which in theory is more accessible, efficient, and people friendly. However, it is not an easy task to have this model in place. For example in the UK recently, the Inland Revenue had to suspend a system enabling taxpayers to file returns over the Internet due to issues with security breaches where users were able to view other people's data on the site (Arthur, 2002).

Peer-to-Peer (P2P): Peer-to-Peer computing is not new. Some argue that it is exactly what the Internet is and always has been about. Many of the Internet's elements are P2P, such as file transfer and Telnet for remote logon. There are predecessors to P2P computing, but they are dedicated to simple functions such as instant messaging, including America Online's Instant Messenger and ICQ and Microsoft's MSN Messenger Service. Another example is whiteboarding, such as Microsoft's NetMeeting, which lets two people communicate and work together in an application such as Microsoft Word. P2P networks in essence, provide a way to link PCs together without the need for powerful central server computers and allow people to search for and retrieve files from individual computers around the world.

e-Business models are described as the missing link between strategy and business processes (Osterwalder and Pigneur, 2002) where the model can be used as a bridge to communicate the business strategy concepts to the operational side of the company in order to ensure a smooth strategy implementation. An e-Business model in this sense is regarded as the conceptual and architectural implementation of the e-Business strategy and represents the foundation for the implementation of business processes and information systems.

2.2.5 Strategic Role of e-Business

To gain financial and competitive advantage in the marketplace, many organisations today are gearing toward e-Business. Some examples of the typical objectives defining why organisations want to venture into e-Business include:

- To expand existing markets and reach new customers;

- To improve company and product image;
- To eliminate redundancy and the inefficiency of intermediaries;
- To lower transaction costs;
- To improve communication with external parties;
- To reduce delivery times;
- To personalise and improve customer service.

The open structure of the Internet and the low cost of using it allow the interconnection of new and existing information and communication technologies, and offer businesses and consumers an innovative and powerful information system and communication channel. The power of this effective communication system that can targets and focuses on the people that matter most to the organisation is believed to be the core of e-Business applications (Coppel, 2000). This makes it possible for buyers and sellers to come together in more efficient ways and is creating new marketplaces and opportunities for the reorganisation of business processes. It is also changing the way products are customised, distributed and exchanged and how businesses and consumers search for and consume products.

The opportunities of e-Business may seem limitless but so do the challenges. The components of the marketplace, such as customers and markets, competitors and alliances, policy and regulation, emerging technologies, and business processes, are in constant evolution and e-Business is thought to be at the heart of these changes (Potter, 2000; Edrich, 2000).

2.2.6 e-Business Critical Success Factors

This section reviews some of the main e-Business critical success factors identified in previous studies. In this research, critical success factors (CSF) are defined as *"key factors that companies consider critical to the success of the implementation of e-Business strategy. These are key areas where successful performance will assure the success of the organisation and attainment of its e-Business goals"* (adapted from O'Brien, 1999).

Various studies (discussed below) have identified several areas that companies need to look into in order to succeed with their e-Business implementation. The critical

areas established from these previous researches were used as guidelines to help analyse the critical areas identified by the case companies of this research (discussed in more detail in Chapter 4 and Chapter 5, see Table 4.14, Table 4.16, Figure 4.6). Each company has its own unique features and will have its own critical success factors, which can be identified by investigating key characteristics such as its infrastructure, supplier value chain, and current customer relationship functions. The following are some of the main issues or critical success factors identified by previous researches that need to be addressed when implementing e-Business.

CSF 1: Customer Focus

Research has shown that the biggest complaint about e-Business is the poor level of customer service in the event of problems. (Whyte, 2000; Seybold, 2000). These studies show that one of the toughest things for business organisations today is differentiating themselves from competitors who offer similar products or services. One of the ways to overcome this problem is to have excellent customer service (Grimes, 1999). Providing first-rate service is really important as organisations come to accept that power is shifting towards the consumer.

According to Viehland (2000), the Internet has changed the information flow from one-to-many and producer-to-consumers, to many-to-many communication flows. The Internet allows consumers to talk to other consumers, producers, suppliers and other business competitors. It has made it easier than before for consumers to find and access information. It also enables the information flow to be reversed so that producers or organisations can also pull information from consumers in order to improve products and services.

Kalakota and Robinson (2001) also stress the importance of having a strategy that focuses on customers in order for organisations to remain competitive. In their discussion on what they call the *"ten-rules of e-Business"* (see Table 2.3), they highlight some of the rules that are forcing companies to change their business model or design and also to adopt outsourcing strategies in order to *"make the customer ecstatic"* and to *"meet customers' needs"*.

Rule 1	Technology is no longer an afterthought in forming business strategy but rather the cause and driver
Rule 2	The ability to streamline the structure of information and to influence and control its flow is a dramatically more powerful and cost-effective service than is that of moving and manufacturing physical products
Rule 3	Inability to overthrow the dominant, outdated business design often leads to business failure
Rule 4	Using e-commerce, companies can listen to their customers and become "the cheapest", "the most familiar", or "the best".
Rule 5	Don't use technology just to create the product. Use technology to innovate, entertain, and enhance the entire experience surrounding the product: from selecting and ordering to receiving and service
Rule 6	The business design of the future increasingly uses reconfigurable e-Business models to best meet customer's needs
Rule 7	The goal of new business designs is for companies to create flexible outsourcing alliances that not only off-load costs but also make customers ecstatic
Rule 8	For urgent e-Business projects, it's easy to minimise application infrastructure needs and to focus on the glitzy front-end apps. The oversight can be costly in more ways than one.
Rule 9	The ability to plan an e-Business infrastructure course swiftly and to implement it ruthlessly is key to success. Ruthless execution is the norm.
Rule 10	The tough task for management is to align business strategies, processes, and applications quickly, correctly, and all at once. Strong leadership is imperative

Table 2.3 Ten-rules of e-Business

*(**Source:** Kalakota and Robinson, 2001)*

As mentioned earlier, power has shifted towards consumers. This is due to the fact that on top of being more informed, consumers have more choices. In this new e-Business era, more new entrants are entering an already competitive marketplace. As a result, customers are no longer willing to tolerate inefficient service from organisations that are not willing to enhance the quality of their systems and processes to meet customers' expectations.

In research jointly conducted by Information Week and Business Week (Dalton, 1999) into the opinions of three hundred and seventy five (375) senior business and IT executives, in order to gauge the impact of e-Business on companies, IT and business executives from all industries agreed that generating new sources of revenue was not the main goal of deploying e-Business applications. The research showed that improving customer satisfaction in order to keep pace with the competition was one of the important goals of implementing e-Business. It ranked second after creating or maintaining competitive edge.

CSF 2: Infrastructure

Failure to thrive in e-Business is primarily due to a lack of emphasis on reengineering the core business to establish a robust infrastructure. *"e-Business infrastructure is the share of total economic infrastructure used to support electronic business processes and conduct electronic commerce transactions"* (Mesenbourg, 2000). This infrastructure includes hardware, software, telecommunications networks, support services, and human capital.

Building an e-Business infrastructure could be the most important task for companies to address. From client PCs to back-end servers, and network infrastructure to management tools, the decisions made will impact on the way the company handles and responds to unexpected events. In order to succeed, managers must look to intelligent solutions to defeat bandwidth and congestion problems, enable a well-protected environment, and provide for a stable operating platform. Among the key areas to look at are: how to configure and outfit servers, network infrastructure, and other hardware to manage the strains of high traffic; various security issues facing e-Businesses, including the challenge of protecting against the growing threat of internal breaches of security, and how to manage and select mobile PCs and workstations (Intel Corporation, 2001)

The computing infrastructure is the fundamental foundation of any e-Business. Managers must be constantly aware of the latest advances and emerging issues in order to ensure that this foundation is able to withstand new challenges. In an article titled: 'How to succeed in e-Business' Voon Seng Chuan, (2000) CEO of IBM Malaysia, discussed the importance of having a stable infrastructure to ensure success in an e-Business implementation. According to Voon, the infrastructure that the e-Business is built on must be solid, yet flexible. *"The infrastructure must be available and accessible to unlimited data, connects and integrates through a massive platform of networks and allows an explosion of transactions which is monitored, controlled, and managed by Internet security. In short it must be reliable, available, secure and scalable".*

Kalakota and Robinson (2001) also supported Voon's suggestion. In discussing the 9th rule of e-Business success (see Table 2.3), they emphasised the importance of having and designing an integrated yet agile infrastructure: *"the ability to plan an e-Business*

infrastructure course swiftly and to implement it ruthlessly are key to success. Ruthless execution is the norm". According to Kalakota and Robinson, management need to give the same attention to understanding a customer's needs when identifying the business's infrastructure needs.

CSF 3: Outsourcing

During the past decades, it can be observed that one of the key issues to emerge for many organisations has been the growing importance of outsourcing (McIvor, 2000; Viehland, 2000; Zhu et. al, 2001). Adapting Franceschini et al. (2003), this research defines outsourcing as *"a management approach that allows delegating to an external agent operational responsibility for processes or services previously delivered by an enterprise"*. According to Deavers (1997) the increase level of outsourcing activities can be attributed to changes in the competitive market environment, which include *"rapid technological change"*, *"the search for flexibility"*, *"greater emphasis on core corporate competencies"*, and *"globalisation"*. Each of these factors is likely to drive companies to move some of its business functions outside the organisations in order to reduce costs. Outsourcing is expected to help improved business performance by reducing costs (Viehland, 2000). Zhu et al. (2001) highlighted that while cost savings has been identified as the primary motive behind outsourcing initiatives, other factors such as improvement of services, the ability to focus on core business, and the ability to access outside expertise, were also recognised as important reasons for outsourcing. Most significantly for e-Business, outsourcing enables an organisation to create the virtual enterprise, which is a key organisational structure in an e-Business environment (Viehland, 2000).

Lord (2000) has also stressed the importance of outsourcing. According to Lord, when developing a practical e-Business strategy, companies need to first determine how much is going to be developed and maintained in house and how much will be outsourced. Companies will face several obstacles if they want to manage their e-Business entirely within their organisation. This includes bringing in new people who have experience and knowledge in designing and implementing e-Business applications to help the companies manage the transformation to an electronic enterprise. In addition companies must be prepared to develop and grow the e-

Business infrastructure according to business priorities. These activities involve a lot of costs and are often too much, especially for mid-sized companies, to absorb.

CSF 4: Strategic Collaboration or Alliances

According to many business analysts (Prigg, 2000) to compete successfully in an e-Business environment, good collaboration is the key. Good collaboration is said to be one of the factors that will decide which company will survive and which will offer the best services. Currently too many companies operate as an island, concerned only about their part of the chain. Companies need to bring their customers, suppliers and other business partners into the business equation to enhance their ability to respond more quickly than ever before to changes in the market place.

In an e-Business environment it is becoming an accepted and important practice to form new organisations through strategic alliances. The benefits of these alliances include increased market penetration; lower development and delivery costs; and the strategic advantage of allowing each company to concentrate on what it believes is its strengths. Creating alliances will also allow companies involved to share risk (Edrich, 2000). According to Kalakota and Robinson (2001) who also support this belief, integration is the key to e-Business. *"The goal of new e-Business design is for companies to create flexible alliances that not only off-load costs but also make customers ecstatic"*.

CSF 5: Flexibility

As discussed earlier, the information-based economy has brought about various changes to the market environment, such as increased competition, introduction of new information-based technologies, and extended global scope of the competition. These changes are forcing many companies, especially established bricks and mortars to experiment with new forms of organisational structure. These include seeking to become *"networked"*, *"virtual"*, *"horizontal"* or *"project/team"* based organisations (Walters and Buchanan, 2001), which basically underline the need to develop organisations that are flatter, and more flexible and open to new ideas or ways of doing business (Viehland, 2000).

The need for organisational flexibility to accommodate the changing world is inevitable as the highly competitive e-Business markets that are aided with advance

technologies and applications, apply added pressure for companies to adapt rapidly and perform at the highest level possible (Englehardt and Simmons, 2002). Transformational thinking is required, in which companies need to be more flexible and adopt an open-minded strategy and act like new entrants to continuously search for new value in existing products and services and create fundamental change. Senior management must revise a lot of the principles they have learnt about business and nurture a healthy sceptism of the status quo, develop the ability to detect trends earlier than the competition, make rapid decisions and be agile enough to create or adopt new business models (Viehland, 2000; Tapscott, 2000).

CSF 6: Good and Strong Leadership

An e-Business strategy does not happen without the leadership and commitment of senior executives. Too often the strategy is not clearly defined by executive management and has been left to the information systems or marketing department to implement it. *"The technologists have in-depth knowledge about specific technologies to meet the identified needs, but strategies come first and for this leadership at the top is required"* (Viehland, 2000). If the e-Business strategy is not integrated with the overall business strategy, which is determined by the companies' top management, then it will lose its clarity with respect to the role it is supposed to play and the objectives it is supposed to achieve (Osborne, 2001).

Kalakota and Robinson (2001) also stress the importance of strong leadership in order to ensure the success of e-Business implementation. This is clearly stated in the 10th rule of e-Business mentioned in their latest book: *"the tough task for management is to align business strategies, processes, and applications quickly, correctly, and all at once. Strong leadership is imperative."* According to Kalakota and Robinson, the task of relating technology to overall business strategy must not be left to IT managers alone. Top management must take responsibility for understanding the implications of the current technologies and anticipating when they will affect business strategy.

CSF 7: e-Business Skills

To implement e-Business, companies need to form e-Business teams. This is not a simple task, considering the scarcity of available talent for e-Business propositions,

which require developers, Web site managers, security experts, e-Commerce specialists, networking specialists, database administrators, among others.

According to a survey conducted by the Thought Leadership Services division of the Economist Intelligence Unit together with IBM, titled *"e-Business Transformation"* (Fridman, 2000), executives now see organisational constraints and skill development as more significant obstacles to e-Business transformation than technology challenges. Over half of the survey respondents (which included more than 350 senior executives world wide) referred to a lack of employees with e-Business skills as a major obstacle to e-Business strategy implementation, while about the same number pointed to a lack of understanding on the part of key middle managers.

Beside the difficulty in locating people with the right skills in e-Business, it is also hard to retain those that have been found over the long term. Most talented IT workers are attracted to the hottest projects and will readily change jobs in search of these high-profile challenges. Due to this fact, companies need to be prepared to form a strategy to increase employee retention.

As discussed in the earlier sections, organisations are using e-Business applications such as enterprise resource planning, customer relationship management and e-Procurement to transform traditional businesses into e-Businesses. As organisations pursue an e-Business strategy what are the most important factors to consider? What are the opportunities? What are the threats? The purpose of this section is to answer these questions by highlighting some of the main e-Business critical success factors identified by previous studies. The following section discusses the forecasted future of e-Business in general and summarises recommended key factors to help ensure successful e-Business implementation in the future.

2.2.7 e-Business Future

A study by Gartner Group (Vantage Systems, 1999) has highlighted that the main trend of e-Business in the future will be a switch from enterprise-centric business models to customer-centric business models, increased global competition and increased demands from customers for service that is faster, cheaper and better. The

emphasis of e-Business has shifted to application integration, the integration of all e-Business applications with existing processes, linking supply-chain management with e-Commerce and customer relationship management, and creating end-to-end business processes. This will reduce cycle times and eliminate a lot of process steps. The e-Business of the future is also about creating business processes without technological or organisational boundaries. This will lead to the virtual enterprise model where organisations can begin to outsource components of their business processes to others that can do that particular component better.

Another important factor to look at is network infrastructure. According to Thompson (2000), everyone and everything will be connected. In addition, this connectivity will increasingly be provided through wireless medium.. The future is said to be about being able to interconnect everything, including devices, infrastructure, applications, and business processes. The future is also about collaboration. According to business analysts (Prigg, 2000), collaboration will become one of the most important elements within the e-Marketplace. It will be the key to surviving in the e-Business environment of the future.

Quest (2000) recommended five key factors to ensure successful implementation of e-Business in the future, which include:

- Strategic alignment of a company's business objectives, mission, business processes and its IT capabilities will be vital to delivering e-Business value. Organisations that see e-Business as a *"bolt-on"* strategy are immediately vulnerable. Those that pursue e-Business without full regard to the rigour of business metrics and disciplines will be equally at risk. Alignment is key to delivering success both at a business strategy and business process level.
- Connecting value chains lies at the heart of online business. Connecting directly with customers and suppliers, will increase value, cut costs and increase opportunity.
- Customer loyalty is another critical consideration. Organisations will be required to demonstrate that they know and understand the needs of individual online consumers and can tailor unique service offerings to them.
- Accelerated delivery is essential to achieving e-Business success. Organisations that fail to move quickly and nimbly, turning concepts into services within weeks not

months, risk being overtaken by competition. Speed and agility in e-Business require strong project management, involvement from top management, flexible organisational culture and an aggressive approach to managing risks and uncertainties.

- Trust is an essential factor of e-Business. Organisations need to communicate trustworthiness and overcome concerns over security and confidentiality in all e-Business relationships.

e-Business initiatives have a lot of potential and may greatly increase organisations' profitability. However that will only happen if organisations have clear objectives and if those objectives concentrate on adding value for the people with which they deal.

2.2.8 Summary

In this part of the literature review, different issues of e-Business have been discussed. Firstly the phases of e-Business was reviewed including the rise and fall of the early dot-coms. The new information-based economy that was thought to have promoted e-Business as a possible solution was described using Tapscott's twelve themes of the new economy. This section then went on to discuss the concept of e-Business in order to explore its possible impact and capabilities. e-Business was also defined to help create the basis of this research. It also looked at traditional business models and analytical frameworks and discussed the viability of using these models for developing e-Business strategies. In addition, this section also talked about the possibility of adapting e-Business as an organisation's overall business strategy.

Various e-Business models (as described in Table 2.2), which were introduced by academics and consultants, were explored and then classified based on their description, design and operation. The relationship patterns (such as B2C, B2B, etc.) within these models were also illustrated. Finally critical factors, which might ensure the success of e-Business ventures and the future of e-Business, were reviewed.

This section aims at providing a basic understanding of e-Business in general. As described earlier, in order to explore the e-Business opportunities for the electricity industry, it is essential to first understand the basic question of what e-Business is and

the context within which it exists. Further fundamental questions such as how e-Business affects organisations and what can they do to capitalise from it are also provided in this section. The next section aims at reviewing the electricity industry in general by focussing on the deregulated situation in the UK and Malaysian regulated electricity systems.

2.3 Electricity Industry

The electricity utilities in many countries have been, or are being restructured. There are many reasons for restructuring. In some countries restructuring was driven by the desire of government to meet increasing demands for electricity by encouraging independent power production, which relieves government of many financial obligations. In countries where electricity companies are privately owned, mergers and acquisition have driven restructuring, as companies seek to gain competitive advantage. For advanced countries, restructuring is being driven by the desire to allow consumers to choose their electricity supplier on the basis of price and service provided (Jefferies, 2001).

The success of privatisation of the airline and telecommunications industries has also motivated the deregulation and restructuring of the electricity industry. In 1989, the UK became one of the pioneers in privatising its vertically integrated electricity industry. Norway and California followed in 1990 and 1996 respectively. The success of energy privatisation in the UK and Norway has encouraged other countries worldwide to follow the trend. Countries that have been undergoing energy deregulation include Argentina, Australia, Brazil, Germany, New Zealand, Spain, Taiwan and Malaysia (Lo and Yuen, 2001).

These changes in the organisation of electricity utilities bring with them new challenges and opportunities, as the previous centrally designed and operated systems are dismantled and replaced by a new competitive framework. Table 2.4 lists some of the different characteristics between the regulated and deregulated electricity markets. Companies operating in a competitive market need more sophisticated control and management systems to ensure that their business objectives can be

achieved. The development and application of new technologies is also accelerated in this new environment, as companies seek to improve their effectiveness and efficiency. For example Elexon, an infomediary company in the UK, provides real time prices of electricity for the Balancing Market in UK electricity trading arrangements.

The Regulated Electricity Market	The Deregulated Electricity Market
▪ The utility is vertically integrated where they generate, transmit and sell their own power, in their own franchise area ▪ The consumer has no choice; they have to buy their electricity from their local utility company ▪ 'Simple' financial transaction between single seller and multiple buyers ▪ Data generated for the local utility mainly for operational decisions for running power systems ▪ System operation is simpler due to single seller, multiple buyers model	▪ Introduced to promote competition, efficiency and lowering of cost, for customer benefits ▪ The utility is broken up into separate entities and may compete with each other for market share ▪ Deregulation has opened up the market to everyone, e.g. Consumers can buy directly from a generator in a different franchise area, giving consumers choice ▪ Multi layer business transactions between many players ▪ Data generated for operational decisions and to determine business strategies for increasing market share ▪ System operation relatively more complicated than the regulated system as system operation determined by contracts between many players ▪ New kinds of data required for: • Financial transactions between consumer, broker, generator • Competitor bidding strategies • Transmission line congestion management • Load forecasting • Competitor generation capacity

Table 2.4 Characteristics of Regulated and Deregulated Electricity Market

The ongoing worldwide deregulation and restructuring of the energy industry have resulted in a move from the traditional monopolies towards enhanced competition. Deregulation has promoted an increase in the number of independent power producers and the break-up of the monopolistic structure and the unbundling of the main service. Unbundling refers to *"disaggregating an electricity utility service into its basic components and offering each component separately for sale with separate rates for each*

component" (Lo and Yuen, 2001). The transition towards more deregulated and competitive markets was driven by the large differences in electricity tariffs across regions; the advances in power generation and information technologies that allow small producers to compete against larger generators; and a strong belief that competition will produce a win-win situation (Lai, 2001).

Figure 2.16 illustrates the structural difference between the vertically integrated electricity utility and the unbundled model. Before restructuring and deregulation of the electricity industry and power markets the traditional utility model was centralised and the structure was manipulated by the economies of scale. The industry was later transformed into monopolies and the price of electricity became regulated. In this traditional power systems environment, electricity utilities were mostly owned by governments. Vertically integrated electricity utilities naturally own the generation, transmission, distribution and supply units (refer Table 2.5 for the definition of each unit) covering a wide area of service. Each utility has one or more control centres to maintain the security and reliability in its region.

In the unbundled form, the generation, transmission, distribution and supply services are separated. Generators compete among themselves to sell electricity to the supply business. The supply businesses will then compete to find customers. The transmission and distribution business are natural monopolies in their controlled area and market players pay them a fixed charge on line usage.

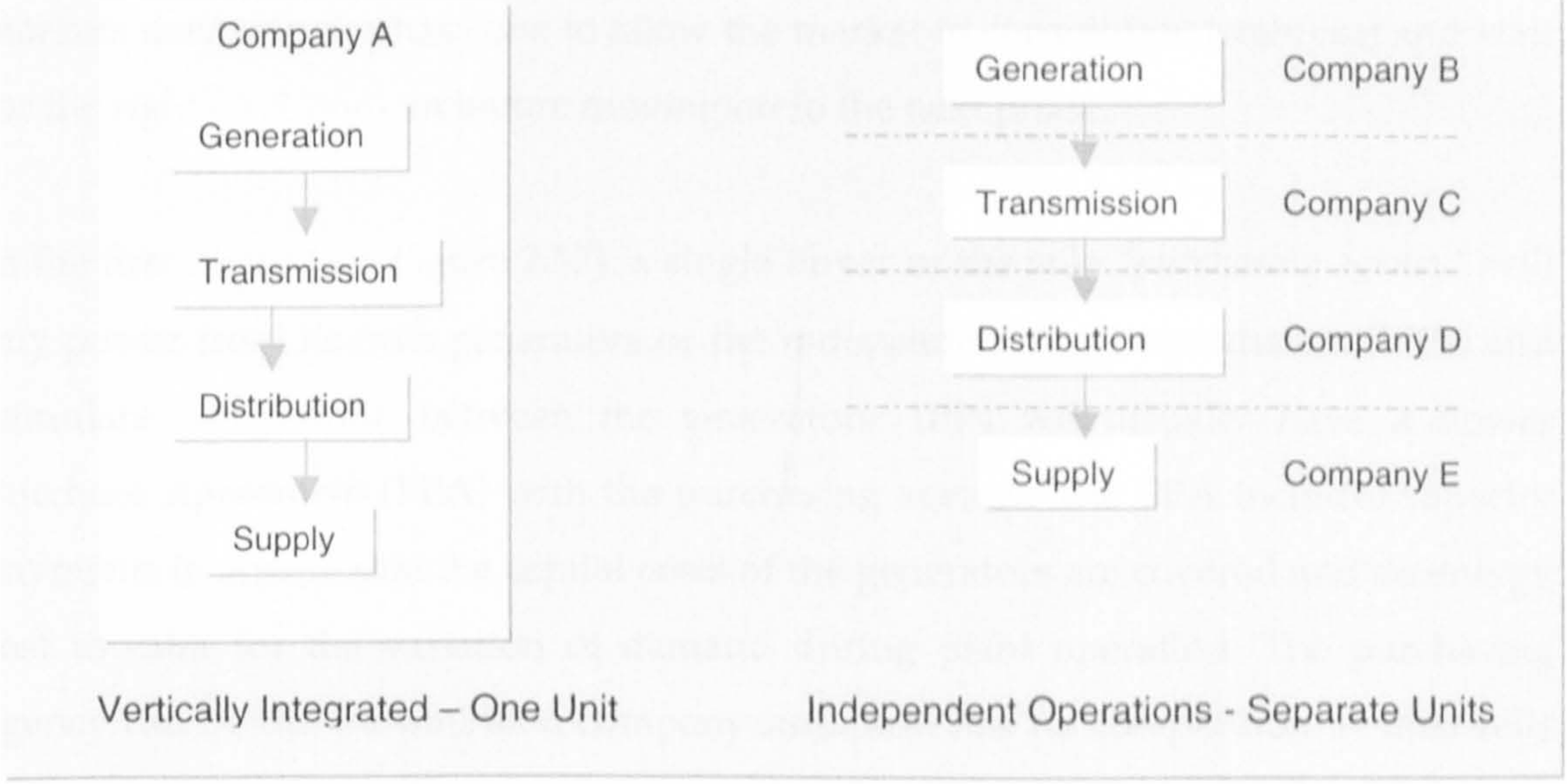

Figure 2.16 Unbundling of Electricity Utilities

Unit	Definition
Generation	The production of electricity at power stations
Transmission	The bulk transfer of electricity across a high voltage transmission system (from generators to distributors).
Distribution	The transfer of electricity from the high voltage transmission system and its delivery across local low voltage distribution systems to customers.
Supply	The bulk purchase of electricity by suppliers and its sale to customers, with associated customer service activities, including sales and marketing, billing and income collection.

Table 2.5 Definitions of Electricity Units

In general, there are three basic deregulation phases that electricity companies will go through, which include phase one, the *"purchasing agency"*, phase two, the *"wholesale competition"*, and phase three, the *"retail competition"* (Lozano Moncada, 2002). However, companies do not necessarily have to follow the order of the phases or go through all three phases. Some companies have been seen to bypass phase one and went straight to phase two, and some were seen to remain only in phase one. Some companies go directly to phase two as this structure opens up more competition as more companies can negotiate with each other (i.e. supply-generator transactions). However, to do so requires more planning on the market regulator side and presents higher risks of market failure or price volatility. Therefore, regulators

must be really confident that phase two can work before bypassing phase one. Other markets may stop at phase one to allow the market to consolidate (stabilise) and wait for the right environment before moving on to the next phase.

In the first phase (see Figure 2.17), a single buyer or the sole *"purchasing agency"* will buy power from its own generators or the independent power producers (IPPs) and stimulate competition between the generators. IPPs will usually have a Power Purchase Agreement (PPA) with the purchasing agency. The PPA includes capacity payments to ensure that the capital costs of the generators are covered and an energy cost to cater for the variation of demand during plant operation. The purchasing agency can be the transmission company itself and has no competition. It then sells the power to distribution companies, which have no choice but to buy from the purchasing agency. There is no competition on the retail side either.

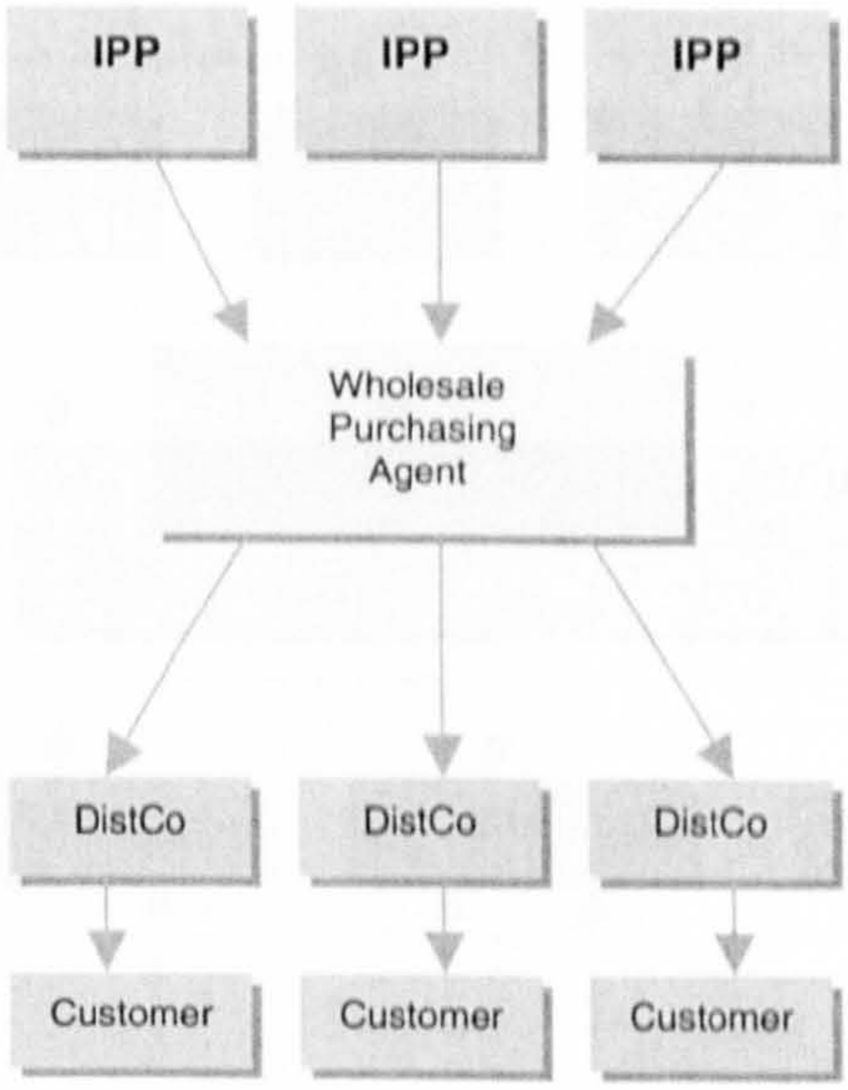

Figure 2.17 Deregulation Phase 1: Purchasing Agency/Single Buyer Model

In phase two, the *"wholesale competition"* model (see Figure 2.18), the transmission network is open to all parties. This allows generators to compete and sell their

electricity directly to any distribution companies and brokers or offer it in a power exchange. The transmission company no longer deals with buying and selling electricity and is now focused on facilitating the power flow between IPPs and distribution companies. In turn, the company collect payments from the generators and distribution companies for using their transmission facilities and services. Distribution companies in this phase have the dual role of operating the distribution network and selling electricity. The latter role requires distribution companies to shop around and get the best deals from generators. This has prompted the growth of brokers and power exchanges, which can facilitate further competition. If necessary, distribution companies can also agree on long-term contracts, which can stabilise the price of their electricity purchases. Wholesale competition can further liberalise the market and bring down wholesale electricity prices.

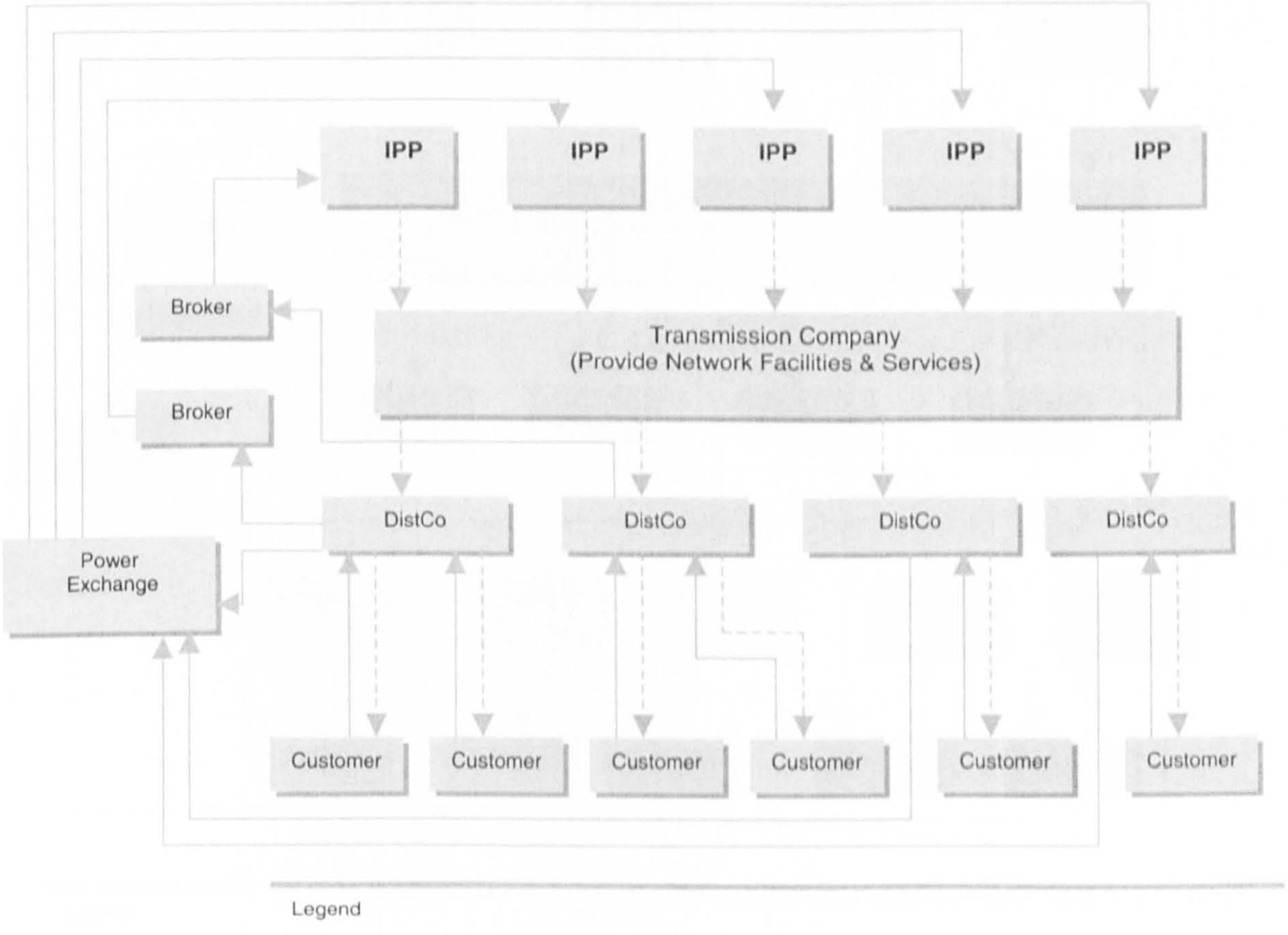

Figure 2.18 Deregulation Phase 2: Wholesale Competition Model

Phase three, the *"retail competition"* model (see Figure 2.19) shows the most advanced phase of electricity deregulation. This phase is an extension of the wholesale competition model, but in this model, access to both transmission and distribution is open to all parties. This effectively limits distribution companies to network operation functions, and allows customers to select their own supplier rather than being constrained to their local distribution company (as was in the wholesale competition model). This results in the development of the supply sector, which only deals with buying electricity from brokers, generators, or power exchanges. The retail competition model represents the final phase of electricity deregulation and can be seen to open up the market considerably.

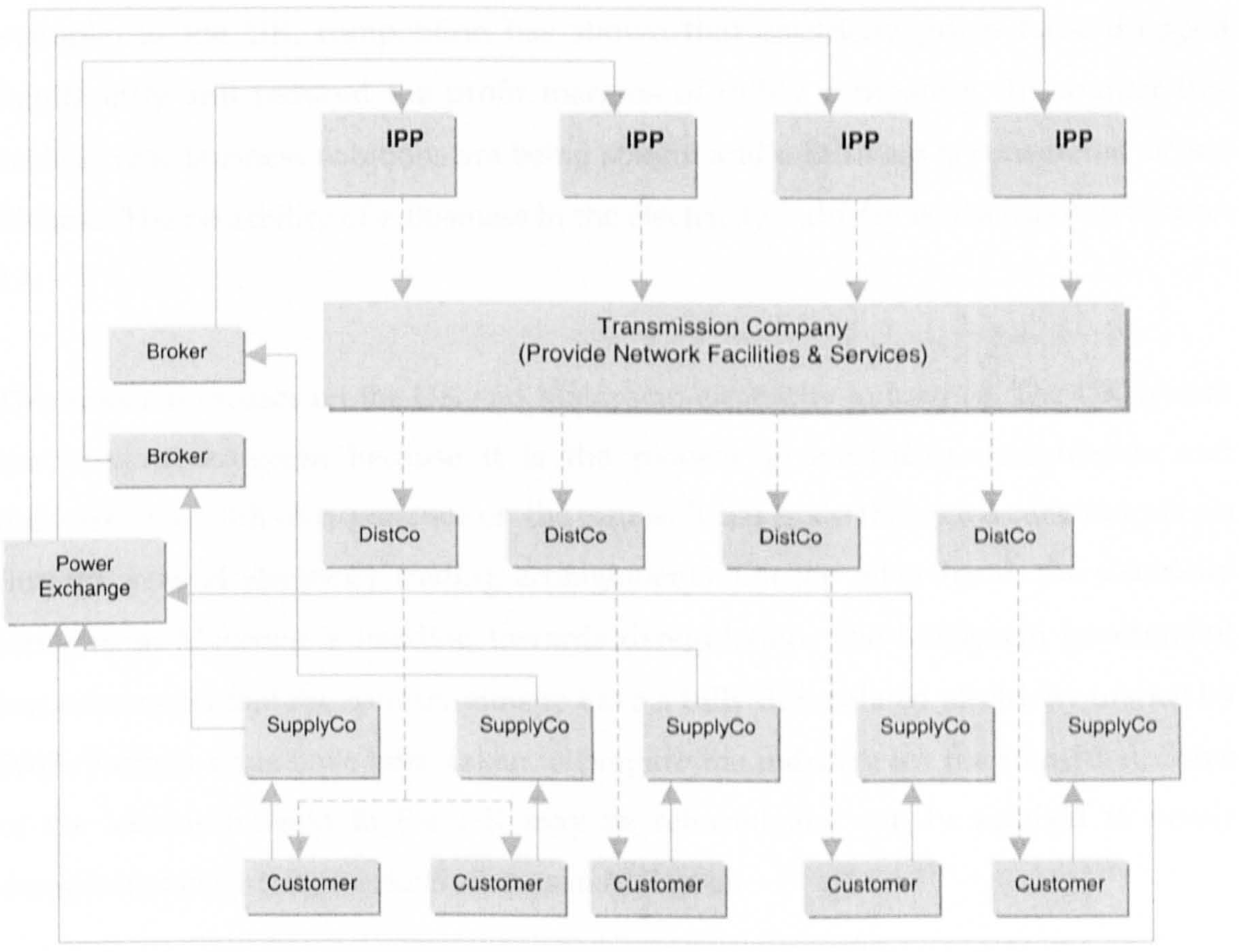

Figure 2.19 Deregulation Phase 3: Retail Competition Model

As the market matures, companies were seen to realign themselves to take advantage of the market environment. For example, Powergen has diversified from a generation only business into the distribution business by acquiring East Midlands Electricity and are also involved in the supply business. Further, ScottishPower and National Grid were seen to acquire American generation assets in order to diversify themselves. Many companies, which traditionally deal only in the electricity business, were also seen to aim to be a multi-utility companies by providing gas and telephone services.

In summary, in this radically changed deregulation environment, electricity companies may need to reassess their business approach to ensure survival. For example, in the UK, competition has shown that electricity prices have dropped significantly and reduced the profit margins of utility companies. To counter this decline, new business solutions are being sought and e-Business is considered as one of these. The possibility of e-Business in the electricity industry is discussed in Section 2.4.

This research focuses on the UK and Malaysian electricity industries. The UK system has been investigated because it is the pioneer in electricity deregulation and possesses a wealth of experience on the issues. It has gone through a metamorphosis through several electricity trading arrangements. On the other hand, the electricity industry in Malaysia is heading towards deregulation. The Malaysian government has announced that the country aims to have a fully deregulated electricity market by 2005. Various steps have been taken to prepare the industry for the transition. Some of the lessons learned in the UK may be relevant and can be applied to newly deregulated electricity markets such as in Malaysia.

The following sub-sections will elaborate both the UK and Malaysian electricity systems.

2.3.1 UK Electricity System

The UK became one of the first nations to launch energy privatisation with the enforcement of the Electricity Act of 1989 (Electricity Association, 1999). The main

aim was to reduce the government's role in the public sector economy. Before privatisation the market structure was a partially vertically integrated monopoly with several distributors. Generation and transmission assets were owned by the state. In the new competitive electricity market in the UK, the industry consisted of a number of large private generating companies that produced electricity, and initially twelve privately owned regional companies that distributed electricity over the network and supply electricity to final customers. The ownership and operation of the transmission system were transferred in 1990 to the newly created National Grid Company (NGC), which is responsible for despatching generation in accordance with a transparent economic *"merit order"* (generator selection based on lowest bid price and technical feasibility). The supply market was opened up to competition in three phases, concluding in May 1999 when all consumers became eligible to choose their suppliers.

The 1989 Electricity Act also created a system of independent regulation, headed by the Director General of Electricity Supply (DGES), covering England, Wales and Scotland. The regulator's principal roles are to ensure that competition develops smoothly and effectively and that, where competition is inappropriate, adequate safeguards are in place to protect customers. In 1999 the regulatory offices for electricity and gas (Offer and Fogies) were merged to form the Office of Gas and Electricity Markets (Ofgem). Northern Ireland has its own regulatory body, the Office for the Regulation of Electricity and Gas (Ofreg).

The UK electricity industry is at the forefront of energy liberalisation in Europe and the liberalisation process has created a highly competitive market in the UK in which suppliers can sell energy nationwide and all customers can choose the supplier which best meets their needs. Competition is supported by open access to the grid and distribution networks on non-discriminatory terms both in relation to granting the use of the system and the charges. Privatisation, which was carried out in stages, beginning in England and Wales, then in Scotland and lastly in Northern Ireland, has resulted in different structural, commercial and legislative arrangements for the three regions, although the same principles have been applied (Electricity Association, 1999; ScottishPower, 2000).

2.3.1.1 Electricity Industry Structure in England and Wales

In England and Wales the monopoly elements of the business (transmission and distribution) have been separated from those that are subject to competition (supply and generation). The generation market in England and Wales has changed from a highly concentrated market with a few players to a market with many diverse generating companies including new generators often owning only one plant. There are now thirty-eight companies regarded as major power producers, which include British Energy, Powergen, Innogy, AES, LE Group and TXU Europe.

Since privatisation, virtually all electricity generated in England and Wales has been sold by generators and bought by suppliers through the Pool, which was a mechanism established on industry privatisation in 1990 for bulk trading of electricity in England and Wales. Wholesale electricity prices were set by the Pool daily for each half hour of the following day, based on the bids of the generators and a complex set of calculations matching supply and demand and taking account of system stability, security and other costs. The New Electricity Trading Arrangements (NETA) replaced the Pool in March 2001 with market-based arrangements more akin to those in commodity markets and comprising a three-tier trading system which consists of a forward and futures market, a short term bilateral market and a balancing mechanism with a settlement process for imbalances. In this new arrangement all generators have to find buyers for their output by offering them competitive prices, and all suppliers have to contract with generators to purchase sufficient electricity to meet their customers' demand. The pay-as-bid and balancing process exposes market participants to the costs and consequences of their actions, and thus leads to more cost-effective prices and more effective management of risk.

NGC, the transmission network operator in England and Wales, has a central role in the industry. It has a statutory duty to develop and to maintain an efficient, co-ordinated and economic transmission system and to facilitate competition in supply and generation. NGC must ensure that the system in England and Wales is balanced nationally and locally at all times, taking into account and resolving any constraints on the transmission network. It also owns and operates jointly with EdF (Electricite de France) the interconnector between the systems of England and France and owns

jointly with ScottishPower and Scottish and Southern Energy the interconnector with Scotland.

Distribution remains a monopoly business and under the Utilities Act 2000 it has become a separately licensable activity. There are currently nine distribution companies operating twelve authorised distribution areas, which includes GPU Power UK, United Utilities, Western Power Distribution, East Midlands Electricity and SEEBOARD. Distribution companies hold separate licences in respect of each area and are governed by the terms of their distribution licences. They are under a statutory duty to connect any customer requiring electricity within a defined area and to maintain that connection. This involves operating and maintaining a network of overhead lines, underground cables, switchgears and transformers.

Any company holding an electricity supply licence can sell electricity. Suppliers may supply customers nationwide using other company's distribution networks and pay the distribution network operators for the use of the system. Suppliers who are authorised to supply domestic customers must meet all reasonable demands made by domestic customers. A number of the major generators are active in the supply market where some of them became suppliers through acquiring the former public electricity suppliers. These companies include, Innogy, Powergen, LE Group, British Gas Trading and some other new suppliers.

2.3.1.2 Electricity Industry Structure in Scotland

The electricity industry in Scotland is principally composed of two vertically integrated companies, ScottishPower and Scottish and Southern Energy, each generating, transmitting, distributing and supplying electricity within their respective authorised areas. British Energy is the third main company operating in Scotland, and is primarily a generator, selling all the electricity it generates at its two nuclear power stations in Scotland to ScottishPower and Scottish and Southern Energy under the Nuclear Energy Agreement (NEA). In addition, there are a number of other companies supplying electricity competitively to customers in Scotland, of which the most significant is British Gas Trading.

The integrated structure in Scotland has required different arrangements for the wholesale market than in England and Wales. The Scottish wholesale price is indexed to that in England and Wales on the basis of a price administered by Ofgem. Following lengthy consultation on future trading arrangements in Scotland, Ofgem and the industry agreed that NETA should be extended to Scotland to allow Scottish companies to participate in a larger British market. Scotland will become a part of the British Electricity Trading and Transmission Arrangements, BETTA, which is expected to be introduced in 2005, with a common set of rules for trading and transmission access.

ScottishPower and Scottish and Southern Energy generate electricity from their own portfolios of power stations. In addition, the companies are obliged, under the NEA, to purchase the entire output from British Energy that provides the bulk of baseload in Scotland accounting for about fifty percent of output. ScottishPower's own generation capacity comprises two large coal-fired plants, hydro plant and wind turbines. The generation capacity of Scottish and Southern Energy consists of the gas-fired Peterhead plant, a large number of hydro plants and wind turbines. Both companies have also invested in generation capacity in England and Wales.

The transmission systems of ScottishPower and Scottish and Southern Energy are connected to NGC's transmission system in England and Wales via a 1,600 MW interconnector. Both companies have access to this link, which enables the companies to export and import electricity from England and Wales and which provides a substantial additional market for the Scottish generators.

The distribution systems are made up of a network of overhead lines and underground cables, operating at voltages ranging from 33kV to 0.23 kV depending on the users requirements and their location. ScottishPower serves an area of 22,950 km2 in the south of Scotland with more than 2.1 million customers and Scottish and Southern Energy serves a large, predominantly rural area of 54,390 km2 in the north of Scotland with more than 670,000 customers in 2000-2001.

The supply businesses of ScottishPower and Scottish and Southern Energy purchase electricity, primarily from their own respective generation businesses, for sale to

customers both within their areas and in each other's area. Competition in supply in Scotland is made possible as a result of third party access to the transmission and distribution systems on a non-discriminatory basis. There are presently ten suppliers licensed to supply electricity in Scotland. These other suppliers generally purchase their electricity either from ScottishPower or Scottish and Southern Energy at a price, which is controlled at the England and Wales price, but may also purchase electricity from independent generators or across the interconnector from England and Wales.

2.3.1.3 Electricity Industry Structure in Northern Ireland

The industry in Northern Ireland differs from that in the rest of the UK in a number of important ways. The electricity system serves a comparatively small area with 690,000 customers. Until March 1995 it had been isolated from other networks. There are only four major power stations, which include Ballylumford, Kilroot, Belfast West and Coolkeeragh with a total generating capacity of 2,082 MW. These four power stations were purchased by a number of competing generators in 1992. Northern Ireland Electricity (NIE) became responsible for transmission, distribution and supply and was successfully floated on the stock exchange in 1993. A further reorganisation carried out by NIE in 1998 resulted in the creation of a holding company called Viridian Group Plc.

The Northern Ireland system has been re-connected with the Electricity Supply Board system in the Republic of Ireland and a new High Voltage Direct Current (HVDC) submarine link with Scotland is being commissioned, which is expected to meet about twenty percent of future demand. Responsibility for the regulation of the industry is the task of the Office for the Regulation of Electricity and Gas (OFREG), which oversees the development of competition and protects the interest of customers in Northern Ireland.

2.3.1.4 OFGEM

Ofgem is short for the Office of Gas and Electricity Markets. Ofgem was established to promote and protect the interests of gas and electricity customers. It is in charge of overseeing and regulating the gas and electricity industries in the UK. It is governed

by an authority made up of non-executive and executive members, responsible for determining strategy, and decides on major policy issues. Its powers are provided for under the Gas Act 1986, the Electricity Act 1989 and the Utilities Act 2000. Ofgem aims to bring choice and value to all gas and electricity customers by promoting competition and regulating monopolies.

Ofgem promotes competition in all parts of the gas and electricity industries by creating the conditions, which allow companies to compete fairly, and enabling customers to make an informed choice between suppliers. Ofgem is also empowered to grant licenses to utility companies. Further, it is also responsible for regulating areas of the gas and electricity industries where competition is not effective by setting price controls and standards to ensure customers get value for money and a reliable service.

Ofgem also runs a public service by publishing any new proposals or discussions of how gas and electricity trading will change and any amendments to the rules, and liaises closely with energywatch, an independent gas and electricity consumers watchdog under the Department of Trade and Industry, which carries out price comparisons between suppliers for the benefit of electricity and gas customers.

2.3.1.5 NETA and The Pool

The New Electricity Trading Arrangement (NETA) was introduced in March 2001 (Ofgem, 2001). It is a new wholesale market, encompassing trading between generators and suppliers of electricity in England and Wales. The aim of NETA is to bring about a more competitive wholesale market, bringing downward pressure on the price of bulk electricity and ultimately prices to all consumers. NETA has replaced the old Pool arrangements and is in large measure designed to overcome the alleged abuse of the Pool by setting prices too high. NETA only applies in England and Wales but Scotland will be included when the British Electricity Trading and Transmission Arrangements (BETTA) take effect in 2005. In the meantime, transitional arrangements are in place that brings the two systems closer together. To date, NETA has mainly been a topic of interest to generators and suppliers but it is now having a profound effect on consumers as well.

Under NETA bulk electricity will be *"traded forward"* (price of electricity agreed much earlier than delivery time) through bilateral contracts and on one or more power exchanges such as UK Power Exchange (UKPX). Those trading will include generators, suppliers, traders and customers. NETA also provides central mechanisms, called the Balancing Market, which does two things: They help NGC to ensure that demand meets supply, second by second, and they sort out who owes what to whom for any surpluses or shortfalls.

The electricity Pool of England and Wales was created on 31st March 1990 in readiness for privatisation of the electricity industry. It is a contractual arrangement entered into by generators and suppliers that provides the wholesale market mechanism for trading electricity. The Pool does not itself buy or sell electricity but those trading in the Pool do so against a defined set of rules. Each day the NGC used to estimate the amount of electricity to be used during each half-hour of the following day. They did this using a complex computer program known as GOAL. Demand is heavily weather dependent but major social events, such as a big football match, can have an effect as a significant number of households are assumed to have got up at half time and boiled a kettle of water (NETA, 2002). For example in a recent football world cup match between England and Argentina, a National Grid spokesman said that the game had produced a new record in demand for power for a daytime sporting event where there was a surge at half-time to 1,500 MW which is equivalent to 600,000 people putting the kettle on (Lee, 2002).

Once the demand had been estimated, the NGC invites generators to bid in capacity to meet that demand. They then schedule the various plants to generate, taking the cheapest first, then the next and so on until the requirements for a given half-hour are met. This is known as the *"Merit Order"* (NETA, 2002). One feature that often surprises customers is that the price bid by the last generating set called into the Merit Order, the so called System Marginal Price, determines the price paid to all generators regardless of the price bid in. It has long been alleged (by players in the UK electricity industry), although not proved, that some generators used their knowledge of The Pool to fix prices by, for example, making cheaper plant unavailable on the grounds of emergency maintenance.

In conclusion, the UK electricity industry has shown the way to much of the world with regards to the development of the energy markets. The liberalisation process, which started in the UK in 1990, has created a highly competitive market supported by the open access to transmission and distribution networks. Privatisation of the industry has created different industry structures for England and Wales, Scotland, and Northern Ireland. However, all of them are based on the same principles where the market was designed to encourage competition where feasible but at the same time regulating prices where natural monopolies exist or where competition required time to emerge. The UK electricity privatisation and deregulation process has provided lower prices and better quality service for the customer, whilst creating dynamic private companies to drive the UK economy. Therefore, based on the success and maturity of the UK market structure, it is regarded as a very good example for other emerging markets to emulate. Apart from the deriving lessons on how the market can be structured, the UK electricity industry can also provide a snapshot of the business plans or strategies employed by UK electricity companies which can be a useful lesson to other electricity companies worldwide

2.3.2 Malaysian Electricity System

The electricity industry in Malaysia was privatised in 1990. There are three main electricity utilities in the country comprising, Tenaga Nasional Berhad (TNB), Sabah Electricity Sdn. Bhd. (SESB) and Sarawak Electricity Supply Corporation (SESCO). As a first step in implementing the government's privatisation policy, the National Electricity Board was corporatised in 1990 as Tenaga Nasional Berhad (TNB) and subsequently privatised and floated on the Kuala Lumpur Stock Exchange, with the Ministry of Finance holding about seventy percent of the shares. The Sabah Electricity Board was privatised in 1998 as Sabah Electricity Sdn. Bhd., with TNB as the major shareholder, while the Sarawak State Government divested fifty percent of its equity in SESCO to the private sector in the late 1990s.

Until recently the utilities were vertically integrated entities undertaking generation, transmission, distribution, supply, metering and billing activities. However, TNB has formed two wholly owned subsidiaries which have taken over the operation of its

thermal and hydro stations, selling the energy generated back to TNB through power purchase agreements. TNB has also appointed its subsidiary TNB Metering Service Sdn Bhd to undertake its metering services.

The electricity industry in Malaysia is undergoing further changes. Governments are being pressured by investors to liberalise their electricity industries. This is a huge challenge as every country is different and requires an individual formula to make deregulation work. As the Malaysian economy returned to growth after the economic downturn in 1998, energy demand increased accordingly. This is still the case in 2002 where the industry is seen growing at a relatively fast rate (Business Times Malaysia, 14/5/2002). The population of the country is increasing, more rural areas are being supplied with electricity and as Malaysia works towards Vision 2020 (its target of achieving developed country status by the year 2020) the demand for energy will grow still further.

The Energy Commission of Malaysia was established in May 2001 as an independent regulatory body for the electricity and gas sectors. The Commission consists of a chairman, two members representing the government, and four other members from the private sector appointed by the Minister of Energy, Communication and Multimedia. Its main functions are to act as the technical, economic and service regulator of the electricity supply and gas distribution industries, responsible for matters such as ensuring adequate, affordable and quality supply; promoting competition and efficient market conduct; and promoting the interests of consumers. The Commission is also responsible for safety issues, promoting the use of renewable energy, promoting research and development, training initiatives, and for advising the Minister on matters concerning national policy objectives for energy supply activities.

2.3.2.1 Generation

The electricity supply utilities in Malaysia have been transformed from state-owned entities to investor-owned utilities. There are three main electricity utilities: TNB in Peninsular Malaysia; SESB in the State of Sabah; and SESCo in the State of Sarawak. There are also a number of Independent Power Producers (IPPs) operating in the

Peninsular, Sarawak and Sabah. The total installed generating capacity in Malaysia is 14,614MW; 12,965MW in Peninsular Malaysia; 872MW in Sarawak, and 777MW in Sabah. Within the total installed capacity in Peninsular Malaysia there is an approximate reserve margin of thirty percent. At the moment it is this generation sector that has experienced liberalisation most. The main IPPs are Genting Sanyen, YTL Power, Powertek and Segari Ventures. Between them they account for about 30 percent of all electricity sold in Malaysia through its Power Purchase Agreement (PPAs) (The Association of Independent Power Producers, 2001).

2.3.2.2 Transmission and Distribution

A subsidiary of TNB, TNB Transmission Network Sdn Bhd, has a monopoly for the transmission of electricity in Peninsular Malaysia. Similarly, SESCo and SESB have monopolies for transmission in Sarawak and Sabah respectively. TNB's monopoly for the distribution of electricity has been removed. The Government has issued licences to twenty-five companies who are allowed to operate as local distributors or suppliers of electricity in certain designated locations, such as shopping complexes and industrial parks (Mustapha, 2001). Some of these companies also operate their own co-generation plants to supply part of their demand. Combined, these companies distribute a total of approximately 1150MW. TNB Distribution Sdn Bhd (another wholly owned subsidiary of TNB), SESCo and SESB remain the main distributors of electricity throughout the Peninsular region, Sarawak and Sabah respectively.

2.3.2.3 Restructuring

In 1998 the Malaysian Government established a task force and appointed a consultant to study and put forward recommendations for the restructuring and market reform of the electricity supply industry. The aim was to improve efficiency, greater transparency and promote competition. Various proposals and models have been considered such as implementing new legislation with a revised regulatory framework, setting up an independent agency to operate the grid system, and divesting some of TNB's generating assets to create more competition (Mustapha, 2001). Although some restructuring has taken place, it is now anticipated that no

major reform will be introduced in the near future, as the Government believes that tangible benefits have already been achieved.

2.3.2.4 Tenaga Nasional Berhad (TNB)

Tenaga Nasional Berhad (TNB) is the largest electricity utility company in Malaysia with RM54.6 billion in assets and serving over five million customers throughout the Peninsular Malaysia and Sabah. TNB's core activities are the generation, transmission and distribution of electricity. To date, TNB remains a major player in electricity generation, which forms a significant part of the Group's diversified range of business activities. Through its wholly owned subsidiaries, TNB Generation Sdn Bhd and TNB Hidro Sdn Bhd, TNB has the largest generation capacity of 8,660.5MW which accounts for sixty-five point nine (65.9) per cent of the total power generation of Peninsular Malaysia. Currently, TNB has a complete power supply system, including the National Grid, Customer Service Centres, Call Management Centres and administrative offices throughout Peninsular Malaysia and Sabah (TNB (a), 2002)

TNB, through its subsidiaries, is also involved in the manufacturing of transformers, high voltage switchgears and cables. It also provides professional consultancy services, architectural, civil and electrical engineering works and services, repair and maintenance services, fuel, logistics, freight and insurance coverage, and undertakes research and development, property development, and project management services.

2.3.2.5 Current Situation, Problems and Future Plans for the Industry

The Malaysian model of privatisation of the power industry, which was designed to meet the country's social and economic objectives, was claimed by the Malaysian government to be able to secure an adequate supply of reasonable quality, ensure affordable and stable electricity prices, provide confidence to the investors, meet the funding challenges, and promote competition, efficiency and productivity. The main features of the model are:

- The incumbent utilities basically remain as vertically integrated entities undertaking generation, transmission, distribution, supply, metering, and billing

activities, although they now operate as independent divisions with greater accountability. IPPs are also allowed to construct generation plants.

- The IPPs sell power to the utilities through long-term power purchase agreements (PPAs)
- A committee of representatives from both government and TNB evaluates proposals for new generation plants before a licence is granted. The PPA prices are negotiated between the IPP and the utility, with government acting as a moderator, although subsequently government has decided to introduce a bidding system to improve the process.
- TNB's National Load Despatch Centre (NLDC) is the Grid System Operator in Peninsular Malaysia, responsible for the operation and planning of the grid system, despatch of generating units, and load forecasting in accordance with the Grid Code.
- The Grid Code establishes the *"merit order"* (generator selection based on lowest bid price and technical feasibility) in despatching generating units and the responsibilities and procedures in the operation and planning of the grid system, testing of generating facilities, and load forecasting.
- A committee chaired by the Minister, with representatives from government agencies and utilities, has been set up to review and approve the construction programmes, tariffs and charges levied by the utilities, and conditions of supply.
- The utilities are required to submit annual reports to the regulator on generation security standards achieved in the previous year and expected in the next few years, the performance of the transmission and distribution systems, and customer services.
- Utilities and IPPs are required to engage independent auditors approved by the regulator to carry out management and engineering audits every four years.

One of the benefits of privatisation is that the government's funding burden is lifted. Other benefits include an improvement in the operation of the generation, transmission and distribution systems. However, there is still room for improvement, particularly in metering and billing, customer relationship management, customer information services, quality of supply, demand side management and energy efficiency. At the moment, the supply, calibration (zero setting) and testing of meters is done by the utilities or their wholly owned subsidiaries, which has led to questions

regarding conflict of interest and fairness. The government and regulator feels that these activities would be better carried out by independent meter service providers to ensure neutrality. Customers have claimed that meters have not been inspected in order to determine if the incumbent distribution company had installed them correctly. There is a lack of emphasis on correct meter readings in a regulated environment in which companies like TNB operates. In this regulated environment, the distribution and supply companies are the same and their meter reading, though inaccurate, would not cause major complications for the company. (Whereas, in the deregulated environment such as in the UK, distribution companies serve not only electricity consumers but also a number of different supply companies. Therefore, the pressure to provide accurate metering information to these supply companies and electricity consumers is much greater.)

Furthermore, estimated meter readings were seldom audited against actual readings, especially for the new large power customers. This resulted in higher *"non-technical losses"* (human errors) and over or under billing, causing problems for both customers and utilities (Metering International, 2001). The need to use a multiplying factor to calculate the actual energy supplied when reading the meter should also be minimised, in order to reduce human errors in billing. Meters should be suitable for the type of load, especially for loads with low power factors. Utilities should carry out inspections and audits on meter installations from time to time, particularly those of large power consumers, for earlier detection of problems. Even though meter inaccuracy of up to three per cent is allowed under existing law, the utilities should periodically have their meters inspected, tested, recalibrated or replaced. Installing smart meters, which can provide information to consumers for load management, and introducing *"time-of-use"* (time sensitive) tariffs, will enable consumers to save on electricity costs and utilities to reduce peak demand.

In summary, privatisation of the electricity industry in Malaysia has produced a set of desired results, but there are areas that need further improvement to enhance the performance of the utilities and increase the level of customer satisfaction. The Malaysian electricity industry is still a long way from being a complete deregulated system especially in the distribution and the supply side. Most of the competition is limited and will be focused on the generation side where bids will be tendered for

building a power plant that can generate the cheapest price per unit of electricity. However, the unbundling of TNB is seen as a positive step towards deregulation in the long term.

2.3.3 Summary

This section looked at the electricity industry in general, focusing on the UK and Malaysia electricity system. It dealt with the changes occurring within the electricity industry due to deregulation, which is supposed to promote investment, competition and efficiency. The characteristics and differences of the deregulated and regulated system were included to illustrate the fundamental changes that had occurred. This section also highlighted the impact of deregulation, which requires electricity companies to reassess their position in the market in order to compete effectively.

Further, different categories of the industry such as generation, transmission, distribution and supply were introduced to facilitate understanding of the industry. This section then went on to look at the UK electricity system, which consists of the electricity industry structure in England and Wales, Scotland and Northern Ireland. Brief introductions to the role of the regulators, Ofgem and Ofreg, as units that determine the market arrangement and continuously monitor its condition, were also included. It also discussed the initial power Pool structure, which has been replaced by the present NETA.

Finally, the Malaysian electricity system was described, including an overview of the industry at present and how it will evolve when deregulation takes effect. A brief description of the main electricity company in Malaysia, TNB, was also provided.

The next section discusses the possibility of e-Business in the electricity industry and looks at current trends regarding e-Business implementation in the industry.

2.4 e-Business and Electricity Industry

The e-Business era emerged as the utilities industry in general faces an intense period of structural change. The industry structure is fragmenting and realigning as markets move from regional and national arenas to international marketplaces with world-class companies seeking to specialise in different parts of the value chain. For the energy sector, e-Business represents one of the most significant business imperatives in recent years. Industry leaders expect this phenomenon to fundamentally change the ways in which the energy sector conducts business.

The industry is expected to transform from an industry that makes money on assets to one that focuses on customers and makes money from its effectiveness in gathering and utilising information and knowledge. Wall Street, which was said to have overlooked the potential for e-Business applications in the energy industry, now places a premium on energy companies that demonstrate e-Business strategies and processes (Treadway and Valocchi, 2000). Global market conditions for utilities are creating entirely new rules for how companies conduct business and create value. In the past few years, major change such as deregulation, globalisation, the integration and greater efficiency of capital markets, and the significant consolidation and convergence of industries, have created a new competitive landscape for the energy industry (Treadway and Valocchi, 2000; Harmon, 2000; Fish et al., 2000).

Among these major forces of change, deregulation appears to have had the most significant impact on energy companies (Popper, 2000; Mullen, 2000). Deregulation has happened in the UK, Norway, Chile, Argentina, New Zealand, Australia, and in most states in the US such as New York, Pennsylvania, New Jersey and California (Read, 2001; Popper, 2000). In the deregulated market, there is a fundamental change in the way that the commodity is traded. Electricity utilities need to have real-time data such as their own current generation capability and generation costs, competitor's pricing structures and current generation capability, line congestions and network constraints, financial transactions, competitor bidding strategy, and many more. A lot of information must be collected, sorted and analysed for sound business decisions. This may require companies to look at e-Business for solutions to

allow information to be disseminated quickly and business operations to be more streamlined and efficient.

An electronic link for consumers to their local energy suppliers, along with information services, can greatly increase efficiencies by cutting processing and payment times. For example, Houston-based Reliant Energy has used customer relationship management technology and launched an online service for customers to reduce customer care costs, particularly for routine matters. The service gives customers the ability to use the Internet to start, transfer or end services and to view energy usage and pay bills (Mullen, 2000). Web-based software allows commercial and industrial users to access and analyse energy-use data and associated costs on a real-time, hour-by-hour basis. Timely information on load profiles, bill summaries, exception reports, and weather, means users have an increased level of control over their commercial and industrial facilities.

The introduction of Web-based exchanges and private e-Marketplaces for utilities and utility related services have disrupted the traditional value chain. According to a study by PricewaterhouseCoopers' North American Energy and Utilities Industry Consulting Practice (Treadway and Valocchi, 2000), within this transformed environment, significant opportunities for value creation exist in all e-Business spaces, provided that companies account for and leverage the following:

- Redefining virtually every business process and function
- Changing conventional concepts and rules about strategic alliances, out-sourcing, competition, industry specialisation, and customer relationships
- Creating an unprecedented wealth of information about customers
- Challenging every business to continually reinvent themselves.

This change in the business environment forces companies to rethink the traditional form of competitive analysis and business strategy.

e-Business combines commoditisation of products and services with personalisation at the same time. On one hand, it encourages users to regard many products as commodities varying mainly in price. On the other hand, it allows more scope to tailor products and services to the needs and tastes of individual customers. Energy companies could choose to focus on commoditisation and drive down unit costs, or

they could concentrate on a more price-insensitive market segments and differentiate through personalisation. With e-Business both are fast becoming a reality (Fish et al., 2000).

The network economy is changing the way utilities do business. The impact of e-Business presents real management issues in the energy industry. As the new economy shifts companies from an asset focus to an information focus, managers need to understand that e-Business changes the way they should look at business and that it is not only about technology or having a Web presence. e-Business demands new thinking and therefore managers need to understand that it encompasses more than just selling products and services through an electronic medium and that it is also about the exploitation of information networks to gain competitive advantage. The challenges are primarily how to utilise e-Business to be a strategic business tool in relation to customers, suppliers, partners and employees. Connectivity among the market participants becomes increasingly important across the entire value chain.

2.4.1 The State of e-Business in the Energy Industry

Like many traditional businesses, utilities have proprietary legacy systems that cannot easily be made accessible via the Internet and, because many utilities have also been slow to change their business models, linking legacy systems to the Web has been slow moving. According to AMR Research (Mullen, 2000), only half of the largest utilities have implemented full-scale e-Business initiatives. The biggest challenge seems to be systems integration. As regulated monopolies, electricity utility company revenue was guaranteed and the cost of doing business was incorporated into their rate structures. Now that deregulation has taken away that guarantee, electricity companies are trying to develop new ways to generate revenue and develop processes, find new ways to attract customers, and manage relationships with partners and suppliers. This condition has made it more necessary for utility companies to adopt e-Business as a possible solution, following the example of companies in other industries such as banking and advertising (Senia, 2000).

In market research conducted by IBM (Dyson, 2000), it was found that companies across many industries follow a similar pattern of e-Business adoption. Figure 2.20

illustrates these common adoption stages and where in general the majority of companies from each industry that have adopted e-Business are positioned. According to these findings, most mainstream utilities have passed the initial stage of creating a Web presence, where information about the company is published on a website. Utility companies are seen to have started to link customers with their existing business processes; for example, enabling online enquiry, online billing systems and online account management. These transactions help address the growing demands of today's consumers while helping the utility company to reduce service costs.

The findings also identify two major challenges known as the *"security chasm"* which is concerned with potential security issues as well as exposing inefficient processes in the company, and the *"business value chasm"* (concerns with the streamlining of business processes to gain the most value from e-Business solutions) which need to be addressed in order to justify significant process transformation and integration. The big leap over the *"business-value chasm"* comes when the company integrates the Web with core business processes including customer relationship management, supply chain management, knowledge management and operations. At this point, management must fundamentally rethink its business strategy.

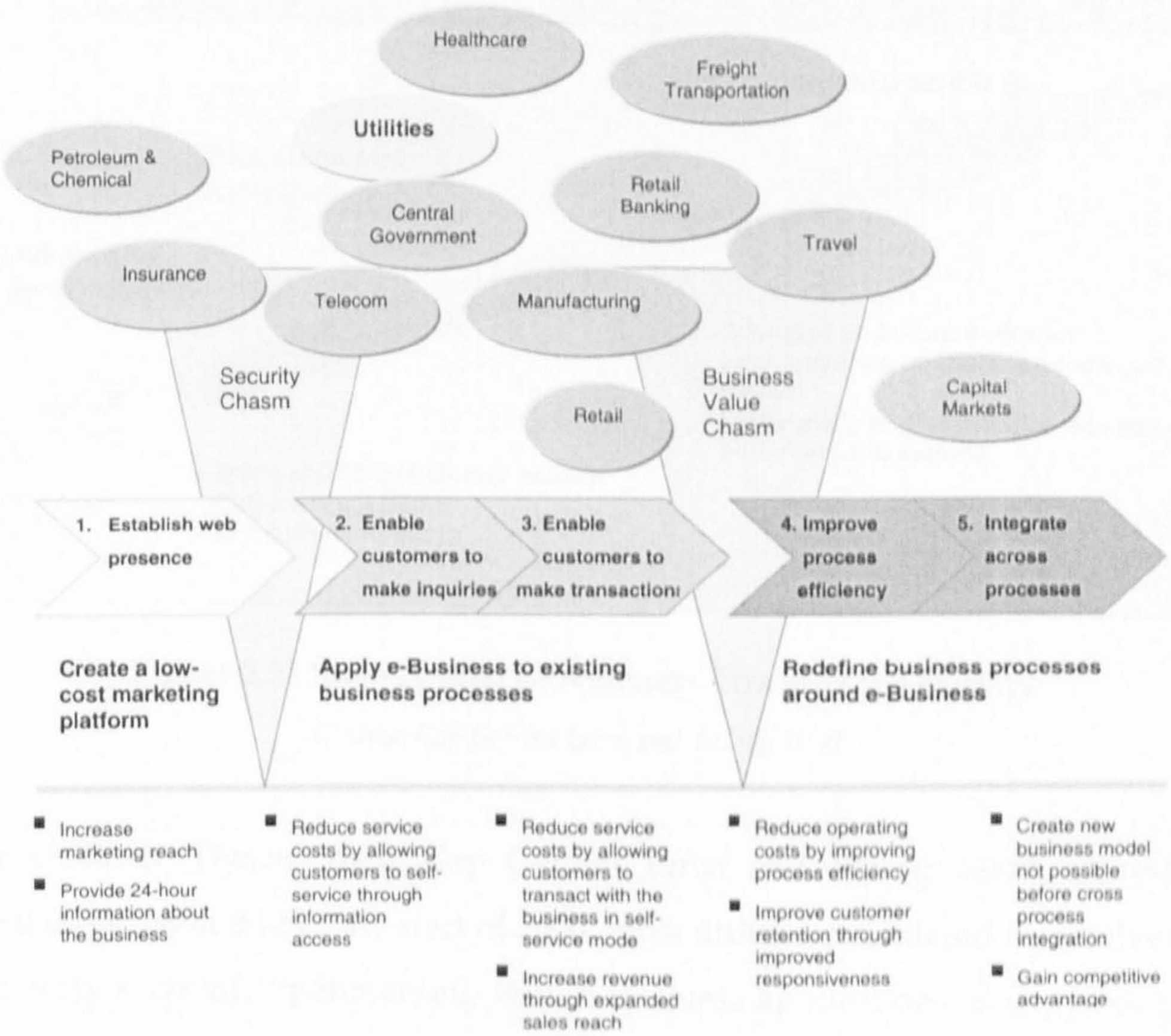

Figure 2.20 The Common Adoption Stages of e-Business

(Source: Dyson, 2000)

In other research, conducted by Cap Gemini Ernst and Young on e-Business in European Energy Companies (2000), it was shown that utility companies have a rather broad e-Business vision, which is to provide a wide range of external and internal web-enabled services. This research found that the participating utility companies have all established a web presence, the first stage that serves as a provider of information on the company and their services and products. Many companies also offer facilities that provide new services with different degrees of interaction. Figure 2.21 shows Cap Gemini Ernst and Young's interpretation of the utility companies step-by-step adoption of e-Business.

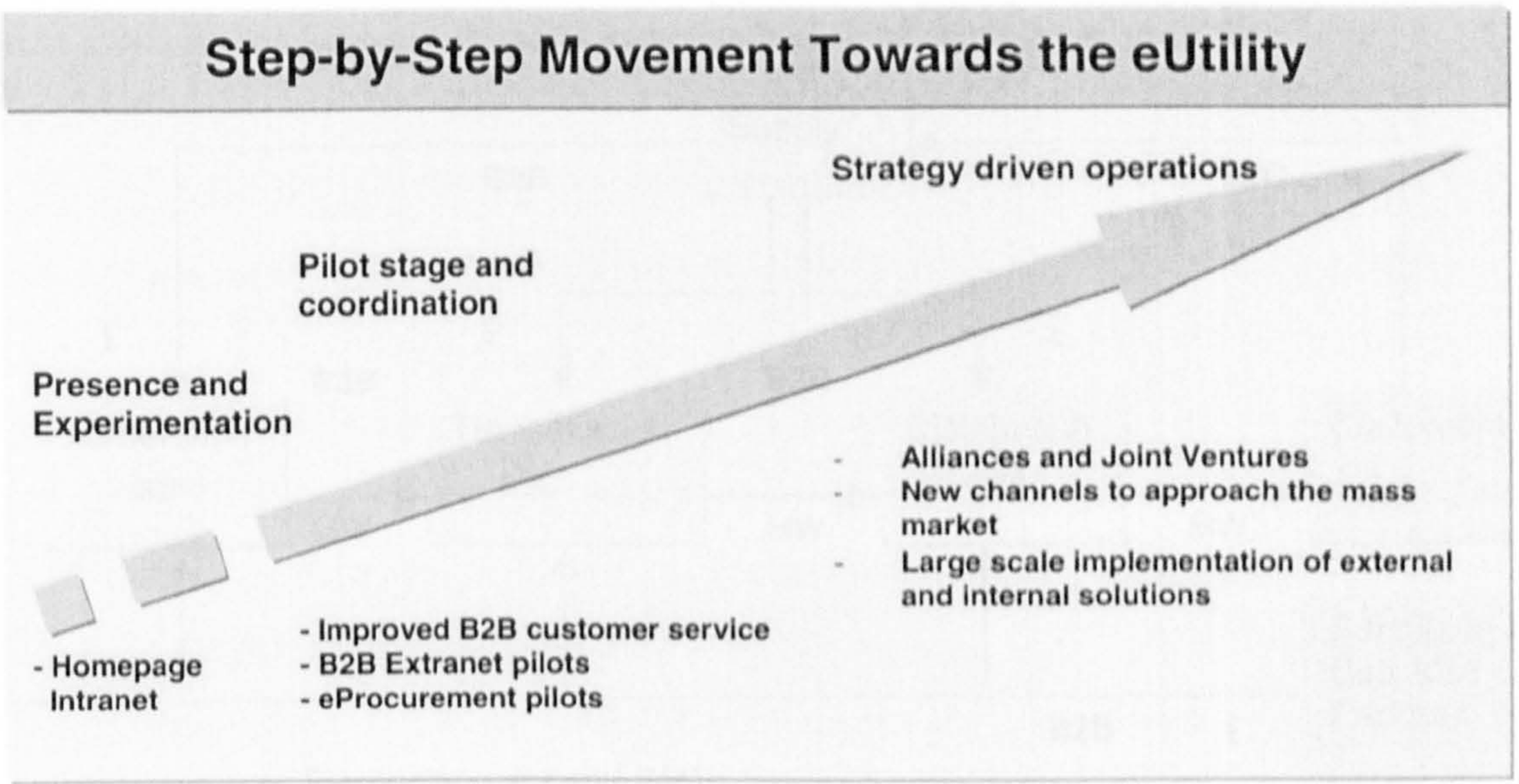

Figure 2.21 Step-by-step Movements Towards the eUtility

(Source: Cap Gemini Ernst and Young, 2000)

These research (Dyson, 2000; Cap Gemini Ernst and Young, 2000), provide the general impression that at the start of 2000, most utilities considered themselves to be in the early stage of experimenting with e-Business applications. Energy companies operating in the more deregulated markets, generally have the most aggressive e-Business plans. They have ambitions to take their products more quickly onto the Internet than energy companies in less deregulated markets. Having used the Internet mostly for customers facing activities, they are now also putting effort into cost saving initiatives, such as e-Procurement and more cost-effective customer management initiatives.

For example in the UK, many of the electricity companies such as ScottishPower, Powergen, Innogy, London Electricity and Scottish and Southern Energy have already established their web-presence and incorporated the direct-to-customer B2C model in their business strategy as one of their initial initiatives to adopt e-Business. Other advanced e-Business ventures are also being explored where companies such as ScottishPower are looking into developing a more advanced B2B channel to improve its current supply chain management and business transactions with its partners and suppliers. Figure 2.22 illustrates a basic model for electricity financial and supply arrangements. It indicates some areas where UK electricity companies are considering developing or have developed their e-Business models.

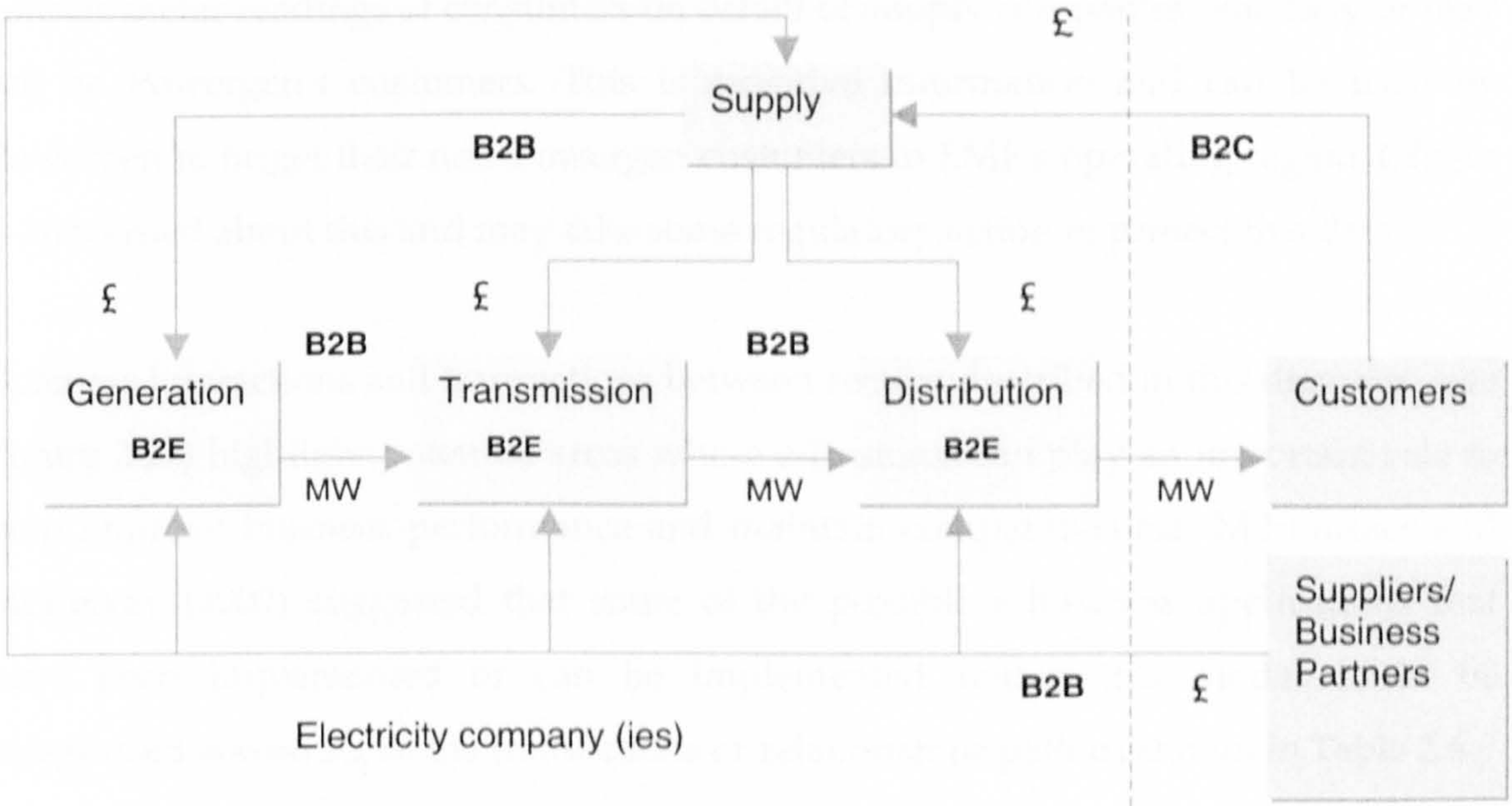

Figure 2.22 Electricity Financial and Supply Arrangement and Possible e-Business Models

The diagram above shows a straightforward representation of the UK deregulated electricity market where each rectangle on the left-hand side of the dotted line (which differentiate electricity supply industry (ESI) from non-ESI entities) shows a sector in the electricity industry. Megawatt (MW) arrows indicate physical power flow. Power flows from generators to customers via the transmission and distribution sector, which is known as the *"wires business"* in the electricity supply industry. Companies in the transmission and distribution sector do not compete in the power market but collect a toll, based on a formula devised by Ofgem, on power that passes through their system. Competition for customers occurs in the generation and supply sectors. The £ arrows show the financial flow of the industry. Revenue is collected from customers by supply companies, who in turn will pay for the power they bought from the generator, and services rendered by the transmission and distribution entities. In certain cases, companies may own more than one sector (e.g. generation and supply) if it maintains the equitability of the market and is approved by Ofgem. The equitability of the electricity market means that companies who also operate in two or more electricity sectors should not misuse their position in one to help the other. For example, Powergen, a generation and supply company, also owns East Midlands Electricity (EME), a distribution company. As a distribution company, EME

collects meter readings of consumers on behalf of supply companies who may or may not be Powergen's customers. This is sensitive information and can be used by Powergen to target their non-Powergen customers in EME's operating region. Ofgem is concerned about this and may take some regulatory action to protect this data.

Business interactions and transactions between sectors described in this diagram (see Figure 2.22) highlight potential areas where e-Business can play an important role to help improve business performance and maintain competitiveness. Mihlmester and McKelvey (2000) suggested that some of the possible e-Business applications that have been implemented or can be implemented within this model could be categorised according to the transactions or relationships pattern shown in Table 2.6

Business-to-Business (B2B)	Business-to-Consumer (B2C)	Business-to-Employees (B2E) or Internal Processes
Energy and News Portal	Sign-on Rebates and Discounts	Knowledge Management and Sharing
Green Energy Tariffs	e-Billing and Pre-selected Bill Dates	HR Services
Extranet Interface with suppliers, distributors and partners	Payments Options	Automated Workflow Processes
Market Nomination (market selection for energy)/ Auctioning Services	Consolidated Billing	Service Routing Requests
Meter Display/Analysis	Internet and Application Service	Document Management
Billing Options	Negotiable Monthly Flat Rate	Extended Teams
On-line Market Clearing Houses	On-line Customer Service/Support	Supplier Procurement Chains
Energy Data Management and Outsourcing	On-line Account Management	
Outdoor Lighting Services	Information and Education	
Energy Commodity Trading	Insurance and Warranties	
Load Settlement and Balancing	Interactive FAQs	
Telecom Data Networks	Telecom and Cellular Service	
	Satellite and Cable	
	Multilingual Services	
	"Green Energy"	
	Online Real Time Energy and Appliance Usage with Money Saving Suggestions	

Table 2.6 Example of e-Business Applications for the Energy Industry

(Adapted from: Mihlmester and McKelvey, 2000)

According to a study conducted by PA Consulting Group (2000), utilities are focussing the majority of their effort and attention on B2C applications and risk overlooking the more significant benefits of enabling B2B and B2E transactions and processes. However, despite the emphasis on the B2C areas, it was found that utility

companies were witnessing very low customers interest in using their websites. The utilities interviewed in this study, which covered electricity, gas and water companies, in the UK, Australia and Scandinavia, believed that the main focus of e-Business activity was B2C and e-Business was perceived to be something owned and driven by the marketing department. Plans to extend the use of Internet and Web technology into mainstream operations, such as transactions or supplier management, did not rate as highly as expected. In addition since PA's field study, further e-Procurement initiatives have been launched in the UK by the Eutilia utility group, which demonstrate a growing recognition of the possible benefits.

2.4.2 e-Business Strategy for Electricity Utilities

As companies increasingly shift to Internet based e-Business, energy companies must develop a keen understanding of their relative participation in this web-enabled business. This understanding provides the framework for developing the e-Business strategies necessary to deliver success in the new utilities landscape.

Supported by the IBM model of the common adoption stages of e-Business by companies in various industries (see Figure 2.20), and based on recent experience, there appear to be four stages that define e-Business development (Treadway and Valocchi, 2000; Dyson, 2000). The first stage is *"Channel Enhancement"* where companies use e-Business technology as an enabler to modify existing business processes and in some case create new ones. In this stage, companies employ e-Business technology primarily for information sharing and essentially establishing a new channel to market. The second stage is *"Value Chain Integration"* where companies search for the next major step in e-Business as the level of the companies' Internet competence and confidence grows. Companies realise that value chain integration allows them to share real-time planning, cost and production data between the company and its value chain partners. The third stage is *"Industry Transformation"* where e-Business creates ways for companies to maximise shareholder value by completely transforming their industries. In this stage companies will find ways to work together and leverage each other's core competencies. Lastly, the *"Convergence"* stage is the coming together of companies in different industries to provide goods and services to customers.

Based on these four stages energy companies seeking to harness and leverage the power of e-Business generally can respond to the new competitive forces along two paths (Treadway and Valocchi, 2000). The first one is the *"enabling"* path, which represents incremental change to the organisation's existing model and may provide the opportunity for a winning solution in the areas of cost reduction and improved business processes. Alternatively like many other industry players, companies can choose the *"transforming"* path where they can transform themselves and the industry through radical application of e-Business strategies, processes and implementation methods. This path presents the greatest risk and the potential for the most rewards.

In a survey conducted by PricewaterhouseCoopers (Quests, 2000), to find out the views of directors and senior managers in UK utility retailers with respect to e-Business, it appears that while many companies were putting e-Business at the heart of their business strategy, others seem to view it in more secondary terms. Even though board leadership of e-Business strategy is the norm for the majority of utility companies, thirty percent of the companies participating in the survey said that they did not assign board leadership to support their e-Business activities. Among the electricity and gas utilities that participated in the survey this rose to forty-two percent. In these companies both sponsorship and delivery of e-Business was much more likely to be assigned to marketing managers. There are also signs that the industry is taking a narrow view of e-Business, seeing it primarily in consumer marketing terms and not so clearly as a driver of change for the supply chain and internal processes.

PA Consulting Group (2000), in its study on the adoption of e-Business by utility companies across the UK, Australia and Scandinavia, has also reported similar findings. According to the study, utilities are failing to perceive the strategic opportunities created by e-Business across their various business units. The results when assessing top management's level of understanding of the commercial implications of e-Business and its translation into a clear and communicated strategy, shows that most companies were at the starting blocks in terms of taking a planned and wide-ranging view of e-Business. These companies perceived the development of e-Business strategy to be in its infancy and only twenty percent of the companies

interviewed believed they had a clear and well-communicated strategy (see Figure 2.23).

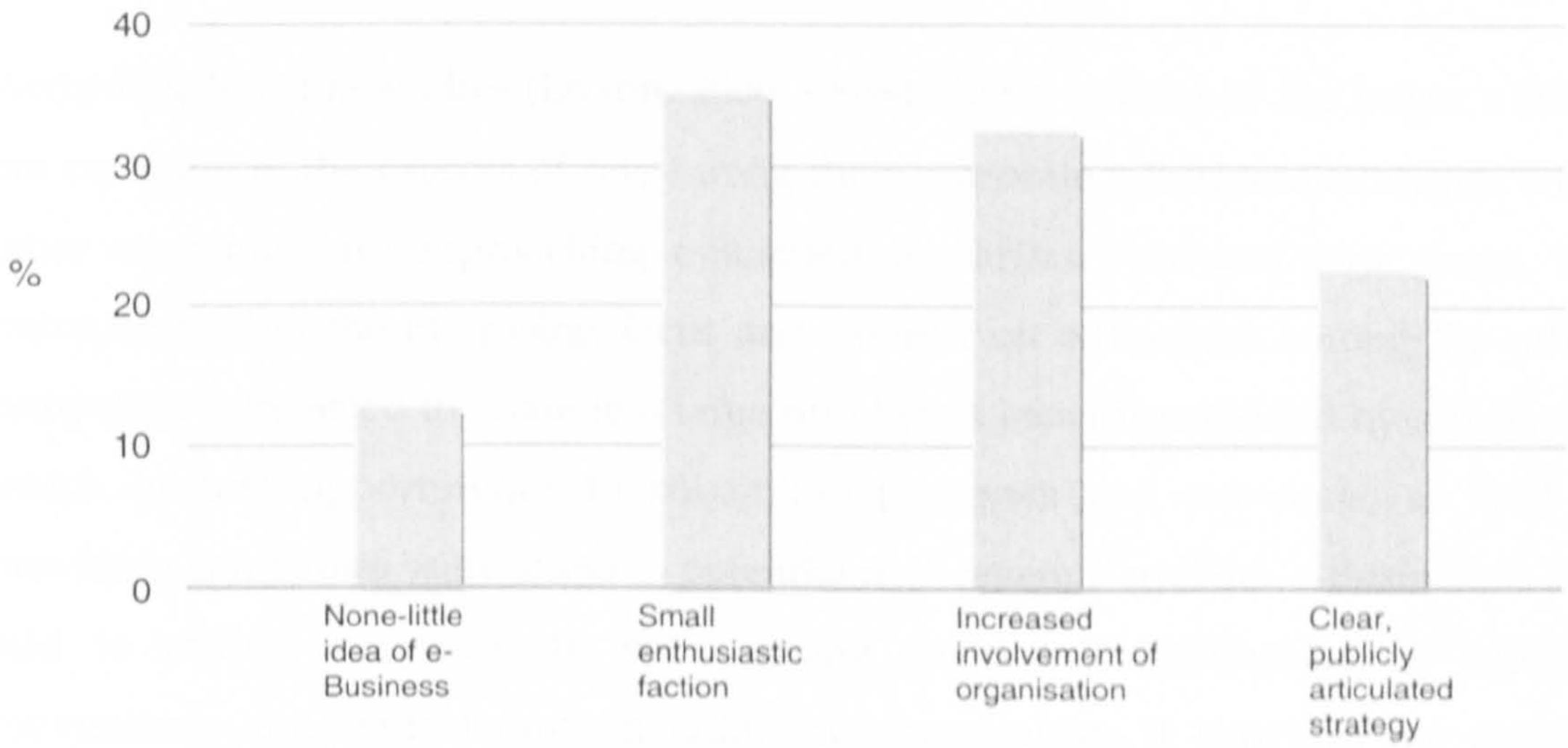

Figure 2.23 The state of development of e-Business vision and strategy

(Source: PA Consulting Group, 2000)

Across the utilities in different countries, a number of different approaches to strategy development are being taken. Some utilities may be able to take the plunge and go for the full transformation approach, incorporating strategic sourcing and integrated online procurement in one leap. However, for many, this may not be a practical or feasible approach, simply due to the risk and the level of investment required. Many companies are starting to recognise that e-Business is about a portfolio of options, not a rigid five year plan. It is about accepting and learning from failure and not success at any cost. Those utilities that choose to start small and continuously refine and improve their initiatives may find that value creation is more durable and more easily achieved.

2.4.2.1 e-Business Benefits

Utilities companies have created a web presence as one of the ways to adopt e-Business, but many are hesitant to move their businesses towards the Internet as quickly as possible (Braun and Lai, 2001). Determining the exact amount of Internet based e-Business benefits is difficult but delaying the move to capture the business opportunities that it can provide may reduce a company's competitive advantage.

Waiting for e-Business and the Internet technologies to settle down and mature could take a long time and could result in loss of revenue and market share for the companies.

According to some studies (Dyson, 2000; Quest, 2000), several of the larger utilities are currently in the process of fine-tuning their corporate e-Business strategies while other companies are approaching e-Business in various trial and error ways. The rationale behind the increasing focus and interest on e-Business among the utility companies is believed to relate to a large number of benefits provided by e-Business, which include opportunities to streamline processes and cut costs, as well as providing companies with access to potential new revenue streams. e-Business is also said to enable companies to build strong customer relationships by offering convenience and control through online communication. It provides the greatest value when applied to the transformation of business processes that helps eliminate inefficiencies by integrating across operational units. Through linking processes from customer to supplier and reinventing the existing traditional processes, organisational performance is enhanced through lower cost structures and quicker, more informed decisions. The integration of e-Business cost reduction strategies into all company processes is considered to be critical to future competitiveness.

In accordance with the benefits mentioned earlier, Braun and Lai (2001) have identified some of the many possible benefits that e-Business can provide specifically to the energy industry. They have categorised these benefits into four major areas of the energy industry, which include:

- **Deregulation of the energy market**
  - General information on power privatisation available for customers
  - Presentation of private energy supply companies
  - Online price comparison for energy customers
  - Online sign up to electricity supplier
  - A revolutionised supply chain by reducing supply chain costs
  - Establishment of remote e-partnerships
  - Improved customer relationship management
  - Broadcast load control for managing peak demand energy pricing

- **Power station monitoring**
  - Remote power systems component monitoring and component control
  - Real-time expert advice for problems which have been experienced on other sites
  - Online consultancy (e-knowledge) improving knowledge management
  - Real-time distribution automation for continuous energy supply monitoring to optimise power system operation, for example in case of point failure
- **Digital marketplace in the energy sector**
  - Online energy trading floors or NetMarkets for electricity suppliers
  - Real-time energy price auctions and negotiations between energy producer, distributor and supplier
  - Ability of governmental regulators to monitor energy companies on-line
  - Purchase of machinery or spare parts from a wider range of suppliers
  - Online trading of raw materials such as oil, coal or gas
  - Independent on-line marketplaces control inventories
  - Quick sales of energy surplus in the marketplace
- **Power industry services**
  - Using the power grid for telecommunications
  - Offering Internet service provider (ISP) services
  - Advertising outsource services
  - Selling of commodities and equipment
  - Offering specialist consultancy and training
  - Publishing power benchmarking information
  - Advertising electricity prices for consumers

These benefits can be observed to be mostly focused on services for customers, cutting operational costs, improving organisational internal processes, and enhancing interactions with business partners. These findings are also reflected in Cap Gemini Ernst & Young (2000) research, which shows that, in dealing with the deregulating markets and other events that are driving change in the utility industries, there are four areas in which most utilities are focused: *"Customer Service"*, *"Value-added service"*, *"Customer Acquisition"* and *"Cost Reduction"*. e-Business strategy and application is seen to have a substantial influence on these activities. Customer

service and value added services to large consumers via the web are prioritised areas in most of the companies. The most advanced e-Business developments were found to have started in business-to-business (B2B) Extranet solutions. The main activities were aimed at the use of the Internet in creating enhanced relations with large industry customers and specifically with the purchasing managers in these organisations.

The overhead and operating costs associated with reaching new markets was found to be one of the largest costs that energy suppliers experience (DeWeese, 2000). One of the greatest efficiencies of using e-Business applications over the Internet to conduct energy business is that it drives down these costs and the cost of transactions, which in turn results in lower costs to energy buyers and a better opportunity to win business. Large utilities are also increasingly looking at implementing e-Business solutions in asset management, internal reporting and knowledge sharing. Cost reductions by deploying e-Procurement are also now being investigated by a number of utilities. Some of the companies are gradually replacing paper oriented work processes by interactive electronic communication (Quest, 2000; Cap Gemini Ernst&Young, 2000; DeWeese, 2000).

Reducing costs in customer-facing operations is a central management issue. By moving towards less expensive Internet related solutions, there are cost saving opportunities, from which it is possible to benefit. A growing number of utilities are looking beyond traditional paper bills and embracing *"electronic bill presentment and payment"* (EBPP) technologies to address the competitive challenges brought about by deregulation (Averett, 2000). EBPP is more than just a new and different way to send bills and collect payments. It provides utilities with a platform for customer communications, and the customer relationship management and marketing programmes they will need to retain current customers and attract new customers in the future.

2.4.2.2 The (New) Competitive Forces

The forces of globalisation, deregulation, the Internet and the World Wide Web have increased pressure for utility companies to have competitive prices and to be more

customer focused, among others. These new business drivers are also changing the understanding of competitive forces, which have traditionally been identified in models such as *Porter's five forces model* (Porter, 1985). For instance, PricewaterhouseCoopers have highlighted the following new competitive forces for the e-Business economy (see Figure 2.24).

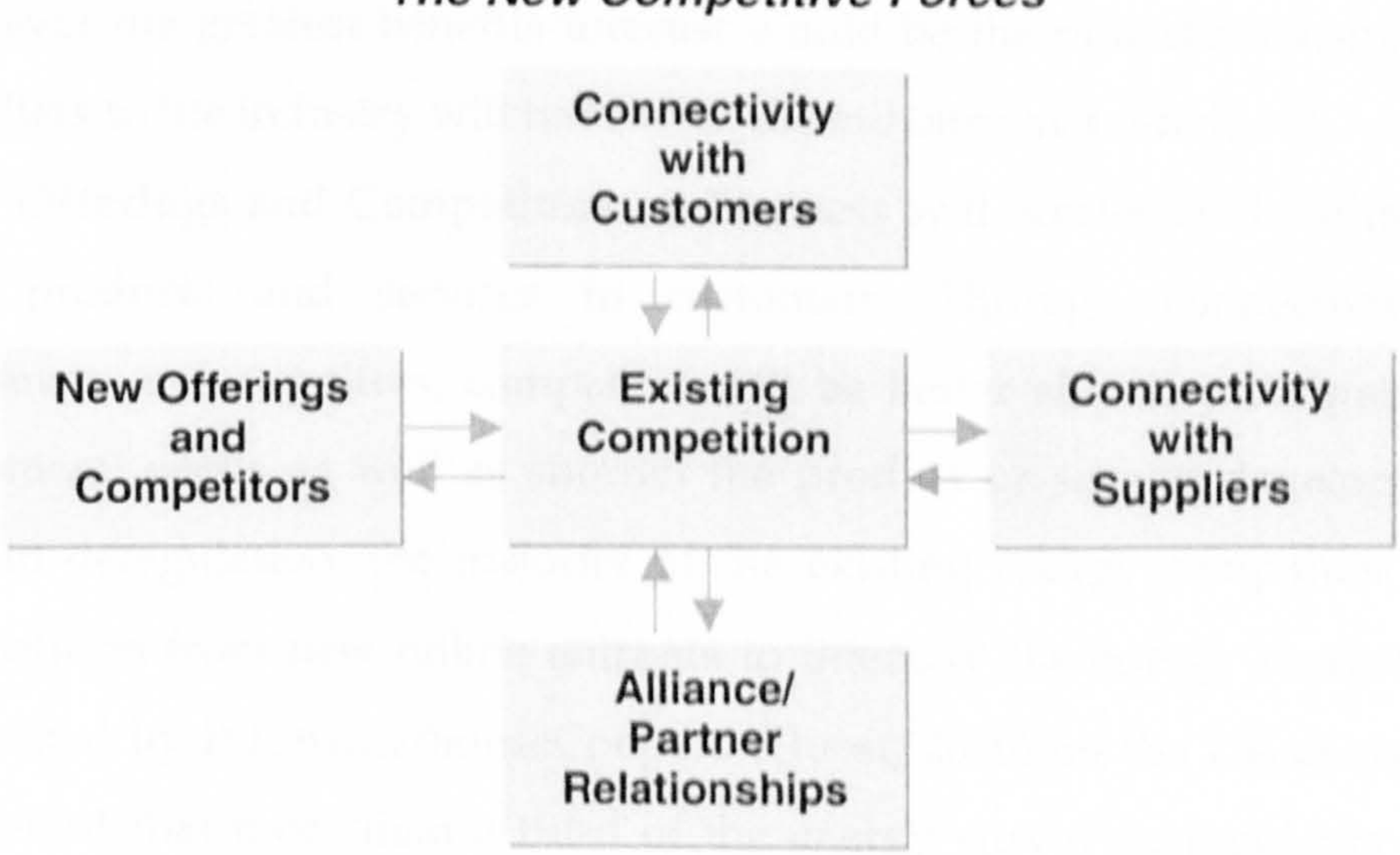

Figure 2.24 New competitive forces have far-reaching effects on the power industry

(Source: Treadway and Valocchi, 2000)

According to this model, utility companies need to build specific competencies (such as forming profitable alliances, understanding customer needs, and establishing efficient customer services) and overcome numerous challenges (which include competing with new entrants that are more flexible and agile, and overcoming organisational cultural issues) to be successful. Current business trends show that businesses are re-evaluating their strategies and organisational structures to maintain a competitive edge in the new economy (Treadway and Valocchi, 2000). These initiatives include:

- **Connectivity with Customers** - customers have now become more informed, and have more choices. In this new e-Business era, many new entrants are entering an already competitive marketplace. As a result, customers are no longer willing to tolerate inefficient service from organisations that are not willing to enhance the quality of their systems and processes to meet the customers' expectations. The

combined forces of increased customer choice and e-Business require energy companies to more fully understand and fulfil customers' needs.

- **Connectivity with Suppliers** - Connection with key suppliers represents a critical new aspect of the changing economy. The introduction of an e-Marketplace fundamentally changes interaction with suppliers. Benefits such as cost reductions and streamlined processes can be gained through this connection. However the greatest benefits forecast would be the new relationships that core suppliers to the industry will have with the industry as a whole.
- **New Offerings and Competitors** - e-Business will accelerate the introduction of new products and services to customers. Through connectivity between customers and suppliers, companies will be better able to anticipate and fulfil customers' needs as well as shorten the product or service development cycle. Due to deregulation, the majority of the existing energy companies can expect competition from new online entrants to intensify the energy market. A survey conducted by PricewaterhouseCoopers (Quest, 2000) on the UK energy industry has found that more than a third of the energy survey respondents anticipated that there would be at least three to five new entrants in the gas and electricity markets within twelve months (from the time the survey was conducted) entering their marketplace, coming in solely via the e-Business route. Already the Internet has opened the door to new players in the UK market who have come in with an online service offer. The introduction of competition in the electricity industry has also posed new concerns. For example, in the UK business critics say (Taylor, 2002) that the determination to pursue competition, which has prevented UK energy companies from developing dominant positions, has resulted in delivering the industry into the hands of powerful foreign *"predators"* such as Germany's RWE, France's EdF and US's TXU. This situation may end in the UK having no national champion to compete in Europe's emerging electricity and gas markets.
- **Alliance/Partner Relationships** - In an e-Business environment it is becoming an accepted and important practice to form new organisations through strategic alliances. The benefits of these alliances include increased market penetration; lower development and delivery costs and the strategic advantage of allowing each organisation to concentrate on what it believes are its strengths (Edrich, 2000). Alliances among competitors are forming in many industries to take advantage of economies of scale and to extract increased efficiencies throughout

the value chain. Many companies are engaging in co-branding and joint marketing to make offers that cater more to their customers' needs, an action that each company alone might not have had the expertise to carry out before (example: Strategic alliances between London Electricity and Virgin to form Virgin Energy). Creating alliances will also allow organisations involved to share risk.

- **Existing Competition –** With deregulation and the introduction of competition, customers may choose their energy providers, generating opportunities for companies with sharp marketing skills and innovative products and services. Physical restrictions, such as service territories, pose fewer barriers for the new economy companies that want to enter the market. The utility industry must move quickly to respond to this emerging trend. Otherwise companies ranging from energy service providers to consumer product companies might enter the market to provide the same or better level of service.

2.4.2.3 e-Business Barriers

In a survey conducted by PricewaterhouseCoopers (Quest, 2000), which assessed the attitudes and behaviour of directors and senior managers in UK utility companies, *"trust"* emerged as one of the main concerns to be standing in the way of the effective development of the business-to-customer (B2C) e-Business. Worries about the security of e-Business transactions and data confidentiality scored highest in a list of barriers blocking the e-Business path to customers. *"Trust"* issues that act as barriers to the growth of B2C e-Business is also reflected in the study conducted by Udo (2001), in which the result shows that there is a great lack of public confidence and trust in the B2C e-Business transactions. The study concludes that for every three B2C users, there are seven others who are too concerned to use the application. The study further concludes that for B2C e-Business to strive, companies need to assure their customers that their privacy and safety are protected (Udo, 2001). So and Sculli (2002) also supported this finding and stresses that *"trust"* in an e-Business environment has become an increasingly more important factor than it was in the past business practices. They emphasised that the need for building trust in B2B and B2C businesses, particularly in B2C e-Business where the general public perceive the risk

in the Internet environment as being very high, is a crucial element for business success.

"Trust" is still a major concern in e-Business implementation, where recent studies (Aljifri et al., 2003) highlighted that the successful implementation of any technology-based application such as e-Business is subject to a variety of forces, which include *"trust"* within the system itself. According to Aljifri et al. (2003), there are several trust factors that can affect the development of B2C e-Business. These factors include *"information security"*, *"technical and industrial infrastructure"*, *"educational"*, *"governmental"*, and *"socio-cultural topics"*. More specifically, these factors have been identified in B2C transactions as issues involving *"hardware and software security"*, *"regulatory regimes"*, *"familiarity"*, and *"user perceptions"* (Aljifri et al., 2003).

Another barrier in this B2C segment was found to be an internal organisational culture of low trust and confidence in e-Business where organisations were not convinced of the benefits of e-Business. Other barriers included: lack of awareness, low customer use, lack of understanding in the B2C business model, legal and liability concerns, and high cost of the overall e-Business implementation (Quest, 2000).

In general, utilities felt that the barriers standing in the way of successful development of e-Business with suppliers (B2B) and in e-Business implementation to internal processes (B2E) were lower (Quest, 2000). However, worries about security and data confidentiality led the rankings of barriers in the case of e-Business transactions with suppliers. When it came to applying e-Business to internal processes, the main problem was seen as the possible disruption caused to the normal operations of the company in order to implement e-Business technology.

2.4.3 Energy e-Marketplace

An e-Marketplace is usually a World Wide Web site where goods and services can be bought from a wide range of suppliers. *"Electronic marketplaces are shared spaces, usually on the web, which enable buyers and sellers to trade electronically under one roof"* (Bray, 2000). It is still a fairly new concept, barely existing two years ago, and which is

still evolving. According to Bray (2000), there are plans to establish thousands of these on-line businesses. e-Marketplaces perform three basic functions. First, they act as exchanges for business transactions such as purchasing, checking prices and stock availability, invoicing, order chasing, and so on. Second, marketplaces manage catalogue content and, third they can provide extra services, from shipping, payment and tax, to online auctions, tendering and vetting suppliers or customers. For buyers, e-Marketplaces promise more competitive prices. Sellers get a new efficient distribution channel to new markets and the opportunity to compete with previously established vendors. In short, an e-Marketplace facilitates product availability, increases price leverage, and improves service levels due to the competitive forces present in a consolidated, frictionless market.

Online business-to-business (B2B) activity in the utilities sector covers a wide range of initiatives from indirect supplies such as office consumables and stationery, through to direct goods in the supply chain and capital expenditure. These activities might be simply shifting existing offline paper-based procurement to an online channel offered by suppliers. To increase benefits, utility companies can deepen online integration with key suppliers, integrating back office systems, sharing information and collaborating on common standards and protocols. In addition utilities are experimenting with online auctions for the procurement of goods and services (Quest, 2001).

e-Marketplaces offer communities of purchasers and suppliers the opportunity for wider collaboration. They are expected to form along two primary dimensions addressing either industry-specific processes and direct procurement, often referred to as *"vertical"* exchanges, or cross-industry functional processes that deal with indirect supplies and services and cover many industries, often referred to as *"horizontal"* exchanges (Porta, 2000). Successful e-Marketplaces create value for both purchasers and suppliers. e-Marketplaces may be the secret to major improvements and cost reduction for the utilities purchasing processes. Their benefits are driven by the advantages of demand aggregation, process efficiency, integration of the supply chain and market efficiency as well as the added content that rises from the creation of a community of interest (see Figure 2.25) (Means and Schneider, 2000).

The trading communities defined in Figure 2.25 as Value-added Communities (VAC) are said to be rapidly becoming the great enablers of e-Business. VACs, also known as e-Markets, e-Commerce hubs, or electronic marketplaces, enable the optimisation of an entire network of businesses. As mentioned earlier, e-Marketplaces or VACs create value for a community of purchasers and suppliers in previously unattainable ways. They have revolutionised trading relationships and B2B transactions by introducing new efficiencies to the supply chain and innovative ways of selling and purchasing products and services. By providing a central platform for transaction automation, demand aggregation, improved market liquidity and extended market reach, they reduce product, process, and sales costs (Porta, 2000; Means and Schneider, 2000).

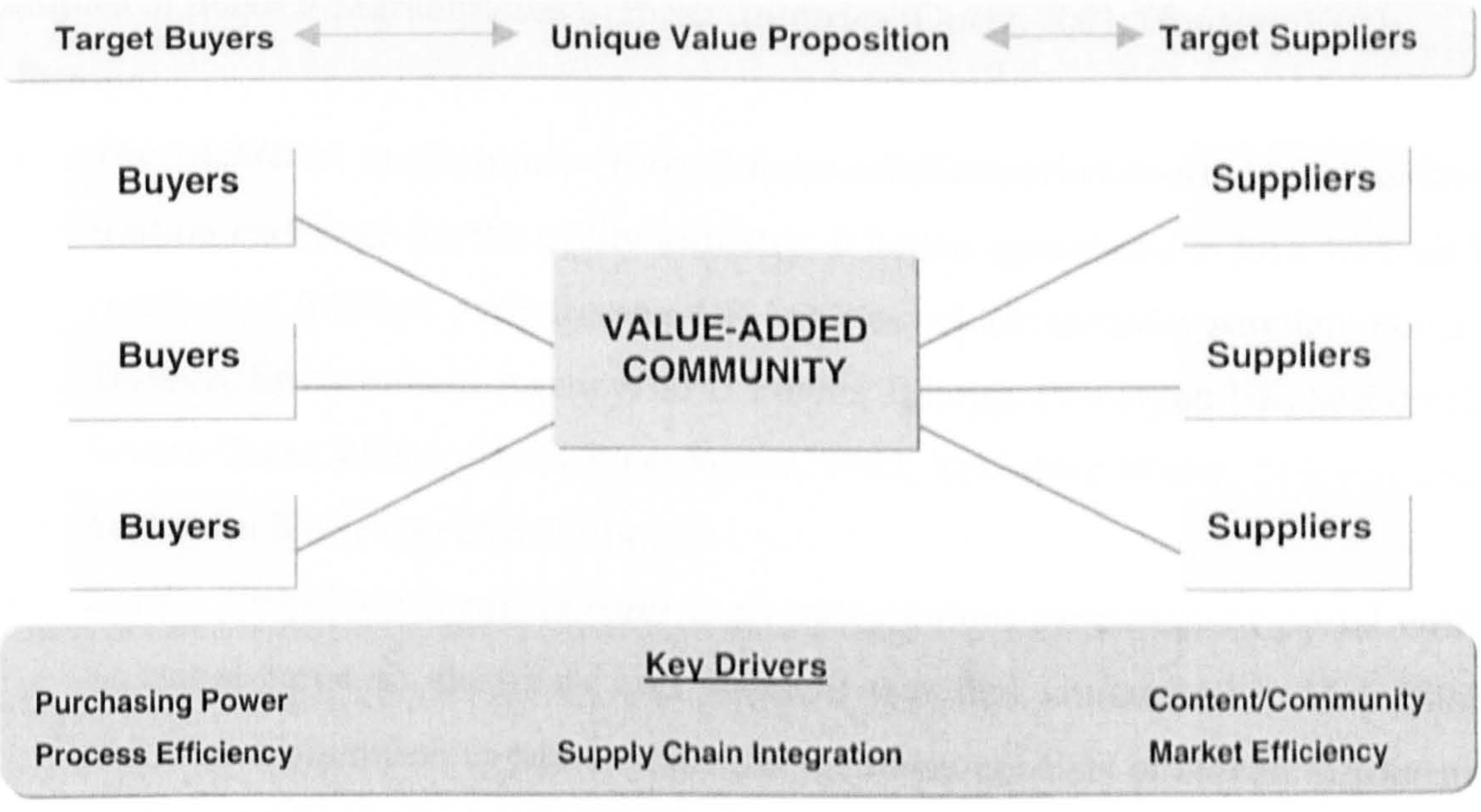

Figure 2.25 Value-added Communities

(Source: Means et al., 2000)

In the last few months, several, new utility e-Marketplaces have been formed to connect utility industry purchasers with utility industry suppliers. The creation of these e-Marketplaces may have emerged due to the promise that transactions would be simpler at these e-Marketplaces when compared to the transactions, which exist in the traditional utility purchasing processes. However, some business analysts believe that Forrester Research's prediction that utilities will be one of the biggest users of the e-Marketplaces might have also played a significant part in prompting the growth of these e-Marketplaces (Hansen, 2001; Means and Schneider, 2000). The report stated

that between forty-five percent and seventy-five percent of e-Business business-to-business transactions would occur through e-Marketplaces over the next few years. The heaviest activity is predicted to take place in computing and electronics, shipping and warehousing, and the utilities industry, where Forrester predicts that more than seventy percent of online trading will go through e-Marketplaces.

Even though it is still too early to predict whether or not these newly created e-Marketplaces will succeed, based on the investors they are attracting and the number of large utilities supporting them, it appears that many in the industry believe e-Marketplaces are the way to go. Currently the US and European countries lead in the development of these utilities e-Marketplaces. The following are some of the examples of major e-Marketplaces in these countries (Quest, 2001; Hansen, 2001):

- **Europe**
  - *The Achilles marketplace (http://www.achillesmarket.com)* is an online trading exchange for the utility industry. It began operations in June 2000 and consists of thirteen participating UK utilities which include: Anglian Water, Transco, Environment Agency, GPU Power, Innogy, Powergen UK, Seeboard, Severn Trent Water, South West Water, TXU, Yorkshire Water, 24Seven and Yorkshire Electricity Distribution.
  - *Eutilia (http://www.eutilia.com)* is an independent procurement portal with an initial focus on electricity and water. It was first announced in May 2000 and began operation in March 2001. Its members consists of eleven European utilities which include: ScottishPower (UK), Endesa (Spain), Electricité de France (France), RWE (Germany), Enel (Italy), Iberdrola (Spain) Electrabel (Belgium), United Utilities (UK), Vattenfall (Sweden), National Grid Company (UK) and Nuon (The Netherlands).
- **US**
  - *Pantellos* (*http://www.pantellos.com*) is an online marketplace for utility industry procurement. It was intended to operate as a global portal for purchasing anything from transformers and wire to turbines and equipment repairs. Pantellos was founded by twenty-one North American utilities in March 2000. Its members include American Electric Power, Progress Energy (formerly known as Carolina Power & Light), CINERGY, Consolidated Edison, Dominion Resources, DTE Energy, Duke Energy, Edison

International, El Paso Energy, Entergy, FirstEnergy Corp., FPL Group, GPU, Ontario Power Generation, PG&E Corporation, Public Service Enterprise Group, Reliant Energy, Sempra Energy, Southern Company, TXU, and Exelon.

- *Enporion (http://www.enporion.com)* is a new marketplace serving the electricity and gas industries. It aims to bring buyers and suppliers together to conduct secure transactions, share knowledge and collaborate to achieve excellence throughout the supply chain. Founding members of Enporion include Allete (formerly known as Minnesota Power), Allegheny Energy Inc., Ameren Corporation, CMS Energy Corporation, Keyspan Corporation, UGI Corporation and PPL Corporation. The first transactions, comprising five auctions, were completed in November 2000.

In addition to the above well-known e-Marketplaces in the utilities industry, several other e-Marketplaces have been formed in the past few months (Quest, 2001; Hansen, 2001). These include a business-to-business e-Procurement exchange called *UtilityFrontier.com* created by publicly owned electricity utilities through a partnership between Hometown Connections, a subsidiary of the American Public Power Association and KnowledgeA-Z, a software technology firm. Other initiatives include *Globalpowerassets.com* that provides an exchange for new and used power generation, transmission and distribution equipment around the world. *Opciona.com* is another e-Marketplace, launched by Endesa, a Spanish utility, as part of its major drive to increase revenues from its e-Commerce initiatives. It began operations in May 2000 and is seventy-eight percent owned by Endesa, twelve percent by PricewaterhouseCoopers and ten percent by CommerceOne (a global B2B e-Business solutions provider) (Green, 2001). Another utility industry business-to-business Internet exchange is a Portland, Oregon-based company called *Utilitywarehouse.com*. This company has been around for five years and deals primarily with the utility energy surplus business.

The e-Marketplaces mentioned above are just a few of those in the utility industry currently in operation or expected to begin operation in 2002. It is evident that many in the industry believe e-Marketplaces will provide a valuable service to the Utilities industry especially for the energy utilities during the 21st century. With so many players in the market it is unlikely that utility buyers or suppliers will position

themselves with only one e-Marketplace. With hundreds of utilities that can benefit from this there is room for more than one provider. Time will tell just how many providers will survive.

2.4.4 e-Business Future in Energy Industry

The global utilities industry is changing to meet the new competitive environment. By becoming an e-Business, utility companies can implement new business strategies to improve competitiveness in this deregulated environment. e-Business is radically changing the way business is done. Emerging technologies that allow companies to more effectively unite with customers, partners, and suppliers, enable new e-Business models. Utilities that can successfully leverage these new technologies and ways of doing business could position themselves for substantial growth (Treadway and Valocchi, 2000).

e-Business is thought to represents one of the most significant paradigm shifts in the energy industry (Shankar and Smith, 2000). As electricity and gas increasingly become commodities, companies will need to go beyond cost-efficiency and pursue growth-oriented e-Business initiatives, such as customer relationship management (e-CRM) processes. At the same time partnering with other type of utilities such as telecommunication and water companies may prove to be an essential strategy to provide customers with easier to manage and lower cost, one stop shopping they are increasingly seeking from their utility companies. Mergers and acquisition strategies may provide these companies with the necessary diversification into other types of utility industries.

According to Dyson (2000), the successful energy companies will be open to and encourage new business models and ideas. They will need to fundamentally change the culture of their company to become more information focused. Companies need to be able to create as many options as possible to face the market, to change products, to improve processes and to restructure their organisation. At the same time, they need internal business management approaches that identify the best of these options and rapidly adopt them to create value.

Currently some of the leading energy companies are developing enterprise-wide e-Business strategies or aggressively pursuing e-Business solutions. Some of the most common value propositions include (Treadway and Valocchi, 2000):

- Cost competitiveness – e-Business enables active outsourcing of internal and customer service-related processes and significantly reduces supply chain transaction and material costs.
- New competition – Web upstarts and industry convergence pose a significant threat for utility industries with traditional characteristics and business models that have been operated in a tightly controlled, highly regulated environment with little or no competition (Mullen, 2000). The traditional utility must focus on a winning strategy of branding, personalised websites, and integration with front-end (CRM) and back office (ERP) operations, amongst others.
- Retain and reach customers – e-Business with an Internet platform has become one of the important methods of interaction with customers requiring personalisation and effective customer relationship management. This is especially critical for those utilities focused on serving large industrial and commercial customers on a national basis.
- New business ventures – Vertical industry portals and other equity ventures are becoming the norm in the market-place, and thereby providing utility companies with opportunities to realise profit from new sources.

Treadway and Valocchi (2000) emphasises that recognising and capitalising on these value propositions should be the companies' first step in developing a credible and sustainable e-Business strategy.

e-Business offers the energy industry tremendous opportunities for accelerated growth. To take advantage of these opportunities, companies will need comprehensive e-Business strategies and the will to implement them. According to Shankar and Smith (2000) in their study on e-Business in the US Electric and Gas Industry, the following seven-step plan should help revise companies' e-Business strategies and move them in a better direction:

1. Perform an e-Business audit of the business unit
2. Revise e-Business vision, goals and measures
3. Analyse the company's "e-Business Gap"
4. Established revised e-Strategy, e-Initiatives and actions steps

5. Arrange revised e-Partnerships
6. Monitor and control the mechanisms put in place
7. Revise organisational culture and hiring and retention processes

From the previous discussion it can be observed that many utility companies are making e-Business part of their strategic response to the changing market landscape due to the perceived benefits that e-Business can leverage brand, cost and service advantages. However, companies should realise that embracing e-Business will not necessarily guarantee future success. Therefore, it is important for companies to emphasise research on finding the best route for them to follow on the e-Business path, as it could be critical for their future competitiveness. Aligning the e-Business strategy to support the overall business strategy while actively managing risk will be essential for companies to achieve their organisational objectives. High profile publicity of e-Business problems has demonstrated that the concept alone is not enough; utilities must be able to demonstrate strength and expertise in the design, implementation and on-going operation of their e-Business services in order to achieve success.

2.4.5 Summary

This section discussed the potential of e-Business in the deregulated electricity industry where deregulation is perceived to have created new competitive forces that require companies to re-think their position in the market. The discussion included the current state and trend of e-Business implementation within the industry. It was observed that most companies have established a web presence and a varying degree of electronic interconnectivity with its partners, suppliers and customers, which led to various examples of possible B2B, B2C and B2E applications.

Utility companies hoped to achieve objectives such as channel enhancements, value chain integration, industry transformation and convergence with their e-Business initiatives. The benefits of achieving these objective were believed to be most apparent in deregulating the electricity market, power station monitoring, creating digital marketplaces and enhancing other spin-off services such as power grid telecommunication and consultancy services.

In addition, this section looked at some of the e-Business implementation barriers such as trust, security and legacy systems. Despite these barriers many e-Marketplaces were seen to have emerged due to the perceived ease of transaction and value adding capabilities. Finally, the future of e-Business in the electricity industry was discussed.

2.5 Conclusion

This chapter has reviewed the main topics of the research theme. The framework at a conceptual level (see Figure 2.26) developed for this research highlights the main areas that were studied and the presumed relationships among them. It also provides the reference from which the research questions were formulated (see Table 2.7).

General Questions	Specific Questions
1. **What is e-Business?**	▪ How is e-Business defined in general? ▪ What is the most recent or currently accepted e-Business definition? ▪ What are other related terms and concept in an e-Business environment? e-Commerce? EDI? Internet? The Information Economy? e-Marketplace? ▪ How does e-Business work? Does it really work? ▪ How does e-Business affect business organisations? ▪ How can businesses take advantage of e-Business?
2. **What is the structure and current status of the electricity industry specifically in the UK and Malaysia?**	▪ What is the trend of electricity industry traditionally and currently? ▪ What are the strategies and models adopted previously and currently? ▪ What are the common characteristics between electricity utility and other utilities? ▪ What are the common and different characteristics between the UK and Malaysian electricity systems?
3. **What are the impacts of deregulation on the power markets?**	▪ What is electricity deregulation? ▪ Why is electricity deregulation introduced or going to be introduced? ▪ What are the benefits of deregulation in the power markets? ▪ What are the problems associated with deregulation in the power markets? ▪ How does utilities deal with deregulation?
4. **What are the implications of e-Business for the electricity utilities?**	▪ How does it affect utility companies particularly the electricity industries? ▪ What is the potential of e-Business in electricity industries?

General Questions	Specific Questions
	▪ Will it make a difference? How? When? Why?
5. **What are the current approaches and practices with regards to e-Business strategy and implementation in the electricity industry?**	▪ What are the current approaches? What are the current practices? ▪ What strategies are being pursued by the electricity companies to benefit from the e-Business environment? ▪ What are the e-Business applications involved? What are the most widely implemented e-Business applications? ▪ What are the important elements that must exist in an organisation before implementing e-Business?
6. **What are the important issues regarding the way in which the management and administration of the e-Business implementation process contribute to the success or failure of the implementation as a whole?**	▪ How do policy/strategy makers behave in relation to the concept of e-Business? ▪ How do they perceive e-Business? How important is e-Business for their companies? ▪ How important is e-Business to the company with regards to its current business strategy? ▪ In what way does e-Business affect the way they currently conduct their business operations? ▪ How do they cope with the rapid pace of e-Business technology developments? ▪ How do they prepare their employees for e-Business? ▪ What kind of exposure is needed to prepare managers for the e-Business environment? ▪ What sorts of investments are being made?
7. **What are the factors considered as barriers to the effective use of e-Business with customers, business partners, and internal processes in the electricity industry?**	▪ What are the barriers or problems faced by electricity companies in implementing their e-Business strategy both in a deregulated and regulated environment? ▪ What are the main or major problems faced among these factors? ▪ What are the reasons or causes for these problems to happen?
8. **What could be the impact of e-Business on organisational performance for the electricity industry and in general?**	▪ In what way could e-Business facilitate better customer services and relationships building? ▪ In what areas of the electricity industry can e-Business be applied to reduce cost? (e.g. data acquisition for metering, project management for just-in-time production or installation of components such as generators, transformers, etc. and buying and selling of electricity) ▪ How can e-Business help find new markets or form new alliances to increase revenue? ▪ How can new products be developed using e-Business? (e.g. diversify into telecommunication, high quality electricity supply etc.) ▪ Does e-Business help increase employee motivation? If yes, in what way?

Table 2.7 General and Specific Research Questions

The conceptual framework mentioned earlier (see Figure 2.26), is organised into three levels to be reviewed. It started with a parallel review of the basic concepts of e-Business and its environment, current e-Business models and strategies; traditional business models, framework and theories; and the general trend in the electricity industry focussing on the UK and Malaysian deregulation situation. At the second level this research concentrates on studying the impact and the state of e-Business specifically in the electricity industry as well as comparing it with the condition of other utilities. The third level is reviewed concurrently with the second level in order to identify the impact of e-Business on the overall organisational performance, concentrating on the success indicators. The *"left-right arrow"* in the framework indicates the relationships between the areas studied within the same level, for example identfying the traditional business model that could be applied in determining e-Business strategies, and the *"down arrow"* represent the levels analysed, although they were not necessarily carried out in the order shown.

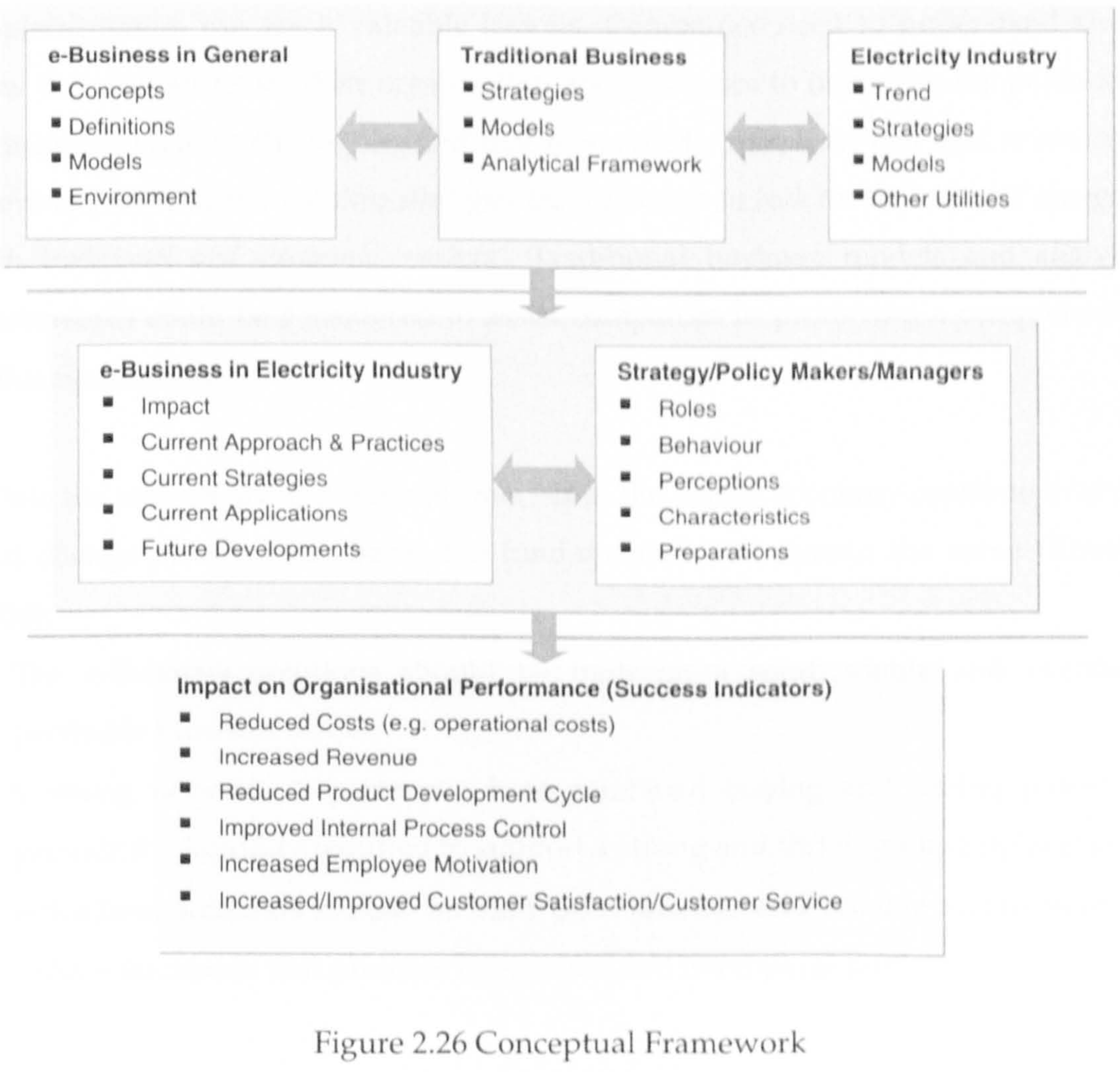

Figure 2.26 Conceptual Framework

The above framework provides the structure of the literature review and the studies that were included in it. Based on these studies, this research believes that e-Business can help companies operate more efficiently by creating larger interorganisational virtual structures that are composed of the company, its customers, business partners, suppliers and other relevant entities. At this stage e-Business is perceived to have a high potential for growth as the market acceptance and understanding of e-Business and the technology that supports it has not reached the maturity stage as shown in the diagram of e-Business phases (see Figure 2.1) and from the description of the technology S-Curve (see Figure 2.2) discussed earlier. The recent collapse of many dot-coms indicates that e-Business is still at the initiation stage.

It was observed that companies with physical presence tend to pass through the volatile e-Business phenomenon better than virtual companies. As a result, the concept of click and mortar companies, combining both physical and network presence, seems to be the formula for success. Previous failures of e-Business implementation can teach valuable lessons. Companies need to understand clearly how they can structure their organisation and processes to maximise the potential of e-Business. Phan (2001) highlighted that to succeed, *"companies will need to constantly search and implement innovative strategies that capitalise on both the Internet and changes in both traditional and electronic markets"* Traditional business models and analytical frameworks could be considered to assist companies in producing a comprehensive e-Business strategy.

While the technology and business models in the digital economy continue to evolve and change on a regular basis, the fundamentals still remain the same (Koushik, 2000):

- The e-Business solutions should be built on a solid, viable and eventually profitable business model;
- A strong network of partners whose combined buying and selling power can provide the liquidity required to support a strong and thriving marketplace; and
- e-Business solutions should be built on a scalable and reliable architecture that utilises standards that promote integration and interoperability.

In the electricity industry, large scale changes in the form of deregulation provide a competitive environment and increase the number of players dealing with electricity. In this new competitive environment, companies need to use the right tools to stay ahead. However, the take-up rate of e-Business applications in the industry is slow as many companies are quite happy to *wait and see* rather than becoming the leaders in implementating e-Business in the early stages. This observation supports the earlier point that there is still much potential for e-Business growth in the electricity industry.

The UK electricity industry was seen to be very open and allows competition in all areas, whereas the Malaysian electricity industry is still taking small tentative steps towards deregulation. However, the UK experience is very much relevant to Malaysia and the rest of the world as one of the more succesful power market models. Some of the lessons that can be learned from the UK market includes its development and implementation of e-Business strategies for the UK electricity utilities. Based on these experiences, electricity companies in Malaysia can identify critical variables that can make or break their e-Business initiatives and take early and appropriate action to leverage themselves in the new market.

The following chapters will discuss and answer the research questions developed in this chapter and the method for answering these questions will be discussed in Chapter 3.

Chapter 3: Methodology

3.1 Introduction

This chapter discusses the method used to find the answers to a number of issues and questions unearthed during the literature reviews presented in the previous chapter. It describes the various steps followed in this research and provides justification for the appropriateness of the methodology used, the suitability of data collection instruments and the rigour of checks and balances applied throughout the research. This chapter also elaborates on the problem statement of the research as well as describing a set of working hypotheses that have been used to focus the study rather than to test or to prove them. These working hypotheses are referred to as *"study propositions"* and were derived from the research questions where each proposition helps to direct attention to issues that should be examined to answer the research questions within the scope of the study (Yin, 1984). Also, due to the exploratory nature of the research, these propositions have also been developed in the form of *"statements of purpose"* (statements that establish casual relationships) to focus the information gathered on the issues being studied.

Based on the issues and questions being investigated, which involves e-Business as a new organisational phenomenon, this research has adopted a mainly qualitative research method focusing on a case study approach. Qualitative studies of organisations and organisational culture have become fairly common in recent years (Martinsuo, 2001). As indicated by Miles and Huberman (1994), the acceptance and appreciation of qualitative studies has increased phenomenally during the 1980s and 1990s. According to Tellis (1997) and Yin (1984) the qualitative case study is an ideal methodology when a holistic, in-depth investigation is needed. Case studies are also designed to increase the depth of findings by drawing out detailed information regarding the research issues from the viewpoint of the research participants.

For this study, in which the objective is to look at e-Business strategy for the electricity utilities in more depth, case-based research involving qualitative data

collection and analysis was felt to be the most appropriate methodology to use and further justification for this choice is discussed in the following sections. This research started with an extensive literature review of e-Business topics, the electricity industry (including the privatisation and deregulation processes), and the potential of e-Business for the electricity utilities. Other relevant topics such as strategic management and organisational performance were also investigated. The conceptual framework developed and the research questions derived from the literature review were used to formulate the fieldwork strategies including preparing the case study procedures and protocols. These were used to investigate five individual cases from the UK electricity environment and one from Malaysia. Most of the data about each case were gained from in-depth interviews with managers in a position to develop, or involved in the forming of, the company's policy and strategy. A series of interviews with the strategy and policy makers were conducted to gauge their views and experiences regarding e-Business. For example, they were asked how they thought e-Business could help in the overall strategy of their company, which might include new ways of doing business, smart partnerships or strategic alliances with other parties in the market, specialised training schemes, or maybe investments in new technologies.

Data were also gathered from brochures, companies' internal and external reports, companies' websites, government regulators' reports and websites, electricity associations' reports and websites, newspapers and other media, as well as from books, journals, and databases to help triangulate the information discovered. The six cases were then compared to build the final theory and framework of how e-Business was used in the new deregulated electricity environment and what were its current and future roles. A proposed strategy matrix was also developed to help companies evaluate their preparedness to venture into an e-Business environment.

3.2 Research Design and Methods

According to Gay and Diehl (1992), research method refers to the overall strategy followed in collecting and analysing data; this strategy is also referred to as research design. Yin (1984) said that in the most basic sense, *"research design is the logical*

sequence that connects the empirical data to a study's initial research questions and ultimately to its conclusions". In identifying the most appropriate design and methodology for this research several important issues and options highlighted by Patton (2002) were considered. These are summarised in Table 3.1 and discussed at length in the subsequent sections. This study implemented a mainly qualitative method and adopted Patton's (2002) philosophy for the research. According to Patton (2002), *"a qualitative design needs to remain sufficiently open and flexible to permit exploration of whatever the phenomenon under study offers for inquiry. Qualitative designs continue to be emergent even after data collection begins"*.

Issues	Design Options and Concerns	Options Selected for This Research
1. What is the primary purpose of the study?	Basic research, applied research, summative evaluation, formative evaluation, action research.	Based on applied research as well as using both summative and formative evaluation.
2. What is the focus of the study?	Breadth versus depth trade-offs.	Less breadth and more depth in terms of number of respondents
3. What are the units of analysis?	Individual, groups, programmes components, whole programmes, organisations, communities, critical incidents, time periods, etc.	The organisation
4. What will be the sampling strategy or strategies?	Purposeful sampling, probability sampling. Variations in sample size from a single case study to a generalisable sample.	Purposeful sampling strategies involving multiple-case study with emphasis on two main cases.
5. What types of data will be collected?	Qualitative, quantitative, or both.	Qualitative
6. What type and degree of control will be exercised?	Naturalistic inquiry (no control), experimental design, quasi-experimental.	Naturalistic case study inquiry. Studying issues and events in real-life contexts.
7. What analytical approach or approaches will be used?	Inductive, deductive. Content or thematic analysis, statistical analysis, combinations.	Inductive analysis
8. How will the validity of and confidence in the findings be addressed?	Triangulation options, multiple data sources, multiple methods, multiple perspectives, multiple investigators.	Using multiple data sources with only one researcher.

Issues	Design Options and Concerns	Options Selected for This Research
9. Time issues: When will the study occur? How will the study be sequenced or phased?	Long-term fieldwork, rapid reconnaissance, exploratory phase to confirmatory phase, fixed times versus open timelines.	Exploratory phase to confirmatory phase within a relatively fixed time frame.
10. How will logistics and practicalities be handled?	Gaining entry to the setting (site), access to people and records, contracts, training, endurance (perseverance,), etc.	Most of the fieldwork involves going to the case companies' sites.
11. How will ethical issues and matters of confidentiality be handled?	Informed consent, protection of human subjects, reactivity, presentation of self, etc.	Addressing ethical issues according to the guideline suggested by Miles and Huberman (1994), which include dealing with informed consent and confidentiality issues.
12. What resources will be available? What will the study cost?	Personnel, supplies, data collection, materials, analysis time and costs, reporting/publishing costs.	The materials and resources used include an audio digital recorder for the interview sessions, ProCite 4 software for references and other PC applications as well as the PC itself, provided by the university. People resources include, supervisor, university lecturers in related areas, contact persons and relevant personnel within the case study companies. Research methodology courses by the university also provided valuable inputs.

Table 3.1 Design Issues and Options

(Adapted from: Patton, 2002)

3.2.1 Problem Statement

This research focused on the UK and Malaysian environment. It has studied the current management approaches of Malaysia's largest electricity company, Tenaga Nasional Berhad (TNB) with regard to its e-Business strategy and implementation. TNB is currently the primary power producer in Malaysia, although it does buy power from several Independent Power Producers (IPPs), which were introduced in

the early 1990s. As announced by the Malaysian Energy Commission recently, the deregulated market will begin operation in 2005 for the energy sector in Malaysia. This would mean that in the future, the IPPs would play a greater role in the industry, as they are able to sell power directly to consumers. This will provide competition for TNB, which will force it to be more efficient in its service and operations.

This research has evaluated TNB's readiness to embrace the deregulated market with the aid of e-Business applications and strategy by comparing it to ScottishPower Plc., which is operating in a deregulated market and has e-Business applications running. Although many countries have a deregulated power market, the UK model was chosen as it was one of the first countries to embark on electricity deregulation and has more experience compared to their counterparts elsewhere (The Electricity Association, 1999).

One of the main reason why ScottishPower Plc was chosen as the primary model for comparison was due to its vertically integrated structure (generation, transmission, distribution and supply still owned by the same company), which is similar to TNB. ScottishPower is also one of the most successful electricity utilities and is ranked among the top five hundred most profitable companies worldwide (Forbes.com, 2002). It is also one of Scotland's leading companies (number three in the top twenty (Scottish Business Insider, 2001)). The company also has acquired vast experience in the electricity-deregulated market since 1990 (The Electricity Association, 1999). ScottishPower was also selected because of its impressive e-Business activities, which were identified from the company's website, the media, and from the initial interview with the company. However, comparisons with other electricity utility companies in the UK were also important. This contributed valuable information and helped in adding confidence to the research findings. For example, if the results show that the e-Business implementation in the generation sector of ScottishPower, Scottish and Southern Energy, Powergen, and LE Group produced similar patterns, the research would then be able to draw stronger conclusion about the effects of e-Business in the deregulated sectors of the electricity industry.

3.2.2 Qualitative Inquiry

This research started with the identification of the broad problem area described previously and was directed by a number of study propositions and questions generated and unearthed by the initial literature review and modified by the initial fieldwork and subsequent findings (see Table 3.2). By specifying the research problem in terms of key themes (e-Business, Electricity Industry, e-Business in electricity industry) it was possible to generate a number of broad study propositions and research questions which could be constantly compared with the emergent data. This research also adopted a strategy that was flexible enough to identify and incorporate emergent issues into the propositions.

Study Propositions

1. e-Business strategy offers a possible business solution that can help electricity utilities improve their organisational performance in order to survive in deregulated power markets.
2. Organisation preparedness towards successful e-Business implementation can be analysed based on management attitudes and perceptions of e-Business.
3. One of the reasons that impacts success or failure in an e-Business implementation is the way e-Business resources are managed.

General Research Questions

1. What is e-Business?
2. What is the structure and current status of the electricity industry, specifically in the UK and Malaysia?
3. What are the impacts of deregulation on the power markets?
4. What are the implications of e-Business for the electricity utilities?
5. What are the current approaches and practices with regards to e-Business strategy and implementation in the electricity industry?
6. What are the important issues regarding the way in which the management and administration of the e-Business implementation process contribute to the success or failure of the implementation as a whole?
7. What are the factors considered as barriers to the effective use of e-Business with customers, business partners and internal processes in the electricity industry?
8. What could be the impact of e-Business on organisational performance for the electricity industry and in general?

Main Research Questions

What are the impacts of e-Business on the electricity industry, both in the regulated and deregulated power markets? What is the potential of e-Business in utilities and specifically in the electricity companies? Will e-Business become one of the more important if not the main strategy for electricity industry in the near future? What can be learned from the current e-Business experience of the electricity companies?

Table 3.2 Research Propositions and Questions

3.2.2.1 Design Strategy

Various factors as described earlier (see Table 3.1) have been taken into consideration when performing this research. Based on the research questions unearthed in the previous chapter and summarised in Table 3.2, this research has adopted a qualitative case study approach to finding the answers to these questions. According to Yin (1984), case study research contributes *"uniquely"* to the knowledge of individual, organisational, social and political phenomena and has been a common research strategy in psychology, sociology, political science, planning, and even economics. Myers (1997) added that case study research is also the most common qualitative method used in an information systems type of research. In all of these fields (psychology, sociology, information systems, etc.), the distinctive need for case studies arises out of the wish to understand complex social phenomena, in which the case study allows an investigation to capture the holistic and meaningful characteristics of real-life events such as life cycles, organisational and managerial processes, international relations, and the evolution of industries (Yin, 1984; Myers, 1997; Tellis 1997; Patton, 2002). In this research the use of a case study approach is important in order to understand the roles of e-Business and its impact for the electricity companies by looking at real life companies' own definitions, views, and management approaches to this strategy, which might be difficult to obtain using another research strategy such as a questionnaire based survey with a predetermined and restricted range of answers.

Although there are numerous definitions, this study adopted the description recommended by Yin (1984), which defines the scope of a case study as "*...Investigating a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used*". For this research, the *"contemporary phenomenon"* was the e-Business concept and this research investigated the implementation and management of e-Business strategies in real life organisations.

The decision and rationale for choosing a case study approach in this qualitative method was also based on Yin's (1984) strategy options. According to Yin (1984), there are three conditions that can help determine what type of research strategy should be selected and when to use each strategy. These three conditions consist of: first, *"the type*

of research questions posed", second, *"the extent of control an investigator has over actual behavioural events"* and third, *"the degree of focus on contemporary as opposed to historical events"*. Table 3.3 displays these three conditions, and shows how each is related to five major research strategies in the social sciences, which include experiments, surveys, archival analysis, histories and case studies (Yin, 1984).

Strategy	Form of Research Questions	Requires Control Over Behavioural Events?	Focuses on Contemporary Events?
Experiment	how, why, what (exploratory)	Yes	Yes
Survey	who, what, where, how many, how much	No	Yes
Archival analysis	who, what, where, how many, how much	No	Yes/No
History	how, why what (exploratory)	No	No
Case study	how, why what (exploratory)	No	Yes

Table 3.3 Relevant Situations for Different Research Strategies

(Source: Yin, 1984)

Under the first condition, Yin (1984) suggested that the type of research questions posed could determine the research strategy used. For example, it is considered a *"justifiable rationale"* for conducting an exploratory case study if the research questions focuses mainly on *"what"* questions with an exploratory nature such as "What is e-Business" or "What are the implications of e-Business for the electricity utilities?" and other such questions formulated for this research as described in Table 3.2 (Yin, 1984). For the second and third conditions, the case study is preferred for *"examining contemporary events"* but *"when the relevant behaviours cannot be manipulated"* (Yin, 1984). As mentioned previously, in this research e-Business was regarded as a contemporary event for the electricity industry and its adoption and implementation within each electricity company was not within the researcher's control and could not be manipulated by the researcher.

The focus of the study was to look into the potential of e-Business as a solution for electricity utility companies in the new deregulated environment of power markets. Specifically, the purpose of the study was to understand the role of e-Business and its impact on electricity companies in a variety of settings.. This study has looked at current management approaches and practices of these companies with respect to e-Business strategy and implementation. It is hoped that the results and findings of this research will provide insights or themes on e-Business strategy for electricity utilities, in order to establish a point of reference for strategy and policy makers in this industry and particularly for the Malaysian environment.

Based on the discussion above, it appears that a great deal could be learned by studying in depth a small number of selected electricity companies that had implemented e-Business as one of the solutions to increase competitiveness in the new deregulated electricity environment, as compared to gathering standardised information from a large, statistically representative sample of electricity companies worldwide. This research also adopted a naturalistic inquiry design strategy defined by Patton (2002) as *"studying real-world situations as they unfold naturally"* with design characteristics of *"nonmanipulative and noncontrolling, and openness to whatever emerges (lack of predetermined constraints on findings)"*.

Purposeful sampling was selected as the most appropriate sampling strategy for this study where according to Patton (2002), the logic and power of purposeful sampling lies in selecting information-rich cases, where a great deal can be learned from these cases by discovering in-depth issues of importance to the purpose of the research inquiry, *"Purposeful sampling focuses on selecting information-rich cases whose study will illuminate the questions under study"*. Also, according to Patton (2002), *"studying information-rich cases yields insights and in-depth understanding rather than empirical generalisations"* which was most suitable for this research in order to understand the potential of e-Business in electricity utilities. Sampling then was aimed at gaining insights about e-Business phenomena from cases that the research could learn the most from, and not at empirical generalisation from a sample to a population.

According to Miles and Huberman (1994), *"samples in qualitative studies are usually not wholly prespecified, but can evolve once fieldwork begins"*. For example the initial choice of

informants may lead to similar and different contacts; or observing one set of events may require a comparison with another event; and understanding one key relationship in the setting reveals aspects to be studied in others. Miles and Huberman (1994) additionally suggested that sampling also involves decisions not only about which people or organisation(s) to observe or interview, but also about the physical contexts, environment, events and processes concerning the people or organisation(s) studied.

Using multiple case studies also demands clear choices about which type of cases to include. Although qualitative studies require continuous refocusing and reconfiguring of the fieldwork strategy, some initial selection is still required to set the focus, boundaries and parameters of the study. The literature review and initial fieldworks were used to help set these foci and boundaries for the sampling decisions. For example, when determining the focus and boundaries for the *"actors"* element of the *"sampling parameters"* (see Table 3.4), initial fieldwork indicated that the case companies were very reluctant to involve their personnel from other hierarchical levels. Therefore, the boundaries and focus for the research *"actors"* were set to only receive inputs from the strategy and policy makers. Table 3.4 describes the initial sampling choices identified for this research. The *"Multiple-case sampling"* approach used for this research helps to add confidence by strengthening the precision, the validity, and the stability to the research findings (Miles and Huberman, 1994). Looking at a range of other similar and contrasting cases helps in understanding the main case study findings, by specifying *"how"* and *"where"* issues and if possible *"why"* they are as they are. If the finding holds in one setting, and given its profile, also holds in a comparable setting, but does not in a contrasting case, the findings would be more robust (Miles and Huberman, 1994).

Sampling Parameters	Choices Made
Settings	Power market, Electricity industry – Electricity utility companies (UK and Malaysia).
Actors	Managers – Strategy/Policy Makers, Managers in charge of e-Business strategy and implementation within the selected companies.
Events	Power market deregulation and the introduction of competitive power market.
Processes	Privatisation, Deregulation, Moving from an industrial-based economy where machines dominated productivity, to an information-based economy where information and knowledge are the dominant sources of value added, e-Business as a potential strategy for the new economy.

Table 3.4 Sampling Choices

(Adapted from: Miles and Huberman, 1994)

As explained in the problem statement, the UK was selected due to its vast experience in the deregulation of the electricity power market. The research started with an overview study of electricity companies obtained from the UK Electricity Association web page (see *http://www.electricity.org.uk*). The companies were then categorised by the sectors that they operated in, generation, transmission, distribution and supply, for a better understanding of their organisational structure and functions. Initially it was envisaged that the research would have a number of companies representing each sector to ensure wide coverage and to find out if there were different patterns of e-Business adoption and implementation across these sectors. To achieve this the study initially planned to include, as a maximum, fifteen out of the twenty-five companies from the Electricity Association list, with at least three companies in each sector. This decision was made based on the guideline suggested by Perry (1998), that the widest accepted range for a PhD thesis adopting the case study methodology should fall between two to four as the minimum and ten, twelve or fifteen as the maximum number of case study organisations to be used.

However, further findings and changes in the electricity industry indicated that it would be difficult to achieve the maximum number of respondent companies planned originally. One of the major problems encountered was the difficulty in getting access to these companies. Some companies agreed to participate, but were then involved in a major takeover by other companies, or were having to deal with financial issues and were not able to participate fully or not at all, while others agreed

to participate but could not confirm when they would be available to be interviewed. Another problem was that most companies that agreed to be part of this research agreed to participate on the condition that there would only be input from top-level management.

Initially, it was planned that this research would conduct three sets of interviews at different hierarchical levels within the case study organisations as also suggested by Perry (1998) to be the guideline in identifying the numbers of interviews for this kind of research methodology. However, due to the above problem it was then decided to standardise the number of interviews for all the case companies to being strategy or policy makers only. These problems also reduced the number of participants for this research to only five case study companies from the UK environment. As explained in the problem statement, out of the five companies, ScottishPower was selected to become the main case study due to its structure, background, history, rigorous e-Business activities, and the company's willingness to participate fully in the research.

3.2.2.2 Data Collection and Fieldwork Strategy

As explained previously, a qualitative case study method using a combination of observations, interviewing, and document analysis was selected as the most appropriate method of data gathering for this research. It was hoped that using the combination of these different data sources would increase validity, as the strengths of one approach can compensate for the weaknesses of another approach. According to Patton (2002), the limitations and weaknesses of observation can be in the form of distorted data due to the biased perception of the observer or the possibility that the observer may affect the situation being observed in some ways. Also, observational data are often constrained by the limited sample of activities actually observed and the focus of the observations is often limited to only external behaviour. Therefore, other data sources such as interviews are needed to understand the phenomena being researched in more detail.

However, interview data are also subject to limitations such as distorted or dishonest responses due to personal bias, anxiety, politics, emotional state, and level of knowledge of the interviewees at the time of the interview. Taking that into

consideration, it was decided that observation could provide a check on what is reported in interviews, while interviews on the other hand allow the observer to go beyond external information to explore feelings and thoughts as well as behind-the-scenes look at the cases and issues researched.

Collecting data from documents and records also has some limitations. These include incomplete, inaccurate or outdated data. However, document analysis could help provide a more detailed explanation as well as a general background of the phenomena and cases being studied in order to fill in whatever gaps were found during the interview and observation activities.

The following sub-sections discuss the three methods of data gathering conducted during the fieldwork of this research.

3.2.2.2.1 Interview

The key qualitative tool used in this research was the interview, which is a data collection instrument that has been described as the most important source of information for the case study method (Yin, 1984). The approach to interviewing was based on an *"open-ended nature"* that Yin (1984) also described as the most commonly used form of interview in case studies. In addition, open-ended responses allow the researcher to understand the research issues as seen by the respondents in their own terms without any influence from the researcher. Patton (2002) explained that *"the purpose of gathering responses to open-ended questions is to enable the researcher to understand and capture the points of view of other people without predetermining those points of view through prior selection of questionnaire categories.... one must learn their categories for rendering explicable and coherent the flux of raw realities"*.

The decision to adopt this approach to interviewing was developed as the research progressed, although careful steps were taken to ensure that any changes were consistent with the overall research strategy. For example, in order to maximise the limited time given for the interviews, *"standardised open-ended interviews"* were conducted, which consist of a set of questions carefully worded and arranged before the interview, with the intention of taking each respondent through the same

sequence and asking each respondent the same questions with essentially the same words (Patton, 2002). According to Patton (2002), the highly focused nature of this type of interview can help ensure that the interviewee time is used efficiently. The data collected are still open-ended in the sense that the respondents supply their own words and insights in answering the questions but the precise wording of the questions is determined ahead of time.

The interviews were conducted with an initial set of probing questions categorised into three parts: General Information, e-Business Strategy and e-Business Implementation (please refer to Appendix A for a sample of the Interview Questions protocol). Table 3.5 presents the main research questions derived from the literature review, and summarised in Table 3.2 and which served as the foundation on which the subsequent interview questions were designed. To the right of each research question are codes (S1, S2.... I2, I3...) referring to the specific initial interview questions. For example S1 indicates the first question in the e-Business Strategy section of the interview protocol and I1 indicates the first question in the e-Business Implementation segment. For all the case companies in the UK, the initial interviews were conducted in a face-to-face mode with arrangements and brief introductions made via email and telephone discussions.

Research Questions		Interview Question
1.	What is e-Business?	S1, S2
2.	What is the structure and current status of the electricity industry, specifically in the UK and Malaysia?	G1, G2, G3, G4, G5, G6, G7, G8
3.	What are the impacts of deregulation on the power markets?	G9, G10, G11
4.	What are the implications of e-Business for the electricity utilities?	S2, S3
5.	What are the current approaches and practices with regards to e-Business strategy and implementation in the electricity industry?	S4, S5, S6, S7
6.	What are the important issues regarding the way in which the management and administration of the e-Business implementation process contribute to the success or failure of the implementation as a whole?	S8, S9, S10 I1, I4, I5, I6, I7, I8
7.	What are the factors considered as barriers to the effective use of e-Business with customers, business partners and internal processes?	S9, S10, S11 I2, I3, I5, I6, I7
8.	What could be the impact of e-Business on organisational performance?	S11, S12 I8, I9

Table 3.5 Interview Questions in relation to Research Questions

Follow-up questions and further interview sessions were then arranged after the initial interview findings had been revised. Due to time-constraints and commercial priorities of the contact persons from the case companies, most of the follow-up interview sessions were conducted via email and telephone conversations. On the other hand, because of cost, time and logistic issues, interview sessions for the case company in Malaysia were conducted entirely via email.

3.2.2.2.2 Document

For this research, documentation of various forms (obtained online from the companies' websites or offline from the contact persons or from the media within the time boundaries of 1999-2002) such as companies' annual and financial reports, which are available to the public, as well as internal and administrative documents including project proposals, progress reports and strategy guidelines; reports on formal studies or evaluations of the same company under study by consultancy companies and regulatory bodies; as well as news clippings and other articles appearing in the mass media, provided relevant information for the case studies. These documents were used in conjunction with the information obtained from the interviews described in the previous sub-section. According to Yin (1984) *"documents play an explicit role in any data collection in doing case studies"* and *"for case studies, the most important use of documents is to corroborate and augment evidence from other sources"*.

The documents collected in this research were helpful in: verifying the correct spellings and titles or names of organisations; names and details of projects and applications discussed during interviews; providing information on the companies' structure and background details; as well as providing updated information about the case study companies' current status, such as mergers and takeover details, their current financial situation, and change of name or even business interests.

3.2.2.2.3 Observation

For the purpose of this research, observation method was regarded as a complementary data collection technique to the interviews and document analysis. The opportunities for observation were created during the field visits to the case

study organisations for the interview sessions. Since the e-Business phenomena being studied are very recent and do not yet have a significant history, behavioural and environmental factors can provide additional sources of evidence in a case study (Yin, 1984). According to Yin (1984), the observations can range from formal to casual data collection activities. This research used less formal, casual direct observations, made throughout field visits, which include occasions during which other evidence, such as interviews, was being collected. This observational evidence is often considered useful in providing additional information about the topic or phenomena being studied.

According to Carter (1999), the concept of *"qualitative observation"* is an underdeveloped aspect of research but may provide useful sources of information. It was suggested by Patton (2002) that a common mistake among observers is to take the physical environment for granted. The first fieldwork had helped highlight a variety of qualitative observational suggestions, which included observation while in the reception areas of the case companies, waiting in the car outside the companies' building, walking around public areas in the companies' grounds, as well as using the case companies' facilities. Information gathered during these observations, for instance, the conditions of buildings or workspaces, the respondent's office furnishings and equipments, and technology used at work, are valuable aids to any further understanding of the issues being studied. For example, building and workspace condition could indicate to some extent the economic situation of an organisation, and similarly the location or the furnishing of the respondent's office may be one indicator of the status of the respondent within an organisation (Yin, 1984). Also, observation of the technology used could help in any further understanding of the companies' attitude and problems with the technology (Yin, 1984).

Direct observation method was used mainly to develop a greater understanding of the case companies. Observations were focused on consciously describing the physical research context as well as the aspects such as body-language and tone of expression of the respondents gathered while conducting the interview, with the observation of people and events being part of a continuing process of keeping an open view to the data. Using a semi-structured form developed for this research (see

Appendix D), observation notes were made for each interview (with the exception of Malaysian company) with descriptions including the location of the interview, time of the interview, respondents' attitudes and other activity in the surrounding areas.

As mentioned earlier, observation was regarded as one of the data collection tools and information sources used in this research, which meant that observation became part of a process of combining and comparing data from a variety of sources including data collected during the interview sessions and extracted from document analysis. For example, the research observation notes on the description of the case companies' visitor reception procedures was the starting point for a process of interpretation, which included the findings from interviews with the company's personnel, its internal reports and financial documents, and newspaper coverage on the company's status. The observation of the reception processes of different case companies led to the discovery of a qualitative difference in the attitude of the companies towards e-Business. Companies with a bias towards online registration of visitors in the reception areas were seen to have a more positive attitude towards e-Business as compared to companies using an informal method of reception.

Table 3.6 discusses some of other examples of assessments made and their possible reasons, based on the interview, documents analysis, and observation methods used during the fieldwork.

Assessments	Reasons
1. e-Business is generally regarded as mainly about the technology and not a convergence of business and technology. It is perceived as a route to market, a web-based technology and with a heavy emphasis on the Internet as its platform.	▪ 4 out of 5 companies interviewed, stated in their definitions that e-Business is mostly about technology. ▪ Responses from the other interview questions also showed that most of the companies see e-Business as a technology tool rather than an all-encompassing business strategy.
2. The importance of e-Business or e-Business applications and implementations varied depending upon the company's focus of business (whether it is a generation, transmission, distribution or a supply	▪ Responses from the 5 different companies with their different business emphasis (either distribution, generation, supply, vertically integrated, etc.) showed that e-Business importance is mostly seen in the

Assessments	Reasons
company or whether it is a vertically integrated company with most or all of the business focus in place)	generation and supply business where competition is higher, especially for transactions with large power consumers (B2B transactions). ▪ For example, one company that is only concentrating on the distribution business said that e-Business is not and will not be its main business strategy now and in the near future (5-10 years)
3. Currently, e-Business is not perceived as an important strategy for the electricity industries. Traditional business models and strategy are still regarded as a winning formula and most of these companies are not in a hurry to implement or venture into an e-Business environment.	▪ 4 out of 5 companies interviewed found that attracting customers through the Internet was not successful. For example one company said that for its supply business it uses two channels to market: online through the Internet and using traditional method. Within the same period of time the company got around 10,000 customers through the Internet as compared to 200,000 customers through the normal/traditional channel. ▪ One of the companies said that one of its e-Business initiatives, which is online auctions, is not as cost effective as expected and it is considering terminating the application soon. ▪ Another company mentioned that it has already implemented a very cost effective and efficient procurement system and for it to venture into e-Procurement as one of its e-Business initiatives, it would need to see a really strong business case for it.
4. The definition of e-Business determines e-Business strategy	▪ It was observed that a company that does not define or perceive e-Business as a revolutionary or an all encompassing business strategy will not pursue a comprehensive e-Business strategy

Table 3.6 Assessments from five UK major electricity companies

3.2.2.3 Analysis Strategy

Based on the purpose of this research as well as the number and types of case study companies used, and guided by several options of analysis strategies provided by Patton (2002) (See Table 3.7), this research adopted a mainly *"Inductive Analysis"* approach as its data analysis strategy and also utilised some aspects of the *"Unique Case Orientation"* concepts to address several parts of the analysis issues.

Analysis Strategy	Description
1. Unique case orientation	Assumes each case is special and unique; the first level of analysis is being true to, respecting, and capturing the details of the individual cases being studied; cross-case analysis follows from and depends on the quality of individual case studies.
2. Inductive analysis and creative synthesis	Immersion in the details and specifics of the data to discover important patterns, themes, and interrelationships; begins by exploring, then confirming; guided by analytical principles rather than rules; ends with a creative synthesis.
3. Holistic perspective	The whole phenomenon under study is understood as a complex system that is more than the sum of its parts; focus on complex interdependencies and system dynamics that cannot meaningfully be reduced to a few discrete variables and linear, cause and effect relationships.
4. Context sensitivity	Places findings in a social, historical, and temporal context; careful about, even dubious of, the possibility or meaningfulness of generalisations across time and space; emphasises instead careful comparative case analyses and extrapolating patterns for possible transferability and adaptation in new settings.
5. Voice, perspective and reflexivity	The qualitative analyst owns and is reflective about her or his own voice and perspective; a credible voice conveys authenticity and trustworthiness; complete objectivity being impossible and pure subjectivity undermining credibility, the researcher's focus becomes balance-understanding and depicting the world authentically in all its complexity while being self-analytical, politically aware, and reflexive in consciousness.

Table 3.7 Analysis Strategies

(Source: Patton, 2002)

The strategy of inductive design is to allow the important analysis dimensions to emerge from patterns found in the cases under study without presupposing in advance what the important dimensions will be (Patton, 2002). This research has sought to understand the multiple interrelationships among dimensions (for example the electricity industry sectors, a company's management style, business focus, economic situations, and regulatory issues) that emerge from the data (obtained through interviews, observations and documents analysis) without making prior assumptions or specifying hypotheses about the linear or correlative relationships among narrowly defined variables. As the aim of the research was to generate a comprehensive understanding of the research problem, *"rather than forcing the data within logical deductively derived assumptions and categories"*, it was important that data were inductively analysed (Shaw, 1999). According to Patton (2002), inductive analysis contrasts with the hypothetical-deductive approach of experimental designs that require the specification of main variables and the statement of specific research hypotheses before data collection begins.

As noted earlier, this study will also use the *"unique case orientation"* approach for its analysis strategy. Patton (2002) emphasised that using case studies is particularly valuable in *"program evaluation"* when the *"program"* is individualised, *"so the evaluation needs to be attentive to and capture individual differences among participants, diverse experiences of the program, or unique variations from one program setting to another"*. For this research, *"program"* refers to the e-Business phenomena being studied, in which the strategy and implementation approach of e-Business is individualised within each different company where each company may have varied definitions, experiences and priorities regarding e-Business. Patton (2002) also stresses that the purpose of a qualitative case study seeks to describe the unit of analysis in depth and detail, holistically and in context.

The process of analysing the data collected for this study began as soon as data collection activities began in an ongoing and inductive nature. The early and ongoing analysis was necessary in order to allow any adjustment on the observation or interview strategies by shifting some emphasis towards those experiences and findings which supported the development of understanding, and generally to exercise control over emerging ideas by simultaneously *"checking"* or *"testing these*

ideas" with the collection of further data, for example through follow-up interviews questions (Shaw, 1999). Also, on a practical level, the *"sheer massive volumes of information"* generated by the qualitative methods used, required that analysis was not delayed until the completion of the collection of primary data (Patton, 2002).

The first phase of this inductive analysis occurred during fieldwork. The initial collection of data was guided by the study's pre-understanding of the electricity industry and the aim of exploring the impact and potential of e-Business for electricity companies especially after the privatisation and deregulation exercises. At this stage, in-depth interviews were kept open to the collection of interesting responses and perspectives around which further data collection could focus. For example, when discussing the e-Business definitions used by each company, no prompts were given and respondents were allowed to express their own perspective on this issue. From these responses, the study then identified the nature of the definitions and views given, and categorised them into separate levels based on whether they were technology biased, business and strategy biased, or profit biased (discussed in more detail in Chapter 4, see Table 4.11, Table 4.12, and Table 4.13) to help further queries. The tape recording of interviews also helped the researcher to develop written and mental notes of any analysis made during interviews and allowed the researcher to identify particular responses to probe further at a later stage.

After the initial in-depth interviews and observations were transcribed and recorded, any analysis made was typed together with the transcript or written into the field notes. This second stage in inductive analysis involved reading and re-reading the transcripts and field notes made so far. The purpose of this activity was to help in gaining familiarity with the data and also to help start the process of structuring and organising the data into meaningful units (Shaw, 1999). The familiarity created by reading and re-reading transcripts and field notes helped heighten awareness of the *"themes"*, *"patterns"*, *"concepts"*, *"insights"* or *"understandings"* of meanings existing in the data and helped focus the research attention on these factors (Patton, 2002).

3.3 Case Study Procedures

To assist the research and help provide direction, an overall research process and case study procedures were developed. This included detailing in advance the steps and stages as well as requirements to be followed during data collection and fieldwork activities. Figure 3.1 describes the main stages of the research process.

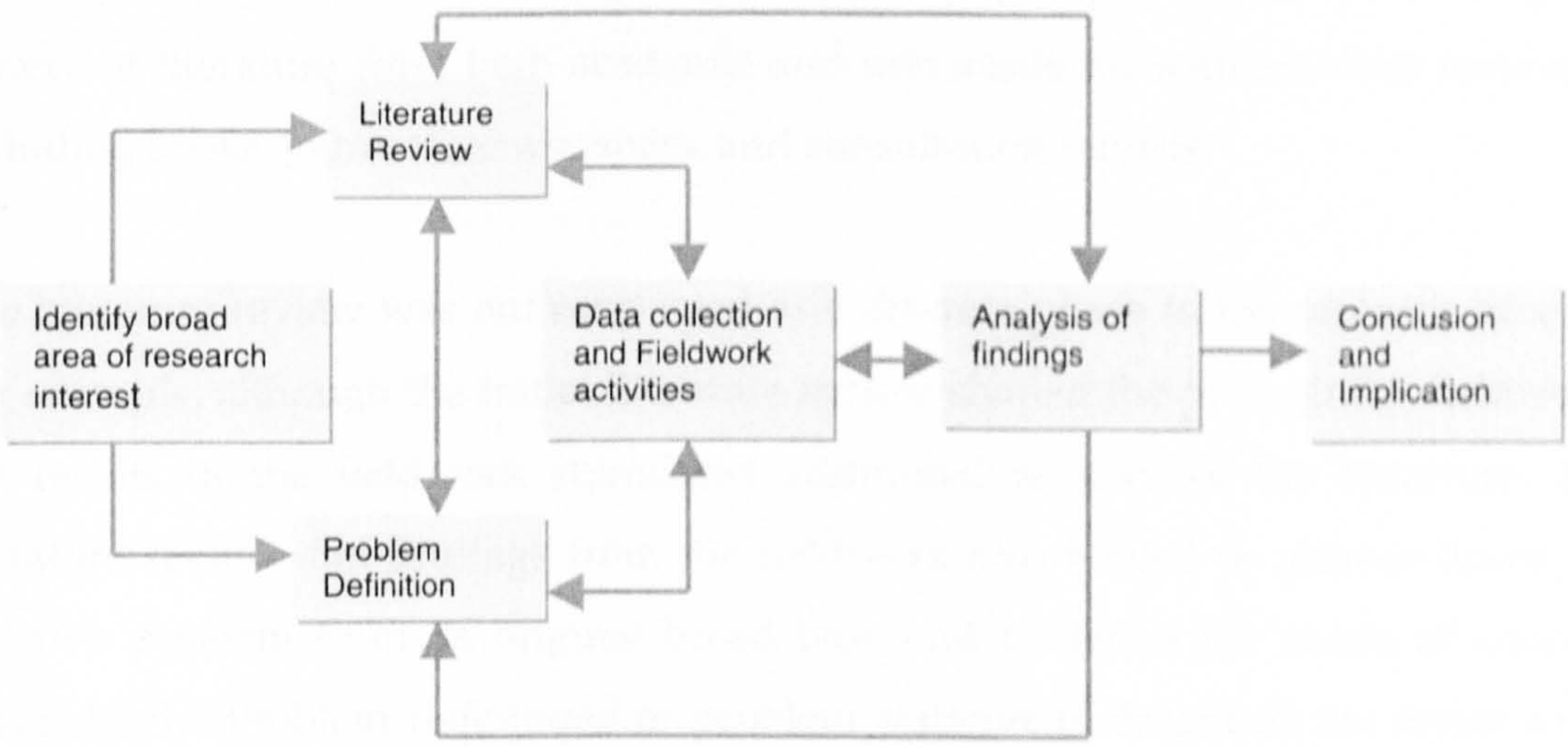

Figure 3.1 Key Stages in the Research Process

The research began by first identifying the broad area of research interest through observation and preliminary data gathering. General e-Business issues and related themes such as the World Wide Web and Internet were looked into and discussed at some length. The introduction to the concept of having a new information based economy, which is highly competitive and emphasises customer satisfaction, led the research interest to further look at how traditional companies, many of which used to be monopolies in their field, including the utilities companies, have coped with this new economic environment. Preliminary data was collected, which included background information on the companies, company policies and structural aspects along with other current information on e-Business phenomena and their impact on these companies.

Initial problem definitions and research questions were developed to provide structure to the research, while maintaining flexibility in order to capture other

important aspects of the issues. A more comprehensive literature review of formally and informally published work within the areas of research interest was then conducted. The literature review concentrated on two parts of the studies. The first part dealt with the main research themes, which covered e-Business issues including e-Business definitions, models, strategies and applications; the electricity industry in general including management and strategy issues focussing on the UK and Malaysian environment; and e-Business implications for the electricity industry. The second part dealt with research methods, research philosophy and research design. A variety of literature from both academic and non-academic sources were reviewed, including books, journals, newspapers, and consultation reports.

The literature review was not conducted as a discrete phase in the research process. For example, although the initial literature review shaped the preliminary fieldwork, the results of the fieldwork stimulated additional reviews of the literature. The literature review and findings from the fieldwork also helped to narrow down the research problem from its original broad base and to define the issues of concern more clearly. Problem definitions or problem statements described the issues to be investigated with the goal of finding answers or provide insights to the issues. They also helped refine the research framework and formulate research propositions and questions.

Appropriate companies were then identified and the process of gaining access and approval to conduct the study at these companies began. This involved repeated activities of writing formal letters and emails as well as telephone conversations to established contact and to provide introduction about the research to the selected companies. These correspondences were firstly targeted towards the companies' corporate communication or public relations department who then forwarded the letter or requests to the appropriate person(s) or department(s) within the company for further action. Companies that agreed to participate were then incorporated into the research design. Case study procedures for these companies were developed to prepare for the data collection and fieldwork activities which included building a case study database consisting of a collection of interview notes and reports, interview transcriptions, documents collected from case companies, audio tape and

digital recordings of interview sessions, and newspaper clippings about the case companies and relevant issues.

Figure 3.2 describes the main activities involved in the first part of the case study procedure for case companies in the UK environment with ScottishPower as the main case company for this research. It involved understanding the companies' background and their business focus as well as identifying the relevant persons to be interviewed in order to gain as much insight into the company's e-Business endeavours. Findings from the interview sessions and data collected through the literature review were consolidated to develop a summary of the e-Business implementation level of each company, which include e-Business models and applications developed, e-Business critical success factors, problems faced with e-Business implementation and use, and e-Business role in the company on the whole. In addition, summaries of the implication of e-Business for the overall organisational performance for these companies were also produced.

The second part of the case study procedure are illustrated in Figure 3.3, which describes the procedures involved in understanding the Malaysian current regulated electricity environment by focusing on TNB, which is the major and monopoly electricity company for everything except generation. The findings from both case environments were then analysed and used to describe and develop e-Business models and frameworks employed currently by electricity companies as one of the possible strategies to survive the highly competitive deregulated power market (discussed in more details in Chapter 4 and Chapter 5). Further analysis was also used to help formulate a matrix or checklist to evaluate electricity companies' preparedness to venture into e-Business with an emphasis on TNB's situation.

Case Companies Characteristics

GPU Power UK
- Operates in a regulated environment
- Focus on: Distribution (monopoly)
- Low interest in e-Business

Scottish and Southern Energy
- Operates in a deregulated power market
- Vertically integrated (Generation, Transmission, Distribution, Supply)
- Has some e-Business initiatives

ScottishPower
- Operates in a deregulated power market
- Vertically integrated (Generation, Transmission, Distribution, Supply)
- Place important emphasis on its e-Business initiatives

LE Group Plc
- Operates in a deregulated power market
- Focus on: Generation, Distribution, Supply
- Active e-Business initiatives

Powergen
- Operates in a deregulated power market
- Focus on: Generation, Distribution, Supply
- Active e-Business initiatives

Informants

Strategy Makers/Policy Makers/Managers

Company and e-Business information

Research Activities - To explore and gain insights on:
- Definition and perceptions of e-Business
- Current approaches and practices
- e-Business strategies and visions pursued
- e-Business implementations issues

Information gathered on company and its e-Business endeavours

Literature Review including information on other power companies in the UK and world-wide with e-Business strategy

Research Activities - Summaries and develop Tables and Diagrams from the analysis of findings to provide insights on case companies e-Business strategy and implementation:
- Levels of e-Business implementation
- Major e-Business models and applications implemented currently
- e-Business potentials
- Problems/barriers to successful e-Business initiatives
- Important factors considered when developing and implementing e-Business

Validate

Figure 3.2 Case Study Procedures: Part 1 (Electricity Companies in the UK)

Figure 3.3 Case Study Procedures: Part 2 (TNB, Malaysia and Concluding Activities)

3.4 Case Study Protocol

According to Yin (1984) a case study protocol is more than an instrument but also contains the procedures and general rules that should be followed in using the instrument. It is regarded as a major technique for increasing the reliability of case study research and is intended to guide the researcher in carrying out the case study. Perry (1998) explained that the development of a case study protocol assists the research in two ways: first, the protocol allows the researcher to detail in advance the procedures and requirements to be followed during data collection and, second, the protocol provides directions for the researcher that might act to improve the reliability of the research findings. For this research as recommended by Yin (1984), the case study protocol provided an overview of the study including research objectives, problem statement, background information of case study companies being studied, and relevant readings about the issues researched. It also contained fieldwork procedures, interview questions and a guide for the research report.

3.5 Methodology Considerations

3.5.1 Balancing Actions and Decisions in the Research Design and Methodology

According to Carter (1999), academic research is frequently assessed on the basis of questions regarding validity, reliability, and generalisability. This approach is believed to have been derive from quantitative research and difficult to apply in the context of qualitative research. Alternative representations have been adopted by some researchers. For example Patton (2002) suggested that the basic purpose of qualitative study and analysis is to provide useful, meaningful, and credible answers and highlighted that the *"fruit"* or findings of qualitative inquiry are in the form of *"themes"*, *"patterns"*, *"concepts"*, *"insights"* or *"understandings"* of the research issues.

Thus, for this research, discussions on validity, reliability, and generalisability also looked at the issues suggested in the overlapping categories proposed by Miles and

Huberman (1994), which cover questions of *"confirmability"*, *"dependability"*, *"credibility"* and *"transferability"*.

3.5.2 Validity

According to Yin (1984), people who have been critical of case studies often point to the fact that a case study researcher fails to develop a sufficiently operational set of measures and that subjective judgments are used to collect the data. Therefore, for this exploratory case study methodology, based on Martinsuo (2001), the question of validity dealt with: establishing correct operational measures for the concepts being studied (construct validity), the degree of truth and credibility of findings (internal validity), and the domain for which findings can be generalised and transferable (external validity). The validity of this research could have been threatened by several issues such as the reliance on a limited number of case companies with a restricted number of interviews within the companies, the use of only selected perceptions and examples, and self designed interpretation of the issues investigated. Table 3.8 describes some of the questions and issues that are considered important in addressing the validity concerns of this research.

Research Stages	Validity concerns
Choice of research approach	• Was selecting a case study approach the best? • Were the cases selected suitable enough? • What/who the chosen companies represent and how generalise are the results? • Would other approaches have been more appropriate or better?
Data collection	• Were the samples generalisable enough within the industry? What are the limitations? • Were respondents honest in their responses?
Analysis of findings	• Do the measures used represent the phenomena in questions properly? • Did the open questions approach produce comparable and summarisable information to characterised the phenomenon • Was the theory utilised sufficiently in choosing categories and in preparing the analysis framework? • Were the responses and findings interpreted properly? • Did the analysis framework cover the entire phenomenon sufficiently
Concluding and Reporting	• Did the report provide enough detail?

Table 3.8 Examples Of Validity Concerns

(Adapted from: Martinsuo, 2001)

Various steps were taken to improve validity in the research design and throughout the research process. As suggested by Yin (1984), in order to increase construct validity, this research used *"multiple sources of evidence"* (evidence from two or more sources, but converging on the same set of facts or findings) and *"established chain of evidence"* (clear links between questions asked, the data collected and the conclusions drawn) during data collection as well as the *"draft case study report reviewed by key informants"* after the fieldwork. Also, to meet the construct validity criteria, prior theory from the literature review (described in the previous chapter) was used to define the research constructs. According to Perry (1998), prior theory can have a *"pivotal"* function in the design of a case study and analysis of its data, and provides a focus for the data collection phase in the form of research issues.

As described earlier, the internal validity or credibility or authenticity of the findings was seen as the degree to which the findings have meaning for those interested in them (Carter, 1999). One of the ways for dealing with this issue was to present comprehensive descriptions of the context of the cases studied, with regards to organisational size, location, business focus, and the management position of the interviewees as well as the dates of the interviews. Information on why things happened not just describing what happened was also taken into consideration, using both theoretical replication (comparing cases from different conditions or settings, for example comparison made between ScottishPower in the UK environment, with TNB in the Malaysian environment) and literal replication (comparing cases within similar conditions or settings, for example comparison made between Powergen and LE Group, which are both operating in the UK environment and have similar organisational structure and business interests). Triangulation was used extensively to synthesise multiple perspectives and clarify meanings. In addition, findings were drawn from several information rich cases, which covered a number of different contexts. A systematic process of examining the propositions and questions generated by the research, added credibility to these findings.

Finally, in order to address the issues of external validity or transferability or generalisability of the findings, the researcher attempted to provide a substantial description of the research settings and findings to enable others to compare with their work. Sampling within the electricity industry was made to be as

comprehensive as possible covering several cases in all the four electricity sectors of generation, transmission, distribution, and supply in both regulated and deregulated areas. The limitations of the research findings were examined and proposals for future research in the area were also provided.

3.5.3 Reliability

Reliability generally means consistency, dependability or trustworthiness. Gay and Diehl (1992) define reliability as the degree to which a test consistently measures whatever it measures. According to Sekaran (1992) the reliability of a measure indicates the stability and consistency with which the instrument is measuring the concept and helps to assess the goodness of a measure. Based on these definitions and by adapting Martinsuo (2001), reliability for this research means demonstrating that the operations of the study, such as the data collection procedure, can be repeated with relatively the same result, which is also referred to as confirmability and dependability by Miles and Huberman (1994). In conducting this research, reliability was susceptible to various factors such as researcher bias, methodology used, informant's characteristics, as well as current economical and financial issues (for instance, if the economic outlook or financial situation of the company, is good, the company may be very positive about e-Business, but given a different economic climate or financial situation, data collected on the same issue may be different). Table 3.9 describes some of the questions and issues that are considered important in dealing with the reliability concerns of this research.

Research Stages	Reliability concerns
Choice of research approach	• What is the impact of the companies' willingness or unwillingness and positive and negative orientation towards the study?
Data collection	• Were the companies selected and the people interviewed within each company's representative enough? • Did the contact persons interfere with reliability and what was their influence on results? • Was a confidential atmosphere created to encourage people to respond reliably • Were the interview sessions handled properly to produce comparable data? • Were enough steps taken to ensure minimum researcher influence on outcomes? • Were the interviews sufficiently consistent for all companies?
Analysis of findings	• Could the analysis be repeated? • Were the right examples selected?
Concluding and Reporting	• What important items remained unreported, supporting or disconfirming the findings?

Table 3.9 Examples Of Reliability Concerns

(Adapted from: Martinsuo, 2001)

Various measures to improve the reliability of research findings were taken into consideration. These included documenting in detail the data collection and analysis methods as well as the research procedure carried out. Yin (1984), suggested that a good way to improve the reliability and repeatability of the study is to use a case study protocol and to develop a case study database. This study has used both of these techniques and in addition all notes have been stored. Using one interviewer across the study has also ensured that the protocol was followed and recording took place consistently. During all face-to-face interviews an audio recorder was used, which helped the researcher to counter check with the field-notes afterwards, which according to Perry (1998) is a desirable form of triangulation.

As discussed earlier, the research was based on a number of fundamental research questions, which linked the fieldwork and theory. These questions were used to maintain the focus of the study while at the same time allowing relevant unanticipated issues to be encompassed during the fieldwork and data collection activities. Efforts were made to collect data from a variety of data sources and using a variety of data collection instruments as described in section 3.2.2.2, which are consistent with the research questions. Furthermore, data were assessed on a number of dimensions including the degree to which meaning was shared between the

researcher and the interviewees, and consistency with data gathered through other means.

3.6 Ethical Considerations and Protocols for Conduct

In conducting this research ethical issues such as openness with interviewees and appropriate treatment of confidential information, were taken into consideration and have been approved by the Departmental Ethics Committee based on the University of Strathclyde standard. Based on the guidelines provided by Silverman (2000) and the specific ethical issues recommended by Miles and Huberman (1994), *"informed consent"* was obtained from the case companies prior to the beginning of the study. This included providing the companies with information about the research, a preview of the study initial design, as well as giving basic ideas on the themes of the research questions that were relevant to the companies' decisions about whether to participate or not. Further consent on how the data collected might be used (*"use of results"*), was also obtained by providing the companies with a summary report of the interview findings and confirming permission to use it for PhD thesis purposes.

Other specific ethical issues for qualitative studies as suggested by Miles and Huberman (1994) were also considered, which included issues such as:

- *"The study's worthiness"* – This research looked into the current management approaches and practices toward e-Business in the power industry. The results and findings of this research are hoped to help establish a point of reference for TNB's management in particular as well as other parties in the electricity industry in general with regards to e-Business issues. It provides insights into the e-Business strategies and implementation and its potential within the electricity utilities. Models of the current e-Business practice developed from this study can be used to help in proposing appropriate strategies for effective implementation and management of e-Business application and resources.
- *"Competence boundaries"* – In this issue *"the questions of the researcher's own competence"* was addressed by emphasising that the researcher was always prepared to study in detail all the required and necessary skills for conducting this research. Various qualitative methodology references in terms of books and

journals were used to formulate the appropriate research design. Consultations with people in the appropriate fields, which included lecturers and other postgraduate students doing similar studies, were also carried out.

- *"Anticipated benefits and cost"* – The question of *"what will each party to the study gain from having taken part?"* was addressed by providing the research's case companies with the summary report of the research findings which may provide insights into their own e-Business endeavours, and the e-Business models developed, which may also help them to identify their e-Business strategies for the future. In dealing with the issue of *"what do they have to invest in time, energy, or money?"* and to ensure *"equitable balance"*, the fieldwork strategies, and especially the interview sessions were conducted in ways that ensured minimum imposition. Participant companies were given flexibility in determining the most suitable time and the duration for them to be interviewed. Based on the time allocation given, the appropriate interview strategies were then edited and formulated to ensure maximum usage of the time. Any further or follow-up questions were addressed through emails and phone interviews, which were also determined by the case companies. Also, minimal disruption to the companies' work schedule was assured as the study adopted a *"one-shot or cross-sectional time horizon"*, in which data were gathered just once over a period of time instead of several points in time (*"longitudinal studies"*), which often take more time and effort from the participants (Sekaran, 1992).
- *"Harm and risk"* – This issue deals with the question of *"what might this study do to hurt the people involved?"* According to Miles and Huberman (1994) harm to participants can come in many varieties including *"looking bad"* to others, threats to one's interests or position, and the possibility of being sued or arrested. For this research the harm and risk issues were addressed in the same manner as the *"privacy, confidentiality and anonymity"* concerns explained below.
- *"Honesty and trust"* – These issues were addressed by making sure that from the very beginning of the research, all participating companies were clear on the research aims and objectives and how the findings from the research would be used. Also, summaries of the findings were sent to the companies for their review and approval.
- *"Privacy, confidentiality and anonymity"*- The issue of privacy was attended to by ensuring that the research questions were mostly general in nature, focussing on

the companies' e-Business objectives and their ways of implementing it and did not aim to probe into any sensitive information that the companies wished to remain unknown to the public. Confidentiality and anonymity were also promised in the initial agreements with the participating companies. Companies involved in this research were not identified unless they wished to be.

- *"Intervention and advocacy"* – Based on the research strategy developed, which is "to study the phenomenon as it normally occurs and within its own natural settings", this research adopted the approach of zero intervention with the participating companies' views, attitudes and management style towards e-Business, in order to gain insights into the real impact of e-Business for the electricity companies.
- *"Research integrity and quality"* – This issue focuses on the question of *"Is my study being conducted carefully, thoughtfully, and correctly in terms of some reasonable set of standards?"* Miles and Huberman (1994) acknowledge the difficulties in assessing the quality of qualitative studies and suggested a series of questions to be asked about the goodness of any particular study with regards to its confirmability, dependability, credibility, and potential transferability to other settings, which have been discussed in the earlier parts of this thesis. In addition, they also recommended that qualitative studies should adopt *"methodology frankness"* by being honest about how the studies were conducted and what worried the researchers about the quality of the researches. These issues have also been discussed in the previous sections.
- *"Data ownership"* – This issue looks into the questions of *"Who owns my field note and analyses?"*, and *"once my reports are written, who controls their diffusion?"*. According to Miles and Huberman (1994), these questions relate directly to the confidentiality issue. Addressing the issue of confidentiality requires being clear about who own and can have access to the information collected. For this research, based on the university regulation and guideline, the physical ownership of the data (in thesis format) belong to the university's library; the content of the thesis belong to the author; and the commercial and confidential information of the case companies used in the thesis belong and can only be released by the case companies.

According to Miles and Huberman (1994), all the above ethical issues have clear implications for the research and its analysis as well as the quality of its conclusions and dealing with these issues effectively involves *"heightened awareness, negotiation and making trade-offs among ethical dilemmas rather than the application of rules"*.

3.7 Conclusion

One of the research aims is to establish a point of reference for TNB's management in particular as well as other parties in the electricity industry in general with regards to e-Business issues. To do so, analysis of the e-Business approaches of companies operating in the UK electricity market was undertaken. This comparison between TNB, Malaysia and the UK electricity companies were argued to be reasonable due to the industry background in terms of the business of generating, transmitting, distributing, and selling electricity, and also the deregulated market that the Malaysian electricity industry will enter in the near future. This chapter has discussed the methodological issues necessary to meet the objectives of the research. It has discussed each of the steps in the case study research, which ranged from the research design and the justification of using a mainly qualitative approach.

The research methodology was shown to adhere to case study procedures, which included identifying a broad area of research and the search for preliminary data. In this research, preliminary data acquisition included identifying e-Business themes, the issues surrounding utility companies in the regulated and deregulated environment, and the companies' approach to e-Business. Once the preliminary data acquisition phase was completed, it provided the basis for pursuing the research further by using a case study approach. The research decision to use qualitative methods with a case study approach was seen as a suitable option in order to explore the main research problem because of its appropriateness in terms of the type of data and information collected, and also in terms of meeting the research objectives. Further, the qualitative method chosen allowed for the study to proceed without creating predetermined ideas that can impede the scope of answers to the research questions and limit the originality and depth of the research findings. The data collection process was then devised and consisted of three main inputs, which were from face-to-face interviews, first-hand observations before and during the interview

sessions, and various documentations produced by the companies particularly on their e-Business initiatives.

The following chapters will discuss the analysis of the research findings using the method described earlier and also discuss the implications of these findings on both theory and practice of the case companies and in the electricity industry in general.

Chapter 4: Data Analysis

4.1 Introduction

The objectives of this chapter are to describe and explain the phenomena and situation that have been studied by focusing on *"what"* is going on and *"how"* things are proceeding and to understand and explain coherently *"why"* things occur as they do (Miles and Huberman, 1994) within the context of each individual case company. However, this chapter will be restricted to presentation and analysis of the collected data without drawing general conclusions or comparing results with those of other researchers, which were described in Chapter 2. The subsequent chapter, Chapter 5, will discuss the findings of this chapter within the context of the literature review.

Case study reports in the first few sections of this chapter concentrate on describing and understanding the issues of *"what"* is happening within each individual case company. These reports encompass data and information gathered during the fieldwork from the interview sessions, associated documentation, and observations made of the environment of the interviewee. In the following sections, some of the various models illustrated in the literature review chapter (Chapter 2) have been used to analyse these findings. Specifically, van Hooft and Stegwee's (2001) SISP model for e-Business (See Figure 2.5 in Chapter 2) together with SWOT analysis (See Figure 2.6 in Chapter 2) and Porter's Five Forces model (See Figure 2.7 in Chapter 2) were used extensively in order to understand the data collected and helped explain both the *"what"* and *"why"* questions of the research more coherently.

The SISP model was adopted because it provides step-by-step processes that are in line with the research objectives. These processes include: firstly, identify how e-Business influences the industry in which the case companies operate; secondly, analyse the current situation of the company and its business; and thirdly, taking new IT developments into account, explore how e-Business will affect the company and the industry in the future and what the e-Business potential is in this area. In order to execute step one and two, the SISP framework used Porter's Five Forces model and

SWOT Analysis to help understand the case companies' current e-Business perspectives and approaches.

Based on the findings of the preliminary studies and fieldwork activities, two of the main assumptions were confirmed and used as guidelines in order to analyse and compare the UK and the Malaysian environment. These assumptions were firstly that the UK is in a more advanced state of e-Business implementation within the electricity industry and, as mentioned in previous chapters, is one of the pioneers in electricity privatisation and deregulation activities. The second assumption was that the Malaysian electricity environment is still in its very initial state of e-Business awareness and the electricity company still operates in a monopolistic and regulated electricity market although it is going to embark on a deregulation exercise in the very near future.

Based on these assumptions, the SISP model was used in different ways when analysing and comparing the UK and the Malaysian environment. For the UK situation, the model was used to chart what has been happening and what approaches have been employed with regards to e-Business strategy and implementation within UK electricity companies. On the other hand, for the Malaysian environment, the model has been used to identify the potential of e-Business for the Malaysian monopoly electricity company and what has been done so far in comparison with the UK environment.

4.2 Brief Descriptions of Cases

In the following sub-sections, the case companies included in this research were divided into two categories depending on their geographic location and business environment: the UK environment and the Malaysian environment.

4.2.1 UK Environment

The UK electricity industry has shown the way for much of the world in the development of open energy markets. The liberalisation process has created a highly competitive market underpinned by open access to transmission and distribution

networks. Privatisation of the industry, which was carried out in stages, has created different structures for England and Wales, Scotland and Northern Ireland. However, all are based on the same principles (Electricity Association, 1999; ScottishPower, 2000).

As described in the previous chapter, five major electricity companies were used for the study of the UK environment. From these five companies, one company – ScottishPower - was used as the main case study company. Table 4.1 summarises some of the basic characteristics of these companies for a better understanding of their situation and position in the UK electricity industry.

Electricity Companies	Scottish Power	Scottish & Southern Energy	GPU Power UK	Powergen	LE Group
Characteristics					
Generation	✓	✓		✓	✓
Transmission	✓	✓			
Distribution	✓	✓	✓	✓	✓
Supply	✓	✓		✓	✓
Multi-Utility / Single-Utility	Multi-Utility (mainly electricity)	Multi-Utility	Single-Utility	Multi-Utility	Multi-Utility (mainly electricity)
Monopoly / Non-Monopoly	Monopoly for Transmission for part of Scotland	Monopoly for Transmission for part of Scotland	Regulated Monopoly for Distribution for some parts of England (West Midlands, Staffordshire, Shropshire, Herefordshire, Worcestershire, Gloucestershire)	Regulated Monopoly for Distribution for some parts of England (East Midlands)	Regulated Monopoly for Distribution for some parts of England (East Anglia and London)
Type of Customers	Industrial, Commercial, Domestic and Other Utilities	Industrial, Commercial and Domestic	Other Utilities (indirectly Industrial, Commercial and Domestic)	Industrial, Commercial, Domestic and Other Utilities	Industrial, Commercial and Domestic
No. Of Customers (Million)	3.5 (in the UK with another 1.5 in the US)	5	✗	3	3
International Operation	✓	✗	✗	✓	✗
Generation Capacity (MW) / Energy Output (MWh)	4,932 / 18, 592	4, 937 / 20,821	Network only operator	8,004 / 31,278	4,932 / 13,270
Total Energy Supply (%)	8	10	Network only operator	6	7

Table 4.1 Summary of Characteristics of five of the UK's Electricity Utilities

The following sections describe each of these companies individually, with an emphasis on their e-Business perspectives, strategy and endeavours.

4.2.1.1 ScottishPower

Background: ScottishPower is an international energy company consisting of two regulated and two deregulated competitive types of business. It has been privatised for more than ten years. Currently it serves around five million electricity and gas customers in both the UK and the US. In both countries the company provides electricity generation (competitive), transmission (regulated and a monopoly for the area), distribution (regulated and a monopoly for the area) and supply (competitive) services. Before concentrating only on the energy business the company used to operate as a multi-utility company that also provided water and telecommunication services, as well as being involved in electrical appliances retailing.

e-Business Definition and Transition Issues: ScottishPower described e-Business as end-to-end electronic business transactions and communications, which encompasses all components of the value chain. e-Business is seen as more than e-Commerce, where e-Commerce is perceived as being concerned with the financial aspects of e-Business. e-Business is also defined as application development that is aligned with revenue generation, cost reduction and other tangible and intangible business led cases.

The transition to the e-Business world required significant changes within ScottishPower. ScottishPower promotes a business culture which consists of: empowered teams and individuals; being a learning organisation; and building, retaining and sharing knowledge throughout the organisation and between organisations and stakeholders. Organisational culture is seen as the biggest factor for successfully transforming a business into an e-Business. ScottishPower believes that employees must understand the Internet and its capabilities and how it can transform the way they work and do business. The company also believes that to venture into an e-Business environment, employees should be empowered to have access to all the information needed to do their job as well as the tools required to get the job done most effectively and efficiently.

Before the transition to the e-Business environment, ScottishPower felt that it needed to decide if the company had an aspiration to become an e-Company and if so with what outcomes: to be a cost efficient organisation or a revenue generation company, or both. The articulation of its aspirations for e-Business was seen as important in allowing e-Business to grow in a co-ordinated manner within the organisation.

e-Business Preparation: For ScottishPower e-Business is about business and not just technology. The company believes that e-Business is the convergence of business and technology and therefore business managers need to be aware of what technology can enable them to do, at what speed and at what cost. ScottishPower feels that e-Business must match the business strategy of the company. Whatever the business strategy is, e-Business is viewed as an enabler to help that strategy. The application of e-Business strategy must be justified as a valid business case for the company. It cannot be a case of a *"other people are doing it, why aren't we?"* strategy. There must be clear cost justification of the strategy as well as articulation of the deployment of the strategy and the benefits that will be realised from the strategy.

With regards to return on investment, ScottishPower believes that the e-Business model is different from the traditional business model. e-Business adopts what ScottishPower called *"short sharp deliverables"* against the targets or objectives of its e-Business projects such as expected returns, the number of years expected to see the return on investment, and the number of customers gained. As a guideline, the company gives itself one to two years to see the return on investment. If the strategy does not show any sign of improvements the company must be brave enough to terminate the initiative. A recent example of this type of situation includes the termination of ScottishPower's joint venture with the Royal Bank of Scotland to form an Internet-based company called R38. This joint-venture company was closed down within less than one year of its formation mostly due to the anticipated lack of profit for both companies.

ScottishPower adopts what it calls a three-phase approach in planning and developing an e-Business strategy. It consists of three major tasks, which are to *"EDUCATE"*, *"COMMIT"* and *"EXECUTE"*. For ScottishPower these phases allow the company to ensure that senior business managers understand how their business

can be transformed by e-Business and how to realise the benefits. The topics and activities encompassed by these three-phases include:

- EDUCATE – run education and awareness sessions, create appetite for change, agree business vision and transformation goals, articulate and communicate the vision, understand where the company is now, assess its capabilities, arrange study tours, set-up an e-Business steering group and appoint an e-Business executive sponsor.
- COMMIT – confirm the business case for the e-Business programme, create an e-Business portfolio, identify projects and their business cases and create an environment for change
- EXECUTE – manage change, deliver projects and deliver benefits, also monitor through feedback on benefits realised, lessons learnt and what components were successful and unsuccessful.

On top of the above activities, ScottishPower also considers external influences, which may change the environment as it moves through the transformation. This includes looking at business and regulatory issues, new markets, new entrants and new technology. It also believes that it is essential to constantly review what the company is doing and to ensure its vision changes with opportunities as they arise.

e-Business Strategy: To benefit from the e-Business environment, ScottishPower concentrates on three principle types of e-Business relationship models (discussed in section 2.2.4, Chapter 2):

- Business-to-consumer (B2C) – Sell side (e-Sell): In this environment ScottishPower looks at how the company can relate to consumers and the retail market. It is about electronic communication with small and medium size customers, which includes:
  - Multi-channel communications
  - Customer relationship management
  - Billing and payment systems
  - Customer services
  - Marketing and sales
- Business-to-business (B2B) – Buy side (e-Buy): This environment includes electronic transactions and communications with the whole supply chain, which

includes large organisations in terms of customers, suppliers and business partners. This includes:

- Supply chain management
- Procurement
- Supply chain planning
- Inventory management
- Business partners

- Business-to-employee (B2E) – In side (e-Inform): B2E is about electronic communication with ScottishPower stakeholders, which are the employees. It is about general communication as well as about employee self-service and knowledge management and having knowledge portals for the employees. This includes:
  - Corporate management
  - Knowledge management
  - Business intelligence
  - Employee empowerment
  - Process integration

Within each of these areas, the business processes can be individually optimised and e-enabled to obtain some performance improvements. Ultimately the e-Business vision of ScottishPower is to integrate the entire value chain to achieve the next level of business performance. In addition to the above three, ScottishPower is also looking at electronic communication environments with the media, shareholders and external stakeholders.

Lessons from ScottishPower case study: The company has been going through a lot of changes over the past ten years or more, starting with the privatisation of the industry and later deregulation of the electricity market, to becoming a multi-utility with telecommunication and water businesses, acquiring US PacifiCorp to operate internationally, and now re-focusing their resources on the energy business and selling off their water, telecommunication and electrical equipment businesses. There is a high level of e-Business interest in the company. The company is seen to be spending and investing continually in e-Business in terms of preparing its infrastructure and employees to operate in an e-Business environment of the future.

4.2.1.2 Scottish and Southern Energy

Background: Scottish and Southern Energy is one of the largest vertically integrated energy groups in the UK, which serves about five million electricity and gas customers across the UK through Southern Electric in England, Scottish Hydro-Electric in Scotland and SWALEC in Wales. The groups generate, transmit, distribute and supply electricity to industrial, commercial, domestic and wholesale customers in the UK. As with ScottishPower, Scottish and Southern Energy's electricity business is also made up of two regulated and two competitive businesses. The company's other business activities include electrical and utility contracting, and gas marketing. The company also provides a comprehensive range of telecommunication services on a regional basis through one of its subsidiary businesses called SSE Telecom.

Organisation Strategy: The main business strategy of Scottish and Southern Energy is centred on *"customers"*, *"sound investment"*, *"cost control"* and *"environmental management"*. The organisation believes that its core strengths are in cost control and quality of service that is *"reliable"* and *"good value for money"*. In terms of high-level strategy, the company stresses thinking *"commercially"* (in dealings with customers and suppliers), thinking about security as well as about reliability, and focussing the business solely on the UK environment. Scottish and Southern Energy strives to be the best energy utility and the lowest cost operator in the UK. Currently, the company is the only utility company in the UK that has a credit rating of AA1, which mean that the rating agencies consider Scottish and Southern Energy as a profitable and well-run company. The company claimed that this is because of its low costs of operation (for example, the low generation cost of its hydro generators), its very strong balance sheets, and the knowledge that its future earnings are secure (due to its strong brand name and monopolistic status in certain areas). In 2001, the company was making profit on a turnover of around £3.4 billion per-annum.

One of the ways that the company is keeping its costs low is through minimising advertising costs. It avoids using television and radio to promote its brands because this exercise is considered to be the most expensive route. Scottish and Southern Energy use various routes to secure customers which include sending regular mail shots to its existing customers together with their monthly bills, online information

on the organisation's official website, local sponsorship of various events (for example in sporting activities), advertising in local papers, having face-to-face customer interaction where the company sends its employees to meet potential customers, and also having partnerships with other companies where for each customer that they bring to Scottish and Southern Energy, Scottish and Southern Energy will pay them a sum of money.

e-Business Definitions and Applications: Scottish and Southern Energy's description of e-Business is any form of business communication or transaction using an electronic medium. This can be externally with customers, suppliers and other business partners, or internally among employees. Examples include: trading energy online over the telephone and through the Internet; online customer information through the company's official website that allow customers to see their bills; and selling electrical equipment (for example washing machines and fridges) as well as financial services (for example insurance) over the Internet. The organisation has also implemented an Intranet for the employees that allows them to have access to facilities such as email and other Internet applications. The system is also used by top management to disseminate information to the rest of the organisation's personnel with regard to major developments of the organisation and its latest strategy updates.

e-Business Strategy and Implementation: Scottish and Southern Energy currently does not have any specific plans or strategy with regards to its e-Business development and implementation. e-Business is mostly regarded as a technology issue and is separated from the business strategy as a whole. It is seen as a tool rather than as an overall concept of management that merges the business and technology issues. e-Business and e-Commerce is also seen as one of the many routes to markets and to suppliers, which is growing in popularity but which is currently a small component of the organisation's entire business routes.

The company's investment in the information technology area is considered very small, which is around one to two percent of the company's overall investment. The company does not anticipate that IT investment will increase in the very near future. However, Scottish and Southern Energy acknowledge the potential of e-Business applications especially with regard to customer relationships and services, and in the

area of network management for electricity distribution. The organisation realises that customers nowadays have higher expectations and have more choice in their energy supplier as well as being able to acquire energy over the Internet. In order to compete successfully the organisation feels that it also needs to have similar Internet facilities to its competitors. These facilities include online customer services and online energy trading and, in deciding to develop these applications, the company must ensure that they are reliable, easy to develop and delivered at the lowest cost.

With regards to e-Business implementation, although Scottish and Southern Energy is not very enthusiastic about it at present, it can be observed that the company does employ some elements of the three main e-Business relationship models. This includes Business-to-Consumer (B2C), Business-to-Business (B2B) and Business-to-Employees (B2E) models. For Scottish and Southern Energy, any future e-Business strategy for the organisation will be very much based on the uptake of the Internet within the industry. The company will not be developing many more applications unless it can see trends towards successful business on the Internet by other companies. As far as technology or e-Business application is concerned, it does not want to be in the *"first wave"* but would be more of a *"follower"*.

Lessons from Scottish and Southern Energy case study: The company is very successful in terms of its operations and maintains a stable and profitable business. It has a strong conviction towards using traditional methods and approaches to increase revenue. The company acknowledges and appreciates the e-Business potential for electricity utilities but does not see it becoming one of the company's main strategies in the near future.

4.2.1.3 Powergen

Background: Powergen is currently one of the UK's leading integrated gas and electricity companies. It is a vertically integrated Anglo-American energy services business, which is a part of E.ON AG (a German-based energy group and one of the world's largest investor owned utilities). The company generates, distributes and supplies electricity in the UK and European markets. It provides around ten percent of the electricity used in England and Wales. Through its subsidiary, East Midlands

Electricity, Powergen run the electricity distribution network for the East Midlands area. The company sells electricity and gas to around three and a half million residential, business and industrial customers.

e-Business Definitions and Applications: Powergen defines e-Business as the use of Internet and web style technologies to do normal business. It was not perceived by the company as a different type of business. Rather, e-Business is regarded as doing the same business in a different way. e-Business is also seen as an online business with a heavy emphasis on people serving themselves, whether they are customers, suppliers or employees. Business interactions with these parties are categorised by the company as Business-to-Customers (B2C), Business-to-Business (B2B) and Business-to-Employees (B2E) dimensions. These three relationship models of e-Business are said to have the characteristics of being online, were developed to streamline and ensure the efficiency of business processes and to eliminate the role of *"middle-persons"*, towards the promotion of a self-service environment (for example, eliminating the process of booking a seminar room through the company's logistic department, where in this case the logistic department is considered as the middle-person).

Powergen has developed a few applications within the B2B area, including e-Procurement initiatives for the company asset management business (mainly power stations). Within these initiatives, Powergen has implemented an e-Procurement market site, which already has a number of suppliers on board and which the company is gradually looking to increase. Most of these suppliers are for the generation and the distribution businesses with only one or two suppliers for other general office supplies. This is due to the vast majority of the purchases being done in the generation and distribution areas, which includes purchasing cables and transformers. Powergen believes that any *"price efficiency"* it will get will come from these types of generation and distribution purchases. On the other hand, the company also feels that *"efficiency in executing"* the purchases will most probably come from the purchases of large volume general office supplies.

B2B applications can also be seen in Powergen's Energy Trading business. An e-Business application in Energy Trading is considered to be one of the most important

applications running at the moment. This application is said to have tremendously improved the liquidity and speed of transactions and has been especially important in providing fast and accurate online information. A large proportion of Powergen's energy trades are done online through various exchanges and the value of those trades was said to *"dwarf"* any value in Powergen's other business transactions.

The retail business has also implemented a B2B application that offers major customers their half-hourly electricity consumption online. According to the company, this information is vital to large power consumers, as they can better understand what their energy consumptions are and think about how they can improve the management of these energy consumptions. In addition, a B2C application has also been implemented by the retail business for its domestic and small power consumers where it offers its services and customer interactions online, such as providing the facilities to apply and register online, make online bill enquiries and conduct online meter reading. An online payment system was suspended recently due to some security problems but the company has plans to reinstate the facility to make online payments soon. However, Powergen has some scepticism about just how fast and how much take-up there will be amongst the customer base for B2C applications. The company has found that so far not many people out of its three million customer accounts are keen to use the online services provided, especially online payment.

e-Business Strategy and Implementation: As an energy company, Powergen does not see e-Business as its main business strategy when compared to information-intensive companies such as those that are involved in advertising, entertainment or banking. On the other hand, in comparison with other energy companies in the UK, Powergen felt that the company is more or less at par with ScottishPower in terms of developing and investing in e-Business applications. However, with respect to the company's e-Business vision and strategy for the future, Powergen does not feel that the company views these as centrally as ScottishPower does with regard to its initiatives and preparation. The business and the business strategy are focussed on managing the physical assets of the company, generating electricity, as well as distributing and retailing it. The *"e"* bit was said to be generally concerned with finding better ways of doing those business activities, which includes doing them

more efficiently, and making them more attractive to customers. e-Business is regarded as a supplement to the business strategy rather than the strategy itself, which can help the company improve efficiency and satisfaction for customers and employees, as well as business partners.

As an e-Business initiative, the company is looking into producing a *"richer"* but much more standardised IT infrastructure. A few years ago, Powergen underwent an IT restructuring process. It was decided that the company would have an IT department in each of the main businesses of Powergen. In order to coordinate these departments, the company had set-up a Group IT function that is responsible for looking at policy, standards and directions of IT across the whole UK business. One of the ongoing e-Business moves is to create a much more standardised IT infrastructure that can be a platform for, wherever possible, the common business processes across the company online.

On the B2E side, there is also a big push within the company to establish the Intranet as a vehicle for communicating with and enabling employees to exchange information and connect with each other. e-Business initiatives can also be seen within each of Powergen's four main businesses (European Generation and Asset Management, Energy Trading, Retail, and Distribution). For example the retail business is doing a lot of work on online self-service for its retail customers, the distribution business is focussing on enabling its employees to get access to all the information relevant for their work wherever they are, and the trading business has more online trading and auctions in place. However all these initiatives will be tempered by the limited funds that the company has allocated to it. Nevertheless, Powergen believes that there is a big transformational push for the UK business in this direction and it wants to bring the whole *"e-thoughts"* concept (which is defined by the company as any ideas on e-Business related applications and initiatives) into how the company does business.

Future Business or e-Business Strategy: Powergen's retail business has plans to expand its customer numbers because it is felt that to be a viable retail business the company needs to have at least five million customer accounts in the UK. The company feels that there are two routes to this expansion. One is to sell more

electricity to more people and the other one is to sell a broader range of products to the people who are already buying the company's electricity. Powergen has a vision to do both and still maintains a focus on retailing utility services. In addition, with regards to the company's overall strategy, Powergen believes that there is a great overall chance of being a successful and increasingly profitable company by maintaining the status of an integrated business across generation, distribution, trading and retail, as compared to restricting its operations to one particular business or the other.

With regard to e-Business implementation, internally, the company is initiating a general move towards eliminating paper based processes by means of having *"everything"* online and *"everything"* self-service, and with information readily available and people readily findable and contactable.

Lessons from Powergen case study: Powergen was created from the privatisation of the Central Electricity Generating Board (CEGB), and has since grown from an electricity generator into a producer, distributor and retailer of electricity in the UK and abroad, a gas and telephone services supplier, and also an ISP. The company is also involved in the construction and operation of power station sites across the world. Powergen has also gone through further transformation and expansion by acquiring US LG&E Energy Corp. The company was later purchased by E.ON AG, a publicly owned German utility, which also now acts as its ultimate parent company. With regards to its e-Business strategy, the company is seen to have an active approach in terms of implementing various e-Business applications within the B2C, B2B and B2E models. However, the company feels that e-Business is only a tool to support the company's organisational strategy and regards e-Business as an evolutionary change and not a revolutionary one, which involves a gradual expansion of the ways and places that the company interacts with its employees, customers, suppliers and business partners electronically. Powergen appreciates that e-Business will grow more important for the company in the future, but the growth will be in a way that reinforces the business of the company, which is making energy, retailing and trading energy, as well as running a physical energy distribution network.

4.2.1.4 LE Group

Background: London Electricity was privatised in 1990 and was acquired in 1997 by the US utility company, Entergy Corporation. Entergy then sold London Electricity in 1998 to one of the world's largest utility companies, Electricité de France (EDF). During 2000 the renamed LE Group was structured into separate business units, which comprise Asset Ownership and Governance, Energy Business and Service Provision. The company is involved in almost every aspect of the electricity business including generation, supply and distribution as well as providing gas and other services such as providing data services for large power consumers (for instance, detailed billing) and green electricity options for all customers.

e-Business Definitions and Perceptions: e-Business is described as a communication tool and as one of the channels to market in order to reach customers, suppliers and business partners. It is defined as doing business through web technologies. It is seen as a tool that provides the ability to connect everyone with everyone through the same web standards. LE Group believes that instead of calling it e-Business it should be referred to as web-Business. Although e-Business is regarded as a major element and a strategic tool for the business, the company feels that it is no more than a web technology and will not influence the company's overall business strategy. The company feels that it is still not obvious whether e-Business can add value to its current business activities. At the moment e-Business is seen as only being able to improve performance and productivity without creating any value, where value is perceived as the ability to create a new business, a new relationship or a new business process.

Another issue that LE Group is looking at is the feasibility of e-Marketplaces. Although the company is part of the Eutilia e-Marketplace, it still has not done any online transactions on the marketplace yet. The company feels that at the moment the e-Marketplace is not a successful application. LE Group believes that this is due to reluctance from the suppliers to deal on marketplaces. Suppliers are said to feel that such marketplaces will increase the power of purchasers by using the marketplace to put pressure on suppliers to get the best price. In order to avoid these marketplaces the company has seen suppliers develop their own Internet site with their own

catalogues and have companies deal directly with them instead of going through e-Marketplaces. LE Group is still uncertain as to what the outcome of the e-Marketplace is going to be, but is looking into fully implementing its own e-transactions once these issues have been resolved and the company can be sure of its value and benefits.

e-Business Strategy, Applications and Implementation: Within the LE Group, there are two important areas where the company sees e-Business plays an important role. The first one is in energy trading systems where without the speed, accuracy and flexibility of e-Business, trading will not be able to take place efficiently. The second one is in the company's Customer Relationship Management initiatives, especially in the services provided for large power consumers (B2B). e-Business applications such as online reports on customers' energy consumption are considered very important. These applications allow LE Group to send reports to its large power consumers almost in real-time, which in turn helps the customers to make strategic decisions in managing their energy usage. The company feels that another reason why this B2B category of e-Business is important and a success is helped by the fact that businesses usually have effective computers and networking systems in place with a full support team to ensure their smooth running.

On the other hand e-Business applications for transactions with small businesses and domestic customers are regarded as not very critical. In fact the company feels that they have not been very successful. The company's Virgin brand for example, implements total online systems through the Internet, where customers can apply and register for its services online, pay their electricity online, as well as view their bills and manage their account online. So far the company has found that only around ten thousand (10,000) customers have signed up for these services as compared to the two hundred thousand (200,000) customers that the company managed to get within the same period of time through traditional marketing methods and using traditional type of services. The company feels that some of the reasons why domestic customers are still reluctant to use online services through the Internet for their utility transactions include slow transaction times, security and accountability of the Internet, customers not having the right software version, unfriendly websites, and

customers feeling that it is not exciting or necessary to look at their utility bills through the Internet.

The company has also implemented a strong Intranet system that is used primarily for internal communications among its personnel. It is also used as a medium for announcing company news, publishing any revised business strategy and updated organisational structure, as well as publishing the company's press releases.

Future Business or e-Business Strategy: To keep updated with the current e-Business strategy, implementation and applications, LE Group has created an e-Business forum where people from all business units meet and discuss what they have been doing in the e-Business space, what applications have been implemented, any problems encountered, and other issues related to e-Business. From this discussion the company hopes to pick up new and applicable ideas for itself and investigate whether it would add value to the company's existing business and, if it has a strong business case, the company will invest in it. However, LE Group does not see itself transforming the whole business to become fully an e-Business. The approach that it will adopt is always to be pragmatic with any of the e-Business applications the company wishes to implement.

Currently the company is looking into expanding the usage of its Intranet systems to provide more capabilities such as managing the company's internal purchase orders and managing personnel claim expenses. The company has also plans to use the Intranet to help eliminate paper-based processes and interactions. e-Procurement is another area that the company is looking at for the future. It is currently conducting studies and surveys to see if there is any value that can be gained from this application. However, the company has doubts as to the value that this system can provide. It claimed that the company already has a very efficient procurement process in place, so in order to venture into e-Procurement systems the company needs to see a really strong business case for it. If there is any improvement over current e-Procurement systems and activities, and if the studies can show that it would bring more efficiency and can add value to the company's current procurement process, the company will not hesitate to invest in it. However, this is not a critical and urgent area for the company.

Lessons from LE Group case study: Like Powergen, LE Group is also a foreign owned utility in the UK. With regards to e-Business strategy, although the company seems rather active in its implementation of e-Business applications, LE Group is quite sceptical about the overall potential and benefits of e-Business, especially in its ability to create value for the company.

4.2.1.5 GPU Power UK

Background: GPU Power UK is a single utility concentrating on the distribution of electricity to homes and businesses in the areas of Shropshire, Staffordshire, the West Midlands, Worcestershire, Herefordshire and Gloucestershire. It was originally part of the nationalised Midlands Electricity Board (MEB). MEB then became the first electricity company in the UK to make the strategic move to separate its distribution business from its competitive supply operation. The distribution business was called Midlands Electricity Plc and later renamed GPU Power UK to reflect the name of the American parent company that acquired it in early 2000. In 2002 it was taken over by another US company called Aquila Inc (formerly known as UtiliCorp United) and the company now has changed its name to Aquila Networks to reflect its new parent company.

It operates in a regulated monopoly environment. The regulator however, is slowly increasing the level of competition in this area. One of the main areas where the regulator is trying to expand competition is new connections to the network. For example, if there are new houses or new industrial estates, etc., then the wiring and insulation of the electricity network within that estate and connection to the existing network can be competitive. New connections were due to become competitive in January 2002, but due to the difficulties in achieving that, mostly because of safety issues, it has taken off very, very slowly. Competition in new connection is seen as having a miniscule effect on the industry as compared to competition in the supply business.

Distribution Business Issues: Distribution businesses in the UK operate as monopoly companies in their respective areas and are price regulated. The regulator, Ofgem (Office of Gas and Electricity Markets) imposes strict price regulation on the

companies. The distribution price is defined by the regulator using certain formulae and will be reviewed every five years. This means that the price that GPU Power UK and other distribution companies can charge is fixed. For example it allows the companies to make around six and a half percent (6.5%) return on the capital they employ during a particular five-year period. This price regulation governs the company's expenditure with regards to buying new equipment or maintaining existing equipment, as well as providing certain services such as fault restoration of the electricity supply, and electricity network systems control and maintenance.

According to GPU Power UK, in order to gain more profit it needs to be more efficient in terms of operational costs. It needs to be able to keep its operational costs as low as possible in order to maintain its margins. Another area that the company is looking at in order to increase its profit is to venture into other businesses that operate in a non-regulated environment, which include forming partnerships or alliances with telecommunication companies, cable laying contractors, as well as other utility companies. So far no decision has been made on the above issues and there are still on-going discussions about it.

Currently the distribution business is going through a process of consolidation and a number of distribution companies have merged. At the time of the interviews, GPU Power UK and SEEBOARD were the only distribution companies that are still independent. However, SEEBOARD is now part of the LE Group, following an acquisition exercise in July 2002. In the long run, GPU Power UK believes that they might lose out due to the lack of economies of scale when purchasing material and equipment.

e-Business Definitions and Applications: e-Business is defined as the usage of electronic media such as computers for business transactions. This includes electronic trading via e-Marketplaces, online auctions, online reverse auctions and also covers anything where Internet technologies are used to transmit information between the company and its suppliers and other business partners. e-Business is also described as being more than traditional proprietary EDI applications.

e-Business Strategy and Implementation: GPU Power UK does not have any specific or structured e-Business plan or strategy. The company does not see e-Business as a very important factor that drives the business strategy of the company. The main reason for this is that GPU Power UK is still not convinced of the e-Business potential and is still struggling to see the benefits of implementing e-Business. The company however mentioned that there have been some successful e-Business applications within the company, but for the most part they have not yet yielded the sort of benefits that the company had hoped for.

Nevertheless, it was observed that the company does have elements of a Business-to-Business (B2B) model in place. GPU Power UK is currently performing a trial run of its online auction activities. The company has signed-up with the Achilles e-Marketplace and bought a package of six auctions for a fixed fee. At the end of these six auctions the company will evaluate the exercise and decide if there is any benefit in it and whether to continue with it or whether to turn back to performing the auctions the way it used to be done. By becoming a member of the Achilles e-Marketplace the company is also part of the electronic trading forum with other utilities. However, at the moment neither the company nor its suppliers are very keen on moving into this environment rapidly. The company believes that at the moment, the theory of e-Business precedes its performance and the actual benefits on the ground are not that easy to realise.

Another application that is being used extensively within the company is an application that helps field personnel to record their investigations and transfer information back to the company. This application can be interpreted in terms of the Business-to-Employees (B2E) model. It consists of a handheld device that helps them record electronically what they see in the field, for example reporting a faulty cable or a faulty overhead, reporting status on transformer upgrades or switchgear maintenance. This information can then be uploaded from the hand-held device to the main computer system for further action. Five years ago they were using pieces of paper and sending them back to their office where somebody else had to key in the information from the paper into the system manually. According to the company, the handheld system has helped to improve the speed and accuracy of the process.

GPU Power UK also stated that there are two main reasons why the company faces difficulties in implementing e-Business. The first one is the technology factor and the second one is a financial or economic factor. The technology area is quite difficult for the company because it has a mixture of legacy systems and new applications. There are some systems that are mainframe-based and were developed internally, some applications the company bought off the shelf from other companies, while others use SAP modules for certain parts of the business process. With this mixture of systems GPU Power UK has had difficulties with system integration. For example integrating the back office systems with the e-Marketplace application has been quite difficult, leading to duplication of work where the information received from the e-Marketplace online website needs to be re-entered manually into the company's back office system. Another problematic area is the financial or economic factor, where the company is still struggling to see real strong business benefits from e-Business.

Future e-Business Strategy: GPU Power UK does not see itself implementing any e-Business plan or strategy in the near future (within five to ten years). The company believes that Business-to-Customers (B2C) will be the model that has most potential. However, being solely a distribution business, the company does not have direct interactions with its customers, whether large or small. Its interactions are mostly with suppliers such as cable or transformer producers and also with the regulator. The company believes that these types of interactions are mainly concerned with the Business-to-Business (B2B) model, and this model does not demonstrate much benefit to the company.

Lessons from GPU Power UK case study: GPU Power UK, concentrating only on the distribution segments of the electricity business, has gone through various transformation and takeover exercises. Being in a regulated part of the electricity business, the company feels that e-Business strategy is not important for the company, as the strategy was perceived as being more viable in the deregulated environment. The company is not active in its e-Business endeavours and feels that it needs to focus its resources and attention more on adjusting to the various transformations and changes that the company has gone through.

In summary, section 4.2.1.1 through to section 4.2.1.5 have provided separate case reports that explore and describe the five UK case companies in terms of the companies' background, deregulation issues, and their e-Business definition, applications, implementation, and strategy. In the following sections of the analysis, these individual cases will be compared against each other, but to begin with as suggested by Patton (2002), each case need to be represented and understood as an *"idiosyncratic manifestation"* of the phenomenon under study. The purpose of these case reports is to offer a descriptive and holistic portrayal, allowing the reader to access, as far as is possible, the information necessary to understand each cases in all its uniqueness. The Malaysian case study is presented in the next section.

4.2.2 Malaysian Environment

Malaysia is currently in the midst of an energy sector reform process. Prior to 1990, the National Electricity Board (NEB) was government-owned, and supplied eighty percent of the total population of Malaysia. The NEB was corporatised in 1990 to become Tenaga Nasional Berhad, or TNB, and was later partially privatised in 1992. The generation sector was opened to Independent Power Producers (IPPs) after this privatisation but TNB still maintains market dominance through control of most of the generation capacity, the transmission network, and the distribution business, as well as the supply sector of electricity for the country.

Electricity demand growth has been rapid over the last decade, and this has assisted growth in inward direct investment by IPPs. Further reform is planned, with the creation of a wholesale market and independent transmission ownership and operation. Despite these plans, Malaysia still wishes to achieve social policy goals by regulating the retail tariff of electricity, in particular maintaining a uniform tariff for all consumers. For Malaysia, as in some other developing economies, the potential benefits of opening energy markets to full competition must be balanced against competing political, social, and economic policy objectives, such as the extension of electricity networks to all communities, and maintenance of tariffs at prices that poorer consumers can afford (Asia Pacific Energy Research Centre, 2000).

Based on the above discussion and due to the market dominance of TNB in Malaysia as well as the researcher's position as an employee of TNB, the company was selected to be the main case study to represent the Malaysian environment for this research.

4.2.2.1 Tenaga Nasional Berhad (TNB)

Background: TNB is the largest electricity utility company in Malaysia serving over five million customers throughout Peninsular and East Malaysia. The Group's core activities are in the generation, transmission, and distribution of electricity and offer a complete power supply system, incorporating the National Grid. At present, even after the introduction of Independent Power Producers (IPP) in the early 1990s, TNB still continues to be a major player in the electricity generation business, which is a significant part of the Group's diversified range of business activities. Through TNB Generation Sdn Bhd, its wholly owned subsidiary, TNB has the largest generation capacity of 8,660.5MW, which accounts for around sixty-five percent of the total power generation of Peninsular Malaysia. Other TNB activities include manufacturing of transformers, high voltage switchgears and cables. The Group also provides professional consultancy services; repair and maintenance services; fuel, logistics, freight and insurance coverage; research and development, which include offering services of higher education, property development and project management services; and architectural, civil, electrical and engineering works services. These are made possible through its subsidiaries and associate companies.

e-Business Definitions, Strategy and Applications: The Group defines e-Business as conducting business activities electronically, which may involve using the Internet and Web technology. e-Business is also seen as applications that will replace traditional pen and paper based systems, which usually involve lots of manual processes.

The importance of e-Business to TNB is beginning to surface especially during the current difficult phase faced by the company's core business, which includes increases in fuel costs, increases in overall costs of operations, and an increase in competition for generating electricity from the IPPs. TNB believes that in this situation, cutting costs is imperative to ensure the company's survival and that the

company remains competitive. One approach the company feels is effective in cutting costs is the implementation of e-Business solutions.

Currently, TNB has implemented what it perceives as one of its key e-Business applications, which, although not a critical issue for the company at present in terms of generating revenue or cost cutting, is considered strategically important in order to demonstrate to stakeholders and specifically customers, that the company is keen on e-Business solutions. TNB also wishes to show its stakeholders that the company is leading in this area as far as electricity utilities are concerned, which the company believes will help its image in building trust and confidence for any future competition. This application is called e-Services and specifically targets the company's domestic and small business customers. The services offered through this application include online enquiries, online billing and online payment facilities. With this application, TNB hopes to project an image that the company is dedicated to providing better customer service, and regards the application as one of the means of preparing the company for future competition.

Although TNB appreciates the potential of e-Business for the electricity industry and is very enthusiastic about it, at present the company is still in what it described as the *"planning phase"*. The company refers to this phase as the initial stage of e-Business implementation, which involves exploring and identifying key areas and processes within the company that could be e-Business enabled. TNB does not have an integrated or complete e-Business strategy or plan for the overall company at present. However, the company has developed a framework to guide its e-Business implementation for the future to concentrate on three key areas, which incorporates a B2C model *"for improved customer services, which also includes demand side management"*; a B2B model *"for e-Procurement and supply chain management"*; and a B2E model *"that will focus on employee self-service for better communication and information access within the organisation"*.

TNB envisages that some of the potential benefits of e-Business with regard to its customers, business partners and internal processes will include the shortening of payment periods and a reduction in operating costs. For example, through an e-Procurement application, transactions would be done electronically and suppliers

could be selected online. Through this application delivery processes from suppliers are expected to be done faster, paper-based transactions should be reduced, the number of human or manual resources should be minimised, and time and effort to monitor the whole purchasing cycle are expected to be shortened substantially. TNB expects to have more streamlined and effective internal business processes by means of implementing various self-service applications, which the company believes will also help improve employee satisfaction. With regards to its customers, the company is looking into extending the functionality of its e-Services and to ensuring that the application could provide round-the-clock facilities with zero or minimum down time.

Future Business or e-Business Strategy: To implement the e-Business strategy for the company, TNB is concentrating on three critical success factors that the company believes are important in developing, planning and executing the strategy. These include: first, support and enthusiasm from top management, without which the company feels it would be difficult to implement the strategy, as a complete e-Business solution will involve changes to the company's business processes, which will need endorsement and support from the top management; second, a strong and reliable infrastructure, which includes the network and servers; and third, involvement of end-users throughout the e-Business application development, *"particularly when the application involve changes to the way businesses are conducted"*.

TNB also regards the level of e-Readiness of its business partners and customers as a critical contributing factor towards the success or failure of the company's e-Business strategy. In order to ensure that customers and business partners are ready to deal in an e-Business environment with the company, various ways are being planned to create an e-Business awareness for these parties. Currently, the company does not have a complete and specific plan of e-Business awareness for its business partners but it is targeting its domestic and small business customers for its e-Business education plan through brochures, by sponsoring e-Business awareness programmes on the media (television, radio, newspapers), and by helping to provide Internet facilities to rural schools so as to prepare the next generation for the acceptance of e-Business implementation in the future.

Lessons from TNB case study: TNB appears to have a positive attitude towards e-Business. However, the company seems to have a more laid-back approach to its e-Business initiatives when compared to the UK utilities. For example, when implementing its e-Services system, in-depth studies were not carried out on important areas such as the anticipated number of customers who would use the facility. Mechanisms for monitoring the number of customers using this facility were also not in place. This makes it difficult for TNB to judge the success levels of its e-Business initiative. As discussed earlier, e-Business at present is pursued mainly as an image enhancing exercise. This may have led to some e-Business applications being commissioned without specific and clear targets. The company needs to have a rigorous assessment process in place before implementing its e-Business plans for the future in order to benefit from this environment.

4.2.3 Summary of the Case Companies Environment

Based on the case study reports presented earlier, it can be summarised that at present most of the case companies have gone through a lot of changes and transformations due to the privatisation and deregulation exercise in the power industry as illustrated in Figure 4.1. Some of the significant developments include unbundling of electricity utilities into their basic components (generation, transmission, distribution, and supply) and offering the service of each component separately; introduction of competition for the wholesale market and the retail market; and formation of the multi-utility concept. The restructuring of the energy industry has also opened up the power markets to include international operation by some of the electricity utilities as described in Table 4.1 earlier.

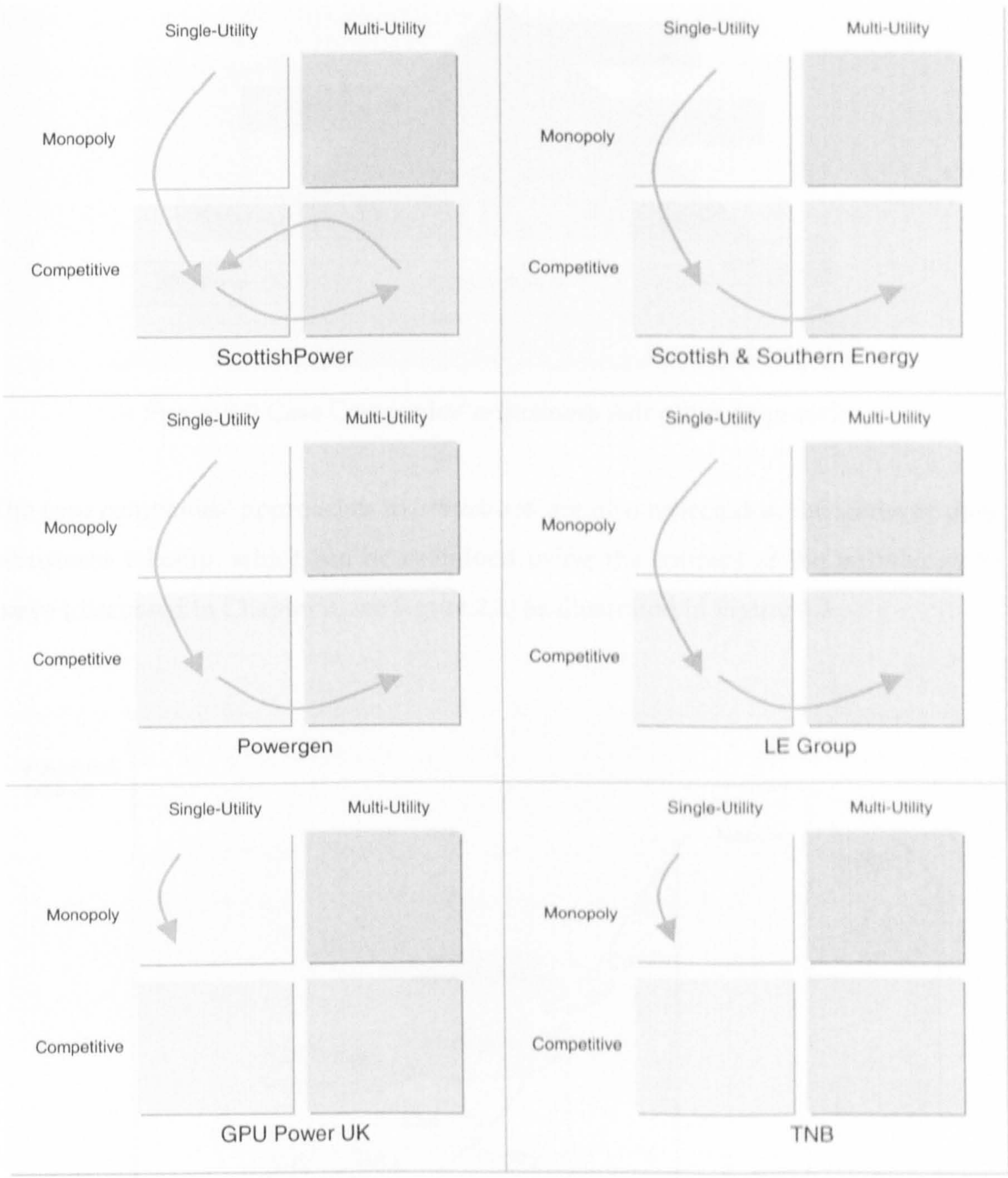

Figure 4.1 Summary of Case Companies' Main Cycles of Transformations

The case study reports also highlighted that the companies' move towards e-Business can be categorised mostly into three approaches, which involve the decision on whether they want to be *"pioneers"*, *"trend followers"*, or *"late adopters"* as depicted in Figure 4.2. (Note: In figures 4.2 through 4.4 the size of boxes and spheres have no inherent meaning and their location within each diagram indicates only an estimate of the relative positions within that framework)

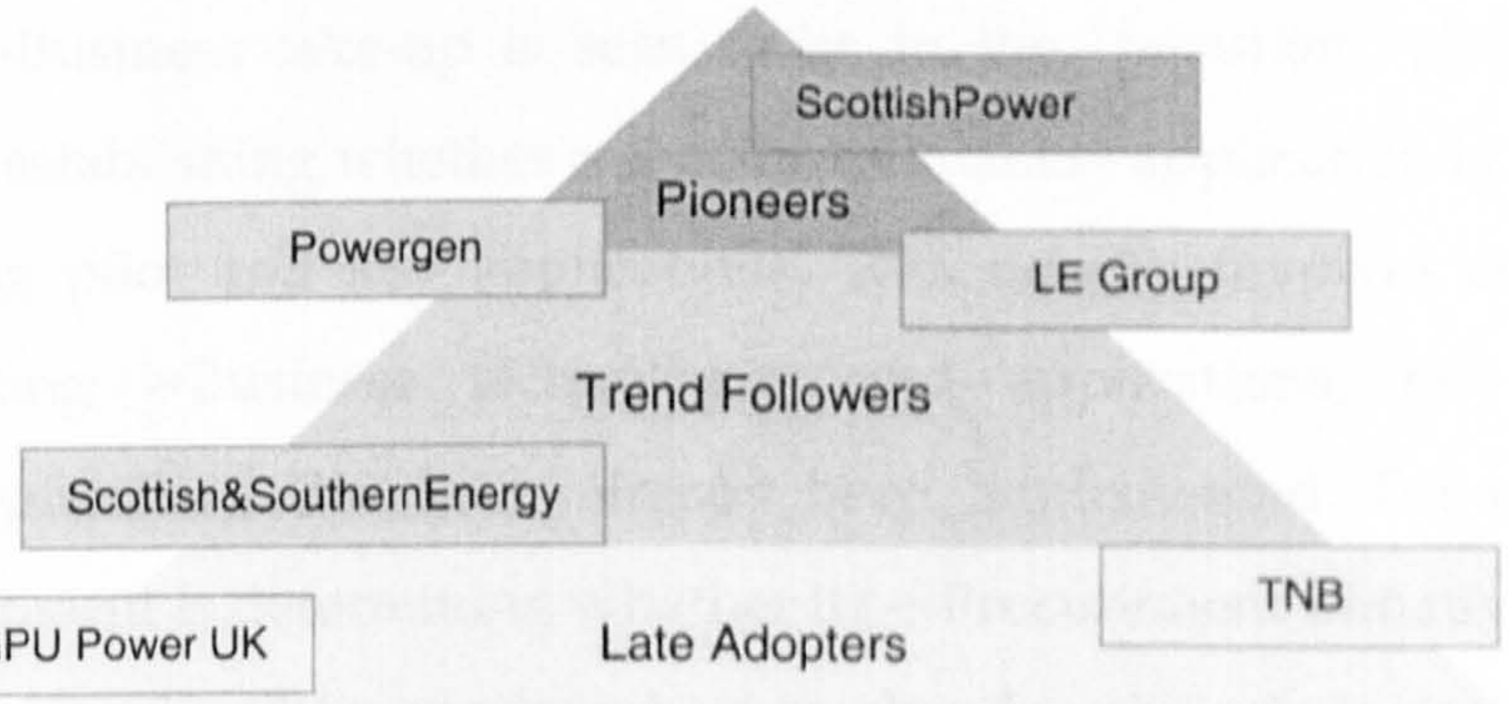

Figure 4.2 Case Companies' e-Business Adoption Approach

The case companies' approaches to e-Business are also reflected in the status of their e-Business take-up, which can be examined using the concept of the technology S-curve (discussed in Chapter 2, see Figure 2.2) as illustrated in Figure 4.3.

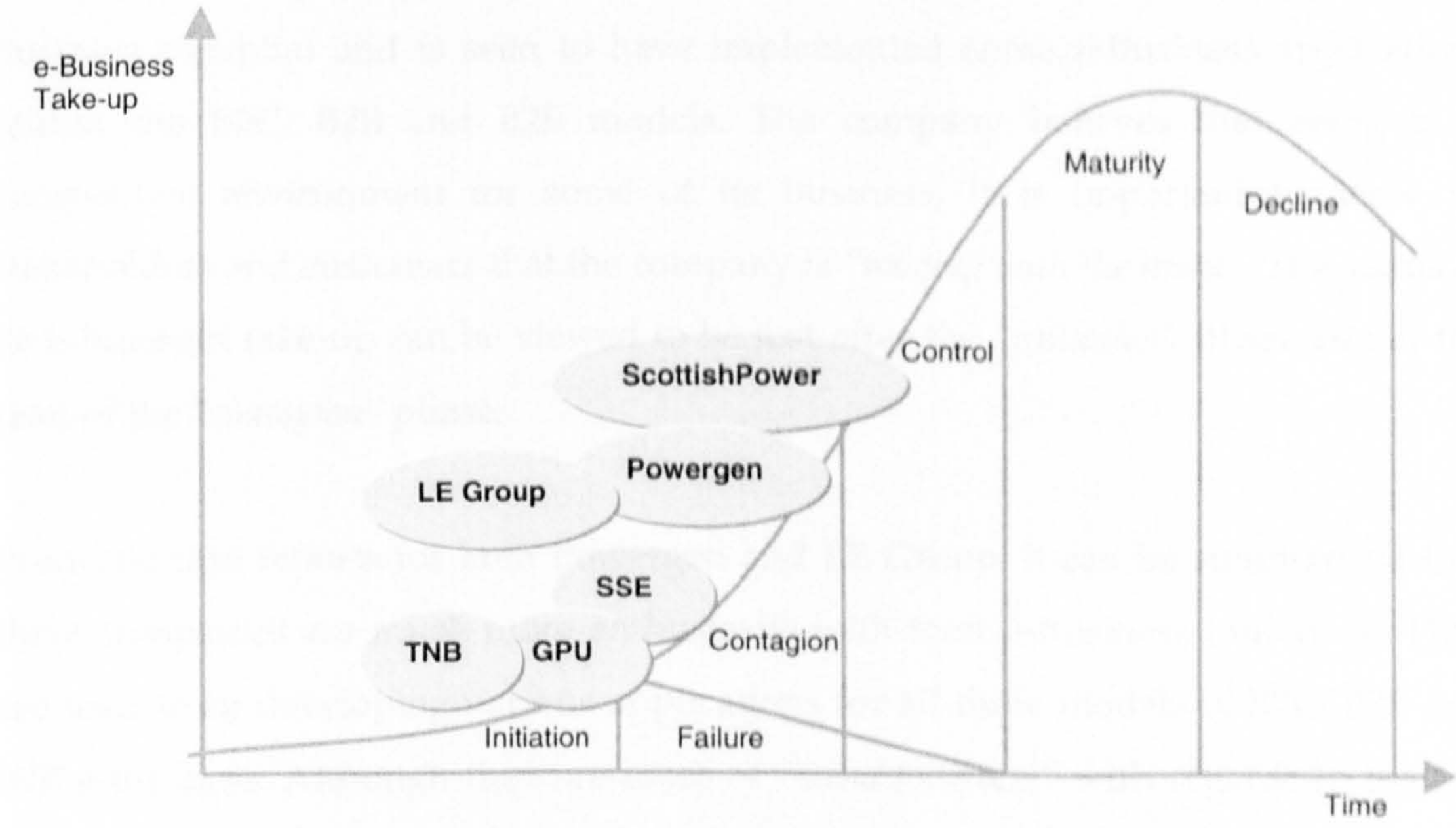

Figure 4.3 Case Companies' e-Business Status Based On The S-Curve

As discussed in the case reports, both TNB and GPU Power UK operate in a regulated monopolistic environment. Being monopolies, they do not see e-Business becoming a crucial strategy for their companies in the near future. They do appreciate the potential of e-Business and have some e-Business initiatives running, but their approach to e-Business is more of the *"late adopters"* approach. Based on the S-curve

model, their e-Business take-up is seen to be in the *"initiation"* phase, where the companies are establishing whether a specific e-Business application is necessary and also developing pilot and key applications. This usually involves comparing and selecting existing e-Business technologies and applications, or rejecting and eliminating applications that have already been implemented. For example, GPU Power UK at present is determining whether its e-Procurement initiatives are suitable for the company and will be continued, or to abandon the whole project altogether. TNB on the other hand is currently in the process of developing its pilot e-Services and e-Office applications.

The case study report on Scottish and Southern Energy highlighted that the company prefers to adopt a *"trend followers"* approach to e-Business rather than be in the *"first wave"* (*"pioneers"*) of the e-Business implementation. Although Scottish and Southern Energy believes that at present the traditional methods of doing business are more suitable for the company and proven to be successful, the company does appreciate e-Business potential and is seen to have implemented some e-Business applications within the B2C, B2B and B2E models. The company believes that being in a competitive environment for some of its business, it is important to show its stakeholders and customers that the company is *"moving with the times"*. The status of its e-Business take-up can be viewed to be just after the *"initiation"* phase and at the start of the *"contagion"* phase.

From the case reports for both Powergen and LE Group, it can be summarised that these companies are much more enthusiastic with their e-Business initiatives. They are seen to be developing various applications for all three models of B2C, B2B and B2E e-Business. Although they are more of *"trend followers"* with regards to their e-Business implementations approach, they can also be considered as *"pioneers"* for some of their initiatives. This can be seen for example in LE Group's joint venture with the Virgin Group to form Virgin Energy that operates as one of the first pure online energy company, and Powergen's successful e-Procurement initiatives with its core suppliers. Based on their e-Business approach and level of enthusiasm, the status of both companies' e-Business take-up can be observed to be at the higher level of the *"contagion"* phase. Even though both companies are very keen with their e-Business

initiatives, the companies regard e-Business as more of a tool and technology that is very useful in supporting their companies' corporate strategy.

In comparison with the case companies discussed above, the case study reports shows that ScottishPower is much more positive with regards to its e-Business approach and take-up. The company believes that e-Business is more than just about technology and should be integrated with the corporate strategy. The company can be seen to be rigorously developing various e-Business applications and initiatives within the B2C, B2B and B2E e-Business models, and at present has the most e-Business applications running when compared to the other case companies (explained further in the following section, see Table 4.5,4.6,4.7, and 4.8). ScottishPower can be seen to mainly adopt a *"pioneers"* approach to its e-Business strategy and implementation and at present the status of its e-Business take-up can be considered to be more at the end of the *"contagion"* phase and moving into the *"control"* phase. As a *"pioneer"*, the company takes the lead in implementing new e-Business ventures and is willing to invest heavily in it. This can be seen in its joint venture effort with The Royal Bank of Scotland to form a pure Internet company, as well as leading one of the energy e-Marketplace projects with a number of European utilities to form Eutilia.

Based on the case companies' e-Business approach and status of e-Business take-up, the case companies' level of e-Business implementation can also be summarised using Hackbarth and Kettinger's *"Three Levels of e-Business"* framework (discussed in Chapter 2, see Table 2.1) as demonstrated in Figure 4.4.

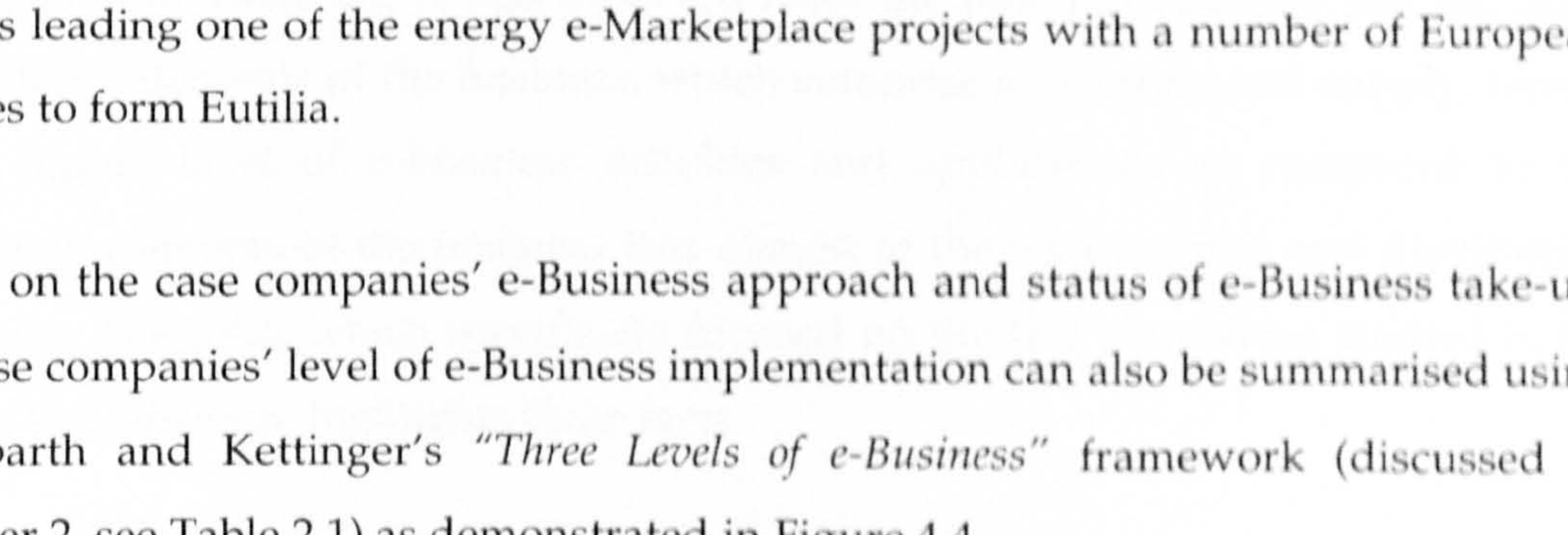

Figure 4.4 Case Companies' Level of e-Business Implementation Based on Hackbarth and Kettinger Framework

Further analysis and discussion of the findings from the case studies are discussed in more detail in the following sections.

4.3 Patterns of data for each research issue

Following the SISP model, the research needed to first identify how e-Business influences the electricity industry. To understand this situation, information was collected through interviews, documentation and observation. The information was then organised into tables and matrices as recommended by Miles and Huberman (1994) and Patton (2002) in order to analyse the qualitative data and is discussed in the following sub-sections (Note: Miles and Huberman (1994) and Patton (2002) have provided a variety of ideas for analytical approaches to qualitative data including a variety of concept mapping and visual display techniques).

4.3.1 Current Situation: Level of e-Business Implementation

As depicted in Table 4.2, it was observed from the research findings that the more competitive elements of the business, which comprise generation and supply, have a much higher level of e-Business activities and applications as compared to the monopoly elements of the business that consist of the transmission and distribution segments. Table 4.3, which specifically focused on the five companies studied in the UK for this research, highlights these facts.

Dimension 1: Degree of competition			
High		Low	
Dimension 2: Sectors			
Generation	Supply	Transmission	Distribution
Dimension 3: Level of e-Business activities			
High		Low	

Table 4.2 UK Electricity Environment: Summary of Findings Based on the Dimensions of Sector, Competition and Level of e-Business Activity

	Dimension 1: Degree of competition				
	High		Low		
	Dimension 2: Sectors				
Case Companies	Generation	Supply	Transmission	Distribution	**Dimension 3: Level of e-Business activities**
ScottishPower	✔	✔			High
			✔	✔	Low
Scottish and Southern Energy		✔			High
	✔		✔	✔	Low
Powergen	✔	✔			High
				✔	Low
LE Group	✔	✔			High
				✔	Low
GPU Power UK					High
				✔	Low

Table 4.3 UK Case Companies: Summary of Findings Based on the Dimensions of Sector, Competition and Level of e-Business Activity

For the Malaysian environment, the findings from TNB, which operates as a monopoly electricity utility, reflect the UK results that show low e-Business implementation for a non-competitive setting as depicted in Table 4.4.

	Dimension 1: Degree of competition (mainly monopoly operation)				
	Low				
	Dimension 2: Sectors				
Case Company	Generation	Supply	Transmission	Distribution	**Dimension 3: Level of e-Business activities**
TNB					High
	✔	✔	✔	✔	Low

Table 4.4 TNB (Malaysia): Summary of Findings Based on the Dimensions of Sector, Competition and Level of e-Business Activity

From both Table 4.3 and Table 4.4, which indicate case companies, findings can be discussed according to the sectors as follows:

Generation Sector: As discussed in previous chapters, deregulation in the UK has increased competition in the bulk sales of electricity to supply companies. This has led generation companies to find and use strategies that could provide them with a competitive advantage and e-Business is considered one of the possible solutions. In the UK, for companies that generate electricity, ScottishPower, LE Group and Powergen appear to have a high level of e-Business activities. However, given the high level of competitiveness in this sector, an interesting finding from Scottish and Southern Energy (SSE) shows that the company's e-Business activity in its generation sector is low when compared with other companies. This may be caused by the reduced bulk generation competition due to the lower generating cost of SSE's hydro generators. The company's generators do not run on fossil fuel (for example gas, oil, and coal) and are not burdened by the high costs for spent radioactive material storage, which has plagued nuclear generators. Thus, even without embarking on e-Business activities, SSE's electrical output remains most competitive and is considered by the company to be what it refers to as an *"easy sell"*.

In the case of the Malaysian utility TNB, the generation sector is not yet truly competitive. Independent Power Producers (IPPs) sign long term Power Purchase Agreements (PPAs) with TNB and nearly all consumers will buy from TNB. Thus the issue of a lack of competition and *"easy sell"* arises here again and the company does not deem e-Business implementation necessary.

Supply Sector: This sector is the most competitive in the electricity market as it represents the front end of selling. For SSE, the advantage of cheaper generation costs ceases in this environment as its competitors may have bought in bulk and can offer reduced electricity prices. In this sector, the playing field is level and very competitive. All case study companies in this research with electricity supply interests have a high level of e-Business activity. The findings here agree with a report by PA Consulting Group (2000) stating that utilities are very biased towards B2C initiatives. This may be due to the perception that websites and electronic marketing add to the competitiveness in the supply sector. These media offer a different channel

for communicating with consumers, which could facilitate differentiation that might entice customers to buy from a different company instead of their present supplier.

In TNB's environment, due to the lack of competition, e-Business is again not given a high priority though the company does have a few B2C applications running through its e-Services function such as e-Bill and e-Pay facilities.

Transmission and Distribution Sectors: These two sectors show the least e-Business activity in the electricity industry. Due to the technicality of the power system, (the already existing electrical transmission and distribution infrastructure, means that running a parallel system is not feasible) all companies in this research who run these *"wires"* businesses (which is how the transmission and distribution businesses are referred to in the industry) are mostly a monopoly in their operating area. They receive a fixed tariff from the users of the transmission and the distribution system. The regulated tariffs are determined by regulators, i.e. Ofgem in the UK, who will not change them for at least five years. The regulator's responsibility with respect to determining transmission and distribution tariffs are similar in other markets around the world but the formulation or approach may vary. Therefore, the non-existence of competition in these sectors does not prompt companies to seriously consider e-Business strategies due to their perceived notion that B2C is the most important e-Business application and more suited and widespread in a competitive environment. However, this lack of enthusiasm may result in them limiting their B2B and B2E initiatives, which have the potential to provide long-term and sustainable value by increasing operational efficiency and reducing costs. For example the price regulation imposed by the regulator would limit their revenue and, in order to increase their profits, these companies need to reduce their operational costs to be as low as possible. B2B exchanges and applications used for transactions and supplier management such as having e-Procurement, and B2E initiatives for streamlining internal processes and managing better dissemination of information for employees could help companies achieve their cost efficiency goals.

4.3.2 Current Situation: e-Business Applications

From the e-Business applications currently implemented in these companies as depicted in Table 4.5 and summarised in Table 4.6, Table 4.7, and Table 4.8, as well as from the case study reports discussed previously, the findings reflect that the focus for most of the e-Business initiatives currently is more on the customer facing business (B2C) such as Internet invoicing or online billing systems. For most of the case companies, the result demonstrates that lower priority has been assigned to initiatives concerning internal support processes (B2E) as well as for suppliers' and business partners' transactions and processes (B2B). This could be due to the need for a faster return on investment and the need to provide a dynamic image to customers, which it was initially thought would come mostly from B2C initiatives. This perception of the importance of B2C has led the electricity utilities to focus the majority of their e-Business investment and resources on the creation of customer facing websites and on B2C interactions, and may have also been encouraged by media coverage that has focused on e-Commerce, which emphasised the B2C type of transactions (Zwass, 1996; PA Consulting Group, 2000; Whyte, 2000; Coppel, 2000).

Companies	e-Business Applications
ScottishPower	http://www.scottishpower.com/pages/ **B2C (domestic users)** Online customer service through **"Online Energy Service"** which includes: • Online application and registration • Online billing • Online payment • Online account management **B2B (industrial/corporate users)** The ScottishPower B2B site is specially designed to meet the needs of large industrial and commercial customers. This includes: • Internet Invoicing • Information Systems • Data Services • Triad Warnings & Day Ahead Forecasts **B2B (suppliers and business partners)** • Eutilia – a utility e-Marketplace **B2B (investors, shareholders and stakeholders)** • Online information on share price, share portfolio calculator and charting or comparison tools. • Online information on protecting the environment activities and programmes • Online information on community services, activities and programmes **B2E (employees)**

Companies	e-Business Applications

	• Intranet site for employees for
	  • Disseminating company-wide internal information
	  • Online "Open Learning" offering various courses from Law, Accountancy, and Finance to Web design, PowerPoint, and High Voltage System Theory.

Scottish and Southern Energy	http://www.scottish-southern.co.uk/index.asp **B2C (domestic users)** • Online application and registration • Online information on company's product and services • Online electrical appliances shop (through "hienergyshop") • Online energy savings calculator **B2B** • **B2E (employees)** • Provide a pension Application Service Provider (ASP), which were formed as an Employee Benefits Consultancy (through "Simple2.co.uk")
Powergen	http://www.pgen.com/ **B2C (domestic users)** Online customer service: • Online application and registration • Online bill enquiries • Online payment • Online meter reading **B2B (industrial/corporate electricity users)** • Online bill enquiries • Managing own website • Online payment (BillPay) **B2B (suppliers and business partners)** • e-Procurement applications **B2E (employees)** • Intranet site for company wide information disseminations and access
LE Group	http://www.le-group.co.uk/default.asp **B2C (domestic users)** • Online company information • Online meter-reading facilities • Online electrical appliances shop • Online energy savings calculator **B2B (business and commercial users)** • e-Billing services • Online summary report on energy consumption • Individual business site invoices (for companies with various branches) **B2E (employees)** • Intranet site for company wide information disseminations and access
GPU Power UK (now known as Aquila Networks)	http://www.gpupower.co.uk/ **B2C (electricity users – domestic and business)** • Online company information • Power loss help line through "Control and Incident Room Automation System" (CIRAS) **B2B (suppliers and regulators)** • e-Procurement application for materials acquisition such as cables, transformer and

Companies	e-Business Applications
	wires. **B2E (employees)** • Materials management system
TNB	http://www.tnb.com.my/ **B2C (domestic users)** • Online company information • e-Services ▪ Online query ▪ Online billing and bills information ▪ Online payment **B2B (suppliers)** • Planning for e-Procurement applications **B2E (employees)** • Planning for e-Office services for the employees, mainly to increase employee self-service for easier access to company information

Table 4.5 Major e-Business Applications Implemented in each of the Case Companies

	Case Companies					
Summary of B2C e-Business Applications Implemented	**Scottish Power**	**Scottish & Southern Energy**	**Powergen**	**LE Group**	**GPU Power UK**	**TNB**
1. Online Company Information	✔	✔	✔	✔	✔	✔
2. Online Application and Registration	✔	✔	✔	✔		
3. Online Billing	✔		✔			✔
4. Online Payment	✔		✔			✔
5. Online Account Management	✔					
6. Online Meter-Reading	✔		✔	✔		
7. Online Energy Savings Calculator	✔	✔	✔	✔		
8. Online Electrical Appliances Shop		✔		✔		
9. Online Bill Enquiry	✔		✔			✔
10. Online Power Loss Help Line					✔	

Table 4.6 Summary of Case Companies' B2C Applications

Summary of B2B e-Business Applications Implemented	Case Companies					
	Scottish Power	Scottish & Southern Energy	Powergen	LE Group	GPU Power UK	TNB
1. Internet Invoicing	✔		✔	✔		
2. Individual Business Site Invoices	✔			✔		
3. Online Payment	✔		✔	✔		
4. Data Services	✔					
5. Triad Warnings & Day Ahead Forecasts	✔					
6. Online Summary Report On Energy Consumptions	✔		✔	✔		
7. Online Company Account Management	✔		✔			
8. e-Procurement (Suppliers)	✔		✔		✔	
9. Online Information On Share Price, Share Portfolio Calculator, Charting & Comparison Tools	✔					

Table 4.7 Summary of Case Companies' B2B Applications

Summary of B2E e-Business Applications Implemented	Case Companies					
	Scottish Power	Scottish & Southern Energy	Powergen	LE Group	GPU Power UK	TNB
1. Intranet Site For Company-Wide Information Disseminations And Access	✔		✔	✔		✔
2. Intranet Site For Online Company-Wide Business Applications	✔		✔	✔		
3. Internet Access and e-Mailing Facilities	✔	✔ (Limited)	✔	✔	✔	✔
4. Online Open Learning (Various Courses) Facilities	✔					
5. Online Employee Benefits Consultancy		✔				
6. Materials Management Systems					✔	

Table 4.8 Summary of Case Companies' B2E Applications

Currently, ScottishPower is the only case company in this research that has rigorously implemented e-Business in terms of all three B2C, B2B, and B2E e-Business relationship models. Presently, other companies have limited e-Business implementation, which may be due to their e-Business perspectives and definition, which will be discussed further in the subsequent sections. However, as discussed earlier and illustrated in Table 4.9, it was observed that most of the case companies are placing or targeting much more emphasis on B2C initiatives and may risk overlooking the more significant benefits of facilitating B2B and B2E transactions and processes.

	Dimension 1: e-Business relationship models								
	B2C			B2B			B2E		
Case companies	**Dimension 2: Levels of implementation**								
	High	Mod.	Low	High	Mod.	Low	High	Mod.	Low
1. ScottishPower	✔			✔			✔		
2. Scottish & Southern Energy		✔				✔			✔
3. Powergen	✔				✔			✔	
4. LE Group	✔				✔			✔	
5. GPU Power UK			✔			✔			✔
6. TNB			✔			✔			✔

Table 4.9 Level of Implementation for The Dominant e-Business Relationship Models for Each Case Company

The B2B focus was limited and this could be due to the highly complex processes and data transactions with suppliers and business partners, the reservations of all parties with respect to discarding present practices, which are operational and proven to work successfully, and returns on investment, which could not be easily quantified. The B2E initiatives were also found to be in their infancy. One indicator of this was the extent of use of Internet technologies to manage knowledge and disseminate information to employees through Internet access and Intranet retrieval. For most of the case companies, paper-based communications are still the main medium used. Another indicator was the lack of emphasis given to improving internal supporting processes, for example in using Internet facilities in terms of managing financial

resources, reporting of key-performance indicators, managing employee leave applications, meeting room bookings, and delivering online e-Learning.

Further interviews with the case companies have shown that although all of these companies had developed websites as one of their B2C initiatives and considered these to be important, most have found out that these websites at present have attracted fewer customers when compared to the traditional ways of transacting business with respect to customer usage of the online facilities and customer acquisition as illustrated in Table 4.10 (See Appendix A for the interview questions used in this research).

Case Companies	Views on B2C Versus Traditional Method – Interviews excerpt
1. ScottishPower	*"...volume has certainly come in sales through 'door-knocking' compared with the web sales, which by volume are much lower..."*
2. Scottish and Southern Energy	- No comments obtained -
3. Powergen	*" ...Powergen retail business is moving to offer its services and customer interactions online but there is some sceptism about just how fast and how much take up there will be amongst the customer base...so far not that many people out of the 3 million customers account actually want to do online payment using the company website..."*
4. LE Group	*"...we are a fully Internet company with our Virgin brand, for example people could apply, register and pay bills through the company website, but we only got 10,000 customers on the net and we have acquired 200,000 customers with traditional marketing tools at the same time"*
5. GPU Power UK	- No comments obtained -
6. TNB	*"...in comparison with transactions which are coming through the conventional way, currently e-Services does not seem to play such an important role as we wanted it to be"*

Table 4.10 Case Companies' Views on B2C Versus Traditional Methods

Based on Porter's value chain model (discussed in Chapter 2, see Figure 2.8), the e-Business applications implemented by the case companies can be further categorised into six major areas, which include providing e-Services, developing company corporate websites, initiating e-Procurement activities, introducing e-Marketplaces, offering e-Learning facilities for employees, and developing internal knowledge management systems as illustrated in Figure 4.5. However, the number and the extensive levels of these applications varied among companies. At present a lot of

emphasis was given to the e-Services area as listed in Table 4.6 earlier. Figure 4.5 also highlights the fact that based on the case companies' current e-Business value chain activities, most of the companies are not using the advantages of e-Business across the value chain to their full potential in order to achieve corporate and commercial objectives. With the possible exception of ScottishPower, there would appear to be substantial opportunities for increased emphasis on a range of e-Business initiatives along the value chain to ensure they can benefit further from the e-Business environment.

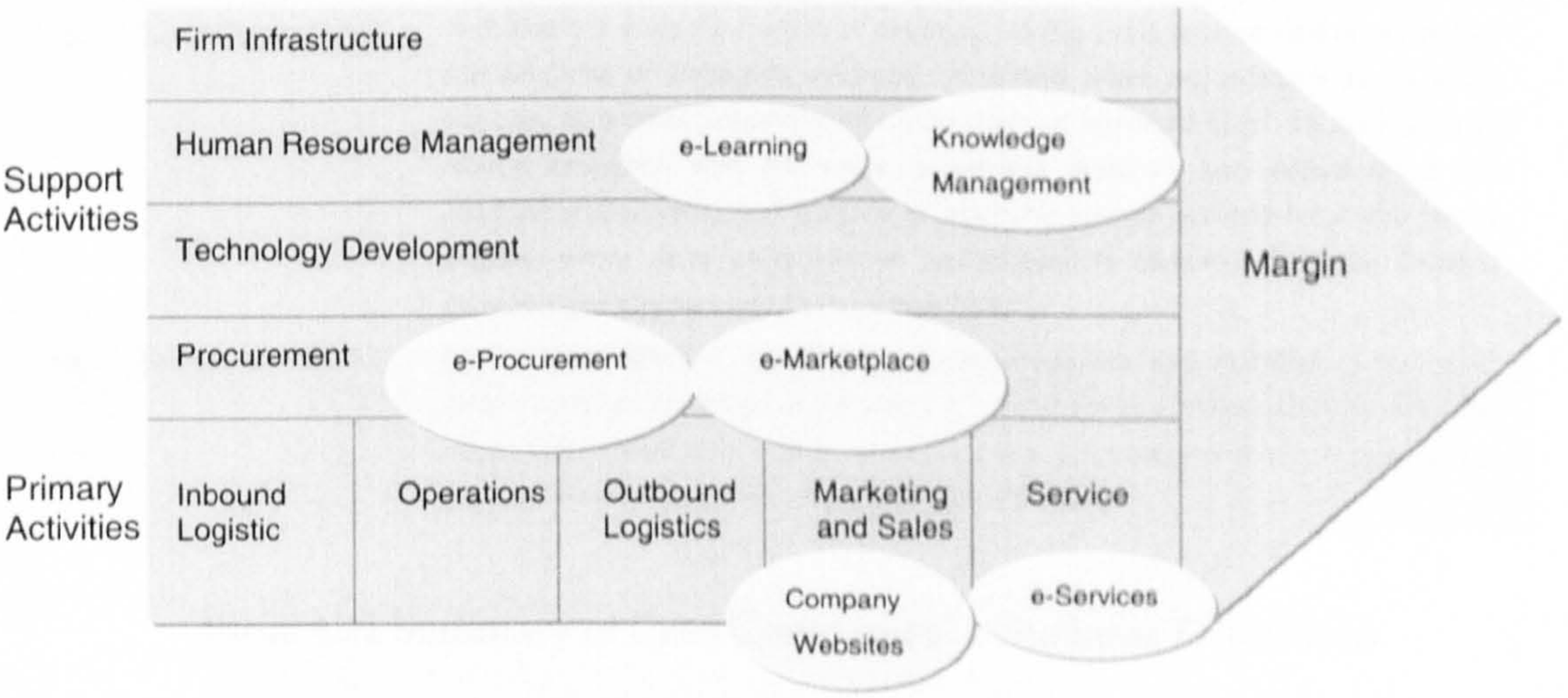

Figure 4.5 Case Companies' e-Business Value Chain

4.3.3 Management styles or perspectives towards e-Business

The case companies' e-Business definitions (See Table 4.11) as well as their views, approaches, and strategies towards e-Business can be categorised mostly into three levels as depicted in Table 4.12. The levels range from a high degree of e-enablement and enthusiasm for the initiatives through to associating e-Business only with technology and having less enthusiasm for this approach.

Case Companies	e-Business Definitions
1. ScottishPower	*"e-Business is an end-to-end business transactions…It is about business and not just technology….It is more than e-Commerce, because e-Commerce is about the financial aspects of e-Business. e-Business than is the end-to-end electronic transactions and communications which encompasses all components of the value chain….e-Business is also about transforming key business processes using Internet technology"*
2. Scottish and Southern Energy	*"e-Business is any form of business communications or transactions using an electronic medium, externally with customers, suppliers and other business partners as well as internally among the employees"*
3. Powergen	*"e-Business is the use of Internet and web style technologies to do normal business. It's not a different type of business, but it's doing the same business a different way and that way are being characterised by its being online and with a heavy emphasis on people serving themselves.*
4. LE Group	*"…e-Business is doing business through web technologies….the ability to connect everyone with everyone through the same standard using web technologies…"*
5. GPU Power UK	*"e-Business is using the medium of electronic trading, using Internet, remote technology and all forms of immediate electronic commerce which are available to us which includes, computers, telephony and other form of communication. Its purpose is to reduce transaction time and costs…e-Business does not only covers things like electronic marketplaces and auctions or electronic reverse auctions but it also covers anything where we're using Internet technologies to transmit information between ourselves and suppliers and it's more than EDI"*
6. TNB	*"In a simple definition, e-Business is defined as the way business is conducted electronically, as compared to the way it is carried out in a conventional manner using paper and involved a lot of manual works… it is a business oriented IT systems that explore the capability of the Internet and Web technology"*

Table 4.11 Summary of Case Companies' e-Business Definitions

	Case Companies					
e-Business Perspectives and Strategy	**Scottish Power**	**Scottish & Southern Energy**	**Powergen**	**LE Group**	**GPU Power UK**	**TNB**
Level 1: See e-Business as an overall holistic strategy supported by high level of enthusiasm and increased organisational involvement of the e-Business projects.	✔					
Level 2: See e-Business as a necessity to give company operational edge but adopt a mostly *"wait and see"* approach towards e-Business implementation.		✔	✔	✔		✔
Level 3: Associate e-Business mostly with technology and have little enthusiasm for it					✔	

Table 4.12 e-Business Perspectives and Strategy

Table 4.12 also sets the tone and reflects the level of e-Business importance for each of the case companies as illustrated in Table 4.13.

	Level of e-Business Importance		
Case companies	High	Moderate	Low
1. ScottishPower	✔		
2. Scottish and Southern Energy			✔
3. Powergen		✔	
4. LE Group		✔	
5. GPU Power UK			✔
6. TNB		✔	

Table 4.13 Level of e-Business Importance For Each Case Companies

From the case study findings shown in both tables 4.12 and 4.13, it was observed that ScottishPower has a very positive attitude towards e-Business and is the only case company that views e-Business as a holistic strategy and has a high variety of e-Business applications implemented and planned for the future. ScottishPower have been seen to take an active lead in many e-Business endeavours such as leading and being one of the founding members of Eutilia, the independent Europe's Utility e-Marketplace, initiating a join-venture with the Royal Bank of Scotland to form a separate pure Internet company called Roboscot (38) Ltd, or R38 for short, and developing an active online Open Learning centre for all its employees. On the other hand, although most of the case companies, which include Scottish and Southern Energy, LE Group, Powergen and TNB, agree that e-Business could help in giving them an operational edge, they are reluctant to follow the active approach taken by ScottishPower (as discussed previously and depicted in Figure 4.2,4.3 and 4.4). These companies prefer to take on what they refer to as the *"wait and see"* approach and will only move forward if there is enough pressure from the market or if there is a strong business case for it. For another case company, GPU Power UK, e-Business is seen as mostly about technology and the company does not foresee itself embarking on active e-Business projects in the near future and rated the importance of e-Business to its overall organisational strategy as low.

The findings from these tables also show that for Scottish and Southern Energy, although the company's e-Business perspectives and strategy is at Level 2 (refer Table 4.12), its e-Business importance with regards to the company overall strategy is rated as low (refer Table 4.13). This can explain that while Scottish and Southern Energy would mainly do what other Level 2 companies would, the company does not rely on its e-Business endeavours as much to show results in terms of return on investment. Scottish and Southern Energy believes that e-Business has a lot of potential but it still maintains its belief that the company's traditional methods of conducting business is presently more profitable and brings value. One indicator of this was the way Scottish and Southern Energy achieves its objectives. For example, one of its main objectives is always to keep operational costs at a minimum while still maintaining high quality. The company feels that this objective is achieved more successfully with its current strategy by eliminating television advertising, minimising the workforce while maximising their work rate, and concentrating their business efforts by only focusing on the UK electricity markets.

Based on the perspectives and approaches taken, this research has also explored what the case companies considered as important when developing and implementing their e-Business initiatives. From the research findings, seventeen main factors have been identified as depicted in Table 4.14. This table also indicates the level of importance rated by the companies for each factors (See Appendix A for the interview questions used to bring together this information).

What are the important factors considered when implementing e-Business?	Level of importance for each factors		
	High	Moderate	Low
1. Costs	✔		
2. Expected returns	✔		
3. In line with overall organisational strategy	✔		
4. Consistent with the company's technology strategy	✔		
5. Provide a "strong" business case	✔		
6. "Appropriate" to current market condition		✔	
7. Customer's needs		✔	
8. Technology e-Readiness and availability		✔	
9. Environment e-Readiness			✔
10. Employees e-Readiness			✔
11. Competitive edge	✔		
12. Systems' integration		✔	
13. Value creation / Provides value	✔		
14. Long term returns			✔
15. Ease of use		✔	
16. Reliability	✔		
17. Security	✔		

Table 4.14: Important Factors Considered When Developing and Implementing e-Business

At present, the case companies mainly view e-Business in the same way as other business ventures. Table 4.14 shows that as in any business venture the *"cost"*, *"expected returns"* and *"provide a strong business case"* were also considered highly important factors when developing and implementing any e-Business strategy. These factors are made more relevant as the results of e-Business implementation are not easily quantifiable especially in the short term, thus making it difficult for the companies to justify the costs involved in embarking on any e-Business project. This has resulted in most case companies investing in e-Business cautiously and also mirrors the findings from Table 4.12 where companies prefer to adopt a *"wait and see"* attitude.

"In line with overall organisational strategy" and *"consistent with the company's technology strategy"* factors were also rated high. This possibly shows that the senior management of these companies realise fully that venturing into e-Business means that they need to seriously look at their overall and technology policies, and should put greater emphasis on examining their current systems, technology infrastructure and business processes before embarking on these projects. Due to the understanding that e-Business is a major undertaking many companies therefore feel that the three factors discussed previously are highly relevant. The companies also feel that e-Business should give them a *"competitive edge"* and help to *"create value"*. However, presently the findings show that most companies are not yet fully confident in the potential of e-Business to provide these benefits.

Value creation can also be tied in closely to the organisation's forward-looking image. A venture into e-Business could attempt to indicate to stakeholders, and especially customers that the company is innovative and dynamic. Even in a company where e-Business initiatives were rejected based on what the company considered as justified reasons, the company may still be perceived as not moving with the times and not being modern. Thus, many companies are eager to show that they are into e-Business although they are not really prepared to invest in it heavily at present mostly due to the factors discussed above.

Most companies rated the *"appropriate to current market condition"* and *"customer need"* factors at a moderate level of importance. These findings may be the reason why it was seen that there is a lack of initiatives on research conducted specifically to determine customers' needs and current market situation. This could be the cause of some of the unsuccessful e-Business implementations in the case companies. For example, ScottishPower's early termination of its R38 venture, LE Group's disappointment with its Virgin brand, Powergen's problems with its e-Payment system, and GPU Power's frustration with its e-Procurement application.

"Technology e-Readiness" and *"ease of use"* were rated as having a moderate level of importance, as most companies are convinced that the technology gap between where they are at present is not too far away from the technology they need to employ when they embark into e-Business projects. They also feel that the current availability of the

technology for most of the e-Business endeavours is at its maturity stage of readiness. The companies believe that e-Business technologies are flexible enough to accommodate their applications as well as their employees', business partners' and customers' skill levels.

Consequently, *"employee e-Readiness"* and *"environment e-Readiness"* were rated as having a low level of importance. One indicator of this was the research finding that most case companies admitted to not having any specific training or programme designed to create e-Business awareness or to increase e-Business skills for their employees or business partners. As discussed earlier, this could be because companies feel that they either can manipulate the environment and their employees to suit their e-Business initiative relatively easily when the need arises, or they could have failed to realise that their business partners and employees must already be prepared or trained to operate and deal in the e-Business environment from the start. The effect of this could be that when they want to start delivering e-Business projects, they may find that their ability to achieve the desired benefits is hampered by the lack of employee exposure and skills as well as lack of support from their business partners to be involved in these endeavours.

At present, companies mainly do not feel that *"long term return"* is an important factor in determining their e-Business initiatives. This is possibly due to their perception that e-Business ventures are not in the same category as their other *"big"* endeavours, for example when deciding to buy a power station or to merge or acquire another company. e-Business efforts are mostly viewed as short term projects with shorter project life cycles when compared to their other *"big"* ventures, and should provide them with *"immediate"* returns. These companies also feel that long term returns are not relevant to their e-Business projects, because to them Internet technologies are constantly evolving and they would need to constantly invest in e-Business to keep ahead. This may not be something that they are prepared to do for now, and thus do not look too far ahead with regards to the returns expected from their e-Business implementation.

Finally, Table 4.14 also shows that e-Business *"reliability"* and *"security"* are important factors for the companies in order to maintain their integrity and the trust of their

customers and other stakeholders. Lack of reliability and security in their e-Business applications may lead to disruption of services and breach of confidentiality of sensitive information. However, most companies as well as their customers currently do not have a high level of confidence in both these important factors in their e-Business applications, which may contribute to the reservation of companies to fully implement and invest more resources in their e-Business initiatives at present.

4.3.4 e-Business as a possible business solution for electricity utilities

As described in previous chapters, it was seen that there have been various changes in the electricity utilities' business environment worldwide albeit at different phases depending on their geographic region, economic environment, and government policies. These changes include privatisation, deregulation, convergence, and disaggregation, which are some of the reasons that have driven these companies to redefine their structure and their position in the markets. These dynamic environments may require the companies to refocus their strategy especially on increasing efficiency regarding cost and customer services. This means that there are some areas of their business operations that need new ways of working, which include taking into consideration the impact of e-Business and finding ways to realise the full potential of e-Business in the electricity utilities.

In order to assess the possibility of e-Business as one of the business solutions for the electricity utilities, PricewaterhouseCoopers's new competitive forces model (Treadway and Valocchi, 2000) (discussed in Chapter 2, see Figure 2.24) was used to analyse the influence of the e-Business environment on the electricity companies by identifying the possible impact of e-Business on each of these forces. Looking at the new competitive forces analysis, questions on how e-Business will influence the competitive position of the electricity utilities have been explored as discussed below:

Connectivity with customers: e-Business with the Internet has helped provide customers with easier access to details on their energy usage especially the ability to make comparison of prices between various suppliers using the online energy savings calculator provided by most energy utilities corporate websites.

Transparency of information for the consumers was also facilitated by the regulator, Ofgem, and provided by energywatch, an independent gas and electricity consumers watchdog, which carries out price comparisons between suppliers for the benefit of electricity and gas customers. Customers are also more aware of the variety of choices and capabilities of their energy suppliers, and combined with a less complex switching procedure and low switching cost, customers' power is considered high in the new competitive power markets.

Connectivity with suppliers: The introduction of e-Procurement and e-Marketplaces has given the case companies wider options of choices to select from both local and international suppliers. This can be seen as having the effect of reducing the bargaining power of the current suppliers and increasing the bargaining power of the customers (in this case being the utility companies). According to one of the case companies, suppliers feel that there will be increasing pressure from buyers for them to lower their prices and offer the best price possible if the transactions are done online through e-Marketplaces. Therefore suppliers are quite reluctant to enter online marketplaces and are finding ways to avoid having e-Marketplaces. To achieve this, some of the suppliers are developing their own Internet sites and their own online catalogues and campaign for utility companies to work directly with them through their private e-Marketplaces instead of going through the more public e-Marketplaces like Achilles or Eutilia.

New offerings and competitors: e-Business can facilitate entry into the new electricity open market both locally and internationally especially in the electricity services areas. For example, it can be observed that the Internet has already opened the door to new players in the UK market who have come in with an online service offer. Some of them combine online services with traditional accounts while others are pure Internet companies. The new arrival companies such as Servista (see *http://www.servista.com*) and Amerada (see *http://www.amerada.co.uk*) are already active with Internet accounts while broker initiatives such as buyENERGYonline (see *http://www.buyenergyonline.com*) offer competitive energy tendering for business customers.

Alliance/Partner Relationship: As discussed in Chapter 2, there are various reasons why companies are forming alliances and these reasons include to obtain technology, to gain access to specific markets, to reduce financial risk, and to reduce political risk (Elmuti and Kathawala, 2001). Also, alliances were formed to achieve competitive advantage where many companies are engaging in co-branding and joint marketing to make offers that cater more to their customers' needs, which each company alone might not have had the expertise to carry out before. e-Business has introduced another channel for requesting energy services, in which customers can now find out about the various choices of energy suppliers online, apply and register online, request their bills online, as well as manage their account and make payments online. These types of services were first introduced by the new pure online companies such as Servista and Amerada discussed earlier, and are now also provided by existing established utilities in order to remain competitive and also to be seen as *"moving with the times"*. For example, in order to provide online facilities for its electricity services, LE Group has set up an alliance with Virgin to form a company called Virgin Energy, which operates as a pure online energy supplier.

Existing competition: The privatisation and deregulation of the power market in the UK has generated intense competition among the existing players and has brought down electricity prices. The fight to win over customers and increase customer bases has led to an increase in the number of mergers and consolidation among companies. Local and international acquisitions and take-overs has also been high. The companies were also keen to try and differentiate themselves from their competitors by increasing the capabilities and functionalities of their customer services. e-Business can play an important role in this area in order to create efficient and customised customer services. Interactions with suppliers and business partners are other areas where e-Business can play an increasingly important role to help provide and improve integration. Competition mostly occurs in the generation and supply business and this is where most e-Business applications are extensively employed in the electricity industry. The transmission and distribution companies operate in a regulated monopoly environment due to technical impracticalities of having parallel power systems and do not have rivals. However, these companies *"compete"* with the pricing formula given by Ofgem and there is a constant push for efficiency in order to remain profitable. e-Business has a potentially important role in this area, for

example in integrating the processes of internal operations and suppliers procedures within the procurement activities.

Summarising the above analysis, e-Business can influence the five competitive forces (Porter, 1985; Treadway and Valocchi, 2000) in the following ways:

- Decrease switching costs
- Increase transparency of information within the market, which leads to increased competition
- Information and service aspect of the industry gains importance to add value

These influences have increased the overall competitiveness in the industry and the competitiveness among the existing players.

Based on these competitive forces, the case companies current strategies can also be analysed using Porter's (1985) framework of competitive strategies (see Figure 4.6). In this framework, Porter emphasises that there are three generic strategies for achieving above average performance within an industry, which consist of *"cost leadership"*, *"differentiation"*, and *"focus"* with the variants of *"cost focus"* and *"differentiation focus"* strategies as describe in Table 4.15.

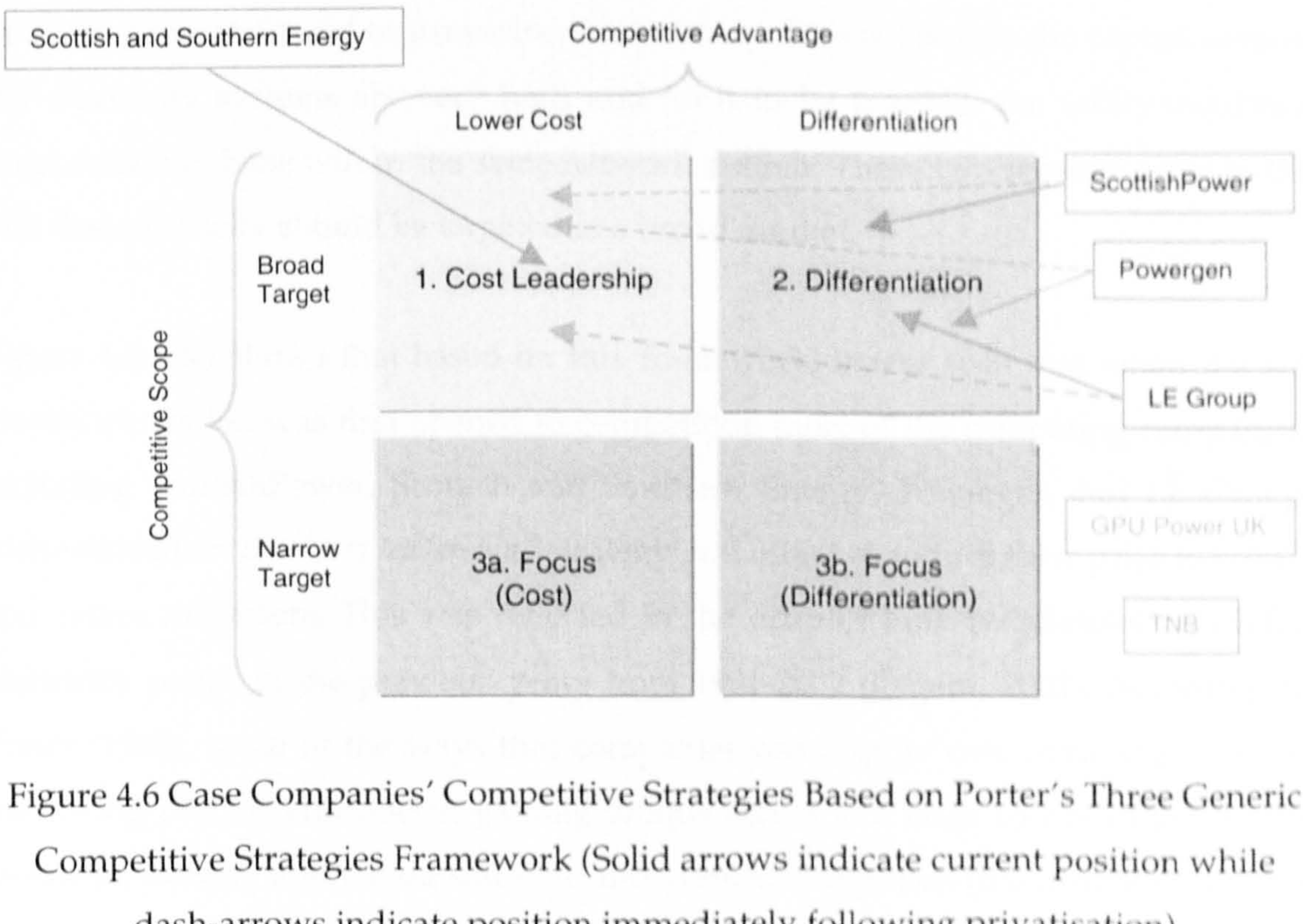

Figure 4.6 Case Companies' Competitive Strategies Based on Porter's Three Generic Competitive Strategies Framework (Solid arrows indicate current position while dash-arrows indicate position immediately following privatisation)

Competitive Strategy	Description
1. Cost Leadership	In cost leadership, a firm sets out to become the low cost producer in its industry. The sources of cost advantage are varied and depend on the structure of the industry. They may include the pursuit of economies of scale, proprietary technology, preferential access to raw materials and other factors. A low cost producer must find and exploit all sources of cost advantage. If a firm can achieve and sustain overall cost leadership, then it will be an above average performer in its industry, provided it can command prices at or near the industry average.
2. Differentiation	A differentiation strategy calls for the development of a product or service that offers unique attributes that are valued by customers and that customers perceive to be better than or different from the products or services of competition. The value added by the uniqueness of the product may allow the firm to charge a premium price for it.
3. Focus	The generic strategy of focus rests on the choice of a narrow competitive scope within an industry. The focuser selects a segment or group of segments in the industry and tailors its strategy to serving them to the exclusion of others.

Table 4.15 Summarised Descriptions of Porter's Three Generic Competitive Strategies

(Source: Porter, 1985)

Using this framework it can be observed that in general, case companies mostly employed two of the competitive strategies, which are *"cost leadership"* and *"differentiation"*. With reference to the electricity markets, there are two reasons that limit a company to employing either of these strategies. Firstly, electricity is not a niche product and is used by almost everyone. Secondly, the economies of scale apply in generation and transmission of electricity. This is because the capital costs of the electricity systems are very high and for it to be feasible, the utility requires a large customer base within the same network system. These two reasons point to the fact that electricity should be targeted at a broad market.

Figure 4.6 also shows that based on this framework, it was seen that when the UK electricity market was first opened to competition most of the competing companies, including ScottishPower, Scottish and Southern Energy, Powergen and LE Group, concentrated on the *"cost leadership"* strategy and opted to reduce their price to attract and retain customers. This was reflected in the drop of bulk (wholesale) and retail electricity prices in the previous years from 1991-2002 (Ofgem, 2002). According to Porter (1985), some of the ways that companies can acquire cost advantages are by improving process efficiencies, gaining unique access to a large source of lower cost materials, making optimal outsourcing and vertical integration (the degree to which a company owns its upstream suppliers and its downstream buyers or customers)

decisions, or avoiding some costs altogether. If other competing companies are unable to lower their costs by similar amounts, the company that employs the most effective *"cost leadership"* strategy may be able to sustain a competitive advantage.

Based on the above *"cost leadership"* descriptions, it can be observed from the research findings that Scottish and Southern Energy is still a firm believer in the *"cost leadership"* strategy and is still employing this strategy to stay ahead. This is mostly because it has the advantage of the economies of scale by having five million customers in the UK (refer Table 4.1). Some of the other characteristic of a *"cost leadership"* adopter that can be seen from Scottish and Southern Energy include its emphasis on using cheaper hydro generators as compared to fossil fuel and nuclear units, and its capability of having easier access to hydropower (mainly due to its generating asset's strategic geographical location), which is a cheaper electricity resource. The company also emphasises thinking *"commercially"* by avoiding certain costs such as television advertising costs and the cost of retaining a large number of employees.

However, each generic strategy has its risk, including *"cost leadership"*. For example, other companies may be able to lower their costs as well. One of the drawbacks of employing the *"cost leadership"* strategy in the electricity industry is that without a large customer base, the profit volume may be small. As the market progresses, companies can build on their experience and for some companies such as ScottishPower, Powergen and LE Group, there is a distinct trend of moving away from the *"cost leadership"* strategy to a *"differentiation"* strategy.

In the case of ScottishPower, the company aims to be different by improving and enhancing its customer services capabilities. Part of its efforts in doing this includes extensive investments in e-Business applications, as discussed in the previous sections. The company also decided to only concentrate on the energy business, as it believes that it could capitalise on its vast experience and expertise in this area and make the most of the *"opportunities within the new UK energy trading arrangements"*. ScottishPower also believes that the company would benefit more by concentrating on the energy business because it feels that *"value is not in becoming multi-utilities"* and *"the long term returns from cross-selling were not proven"*. Powergen on the other hand

believes in differentiating by selling more services to its customers by becoming a multi-utility company. According to Powergen, *"...one of the routes to be sufficiently efficient in scale in order to be able to compete with your competitors is to sell a broader range of product to the people who are already buying your electricity..."*. Powergen aims to be the only utility company that customers need. However, both companies feel that they can maintain a competitive edge by also having international businesses and ventures.

Differentiating through improving customer services was also the route that LE Group had taken. The company claimed that it has the best quality of customer service when compared to other utilities in the UK. It was rated by Ofgem as the leading energy company in terms of customer service quality. According to LE Group, in early 1994 it lost forty percent of its customers due to lower competitor prices. However, two of its main customers (large power consumers), Safeway and Thames Water, switched back to LE Group because they were unable to get important information from their new suppliers that they used to obtain from LE Group's services. This information included accurate details on energy consumptions at each of the companies' different sites or branches, as well as aggregated information on the companies' energy usage at the group level. According to LE Group, customers' needs are changing and they are now placing importance not only on price but also on the type of services provided as explained by the respondent, *"...even if we were not maybe the cheapest, but they thought that our customer service was better, so it is changing now, customers start to realise that price is one thing but good customer service for example good quality of billing, quality information, is also something very useful"*.

Since this framework is looking into strategies in a competitive environment, it is not considered applicable to companies operating in a monopoly environment such as GPU Power UK and TNB. Therefore, these companies' organisational strategies are not discussed within this framework.

This research has also explored what the case companies perceived as the main problems or difficulties faced in implementing their current e-Business projects and in using these applications effectively. The research findings include the identification

of sixteen issues, which were considered as the main problems with varying degrees of seriousness as depicted in Table 4.16 (See Appendix A for the interview questions used to bring together this information).

What are the problems or difficulties faced in implementing e-Business or using e-Business applications effectively?	The degree of seriousness of each problems		
	High	Moderate	Low
1. Systems integration	✔		
2. Systems migration from old to new	✔		
3. Data coordination from legacy and new systems	✔		
4. Lack of top management support or involvement	✔		
5. Lack of e-Business appreciation and awareness		✔	
6. Not convinced of e-Business potential		✔	
7. Lack of Funding/Budget/Costs	✔		
8. Employees or management resistance to change		✔	
9. Existing IT infrastructure	✔		
10. "Cultural" barriers		✔	
11. Shorter implementation time		✔	
12. "Wrong" department leading the e-Business project	✔		
13. "Trust" issues		✔	
14. Legal issues (example: data protection act)		✔	
15. Lack of "training" and "exposure" programmes for managers and other personnel		✔	
16. Limited or lack of knowledge and experience	✔		

Table 4.16 Degree of Seriousness of the Problems Faced in Implementing or using e-Business

"Systems integration", *"systems migration"*, *"data coordination from legacy and new systems"*, and *"existing IT infrastructure"* were rated with a high degree of seriousness in terms of hampering the case companies' e-Business efforts. These findings highlighted that although technologies undoubtedly provide the mechanism for e-Business, they were also seen as obstacles in the form of the above issues. Most of these companies thought that their legacy systems were a disadvantage that slowed their progress towards an e-Business environment. The belief was repeatedly

articulated that the introduction of e-Business would also necessitate the replacement of existing information systems, at a significant cost and disruption. Further, these issues were made worse by the fact that getting funding for e-Business projects for most of the case companies was not easy. Hence the high level of seriousness for the *"lack of funding or budget"* listed in Table 4.16. Most electricity utilities were seen to consider the cost of e-Business projects to be high and that budget and investment allocation for the companies would be more necessary for other ventures since it was felt that the electricity business is still a fairly industrialised business where the companies perceived that *"hard skills"* would generate more cash.

Lack of funding for e-Business initiatives for these companies could be due to the *"lack of top management support"*, which may be because they are *"not convinced of the e-Business potential"* and were having difficulty in quantifying the long term returns of e-Business and difficulty in understanding the scope of what e-Technology could achieve as discussed in the previous sections. This could also be seen as one of the issues listed in Table 4.16 as *"lack of e-Business appreciation and awareness"* within the industry at the moment, which could also be caused by *"employees or management resistance to change"*.

The problem of *"cultural barriers"* within the case companies is also considered as having a high degree of seriousness in delaying any e-Business initiatives or using current e-Business applications effectively. For example, some managers found that it was not economically viable to forego or change successful existing systems for unproven new e-Business applications such as e-Procurement systems. *"Lack of training and exposure for managers and other personnel"* has also led to a significant concern regarding e-Business skills shortages and lack of e-Business appreciation. It was observed that, if top management were not convinced of e-Business potential, then the e-Business strategy for the company would remain unclear. This could mean that the training and development programmes to create e-Business awareness and to nurture necessary skill sets for employees will not be in place and employees will have *"limited or lack of knowledge and experience"* to help the companies to venture into the e-Business environment successfully.

Because of the perceived notion of most of the case companies in this research that the main focus of e-Business activity was e-Commerce, which meant B2C applications, e-Business was then seen as something, which should be owned and driven by the marketing department. Although, B2C marketing will most probably benefit from the existence of an additional channel to market, some companies have started to feel that marketing is the wrong department to lead the project as was pointed out by one of the managers in ScottishPower that *"marketing personnel who did not have full understanding of the technical challenges required to implement e-Business strategy was one of the difficulties faced by ScottishPower"* in carrying out their e-Business initiatives. Thus, *"wrong department leading the e-Business project"* was also rated as having a high degree of seriousness in delaying electricity companies' e-Business endeavours.

Another issue highlighted in Table 4.16 shows that electricity companies are still having some difficulties adjusting to the *"shorter implementation time"* of e-Business projects and are feeling pressured to complete these projects speedily. Electricity utilities usually come from a traditional background where they operated in a monopoly, government controlled environment. They are more used to handling big and long-term projects, such as building power stations, erecting transmission lines, and installing distribution cables, which usually take a few years to complete, inclusive of performing environmental impact analysis and processing land acquisition. This could be one of the reasons why most of these companies do not believe that they can adapt fast enough to capitalise on the emerging e-Business models such as B2B exchanges and e-Marketplaces that have been created to enable buyers and suppliers to interact seamlessly. Most managers of the case companies said that they could not envisage their organisations transforming quickly enough to make the required changes to deal in this environment.

Finally, Table 4.16 also underlines that *"trust"* and *"legal"* issues are also considered as factors slowing down case companies' e-Business initiatives. For example, most of the companies expressed that one of the reasons that they were not attracting as many customers as they would like to their online services was due to customers' reservations on the security of using these facilities. The companies' own survey shows that most customers at the moment are still not convinced and are having difficulties in trusting electricity utilities' online systems and mostly feel that it would

be difficult for these companies to find and provide evidence for criminal activity such as electricity fraud, which involves tampering of a customer's electricity account by impostors.

Based on the findings from the case companies selected for this research as discussed previously, it could be observed that currently e-Business applications such as online customer services, e-Procurement initiatives, and internal organisational knowledge management systems to promote self service operation, have been partially implemented or are in the planning stage within these utilities. Electricity utilities, however, are currently focussing the majority of their efforts and attention on their B2C initiatives, and in the main, overlooking the B2B and B2E models that could transform the way that industrial and commercial energy is transacted. Then again, it could also be observed, that most electricity utilities are starting to recognise the organisational change opportunities from e-Business initiatives. These applications were considered to provide internal strength for these companies and if their full potential were maximised they could help companies achieve their corporate and commercial objectives. Some of the opportunities provided by the strength of these applications include improved and more efficient customer services, an increase in organisation operational efficiency, providing platforms for strategic alliances and collaboration across and between organisations, and an increase in employee motivation levels through the process of empowerment and easy access to information.

However, to realise these full potentials, there are barriers that need to be overcome or eliminated. Electricity utilities need to be able to find ways to overcome current problems faced in their e-Business initiatives as mentioned earlier. To do this they need to bridge the gap between current thinking and true e-Business enabled potential. In the short term, e-Business has the potential to enable electricity utilities to reduce their operational costs still further and to respond to the drivers of increased competition, industry convergence, and regulatory pressure more effectively. In the long term, e-Business could enable the development of new market models and lead to a broader range of players operating in the energy marketplace. Failure to address these challenges could be highly risky.

It was seen that there are potential threats to electricity companies if e-Business impacts were ignored. These could include facing the risk of being at a competitive disadvantage, which could also lead to a risk of being taken over by companies from within the country or by bigger and stronger foreign utilities. Without the appropriate level of e-Business strategy, electricity utilities could fail to maintain their market positions and competitiveness. To ensure sustainable competitive advantage, companies may need new visions, skills and performance capabilities. They may also need to take a broader view of the challenges and opportunities offered by e-Business and e-Technologies, and the changes that these will inevitably bring.

Figure 4.7 summarises the SWOT analysis conducted in identifying the above issues and discussions.

Figure 4.7 e-Business in Electricity Industry – an Overview of SWOT Analysis

4.4 Conclusion

Currently, it seems that in a deregulated electricity environment as depicted from the UK cases, competition, especially in the supply business, is high, and ensuring customer satisfaction is important as customers are now increasingly looking for more efficient services, since from their perspectives the same electricity is flowing

through the wires, irrespective of whichever supplier it is from. Therefore, finding the most efficient ways of doing work is crucial. Deregulation also comes with its own disadvantages. For example, it was claimed that too much competition due to deregulation has opened up the UK market so much that there is fear that soon there will be no more national champion for the country in this industry. Too little deregulation and competition on the other hand, as shown from the situation in the Malaysian electricity environment, may prove to be detrimental. A monopoly situation could drive companies to complacency and inefficient operations. The mindset and attitude of the employees demonstrates a lack of urgency. Customer satisfaction is not a major issue and service standards are based on what the company thinks would be good for the customers with no formal and extensive studies on customers need being conducted.

The research findings have shown that there were clear differences between the UK and the Malaysian environment. Overall, electricity companies in the UK are much more advanced in terms of their readiness for change, which includes higher level of e-Readiness, e-Business strategy development and implementation, and responsiveness of their ICT departments. These differences could be due to several reasons such as the status of market regulation, liberalisation and competitiveness, the level of Internet penetration at work and home as well as Internet access policy of the country, management styles, perspectives, and background especially concerning e-Business, and cultural attitudes to the adoption of new technology.

From the research it could also be seen that the opportunities for electricity utilities to harness the strength of the e-World and to protect their competitive position are there to be realised. Experiences from other industries such as the telecommunication, banking, transportation, and travel industries could help in providing focus and framework for the e-investment in order to benefit from this environment. A structured assessment of the existing way of doing things in every part of the electricity business, and a review of the potential for improvement through the adoption of e-Technology, could provide a good starting point and help to ensure a broad and inclusive view of the opportunities. The following chapter will discuss the implications of the findings from this chapter within the context of the literature with regards to the theory, policy and practice.

Chapter 5: Conclusions and Implications

5.1 Introduction

In this chapter the conclusions and implications of the research findings analysed in Chapter 4, are discussed within the context of the industry, specifically the case companies of the research, as well as within the context of the literature as reviewed in Chapter 2. The objectives of this chapter are to discuss the research's contributions to knowledge with regards to e-Business strategy and its implementation within the electricity industry.

As discussed in Chapter 2, in most parts of the world, the electricity industry is going through a period of extensive change. After a long period of government ownership and heavy regulation, most electricity companies have now become competitive in an increasingly global marketplace. The efforts to restructure have resulted in the disintegration of the industry's value chain. Generation and supply have become competitive while transmission and distribution often remain regulated. With the removal of regulated rates of return and other past practices, the competitive portions of the industry are increasingly exposed to risk. Many existing players are poorly equipped to deal with new risks such as price volatility. New players, such as buyENERGYonline have emerged to trade electricity and natural gas and to take advantage of arbitrage opportunities where none existed before. At the same time, technological advances in generation, communication, and end-use are fundamentally changing the shape of the industry.

Constant pressure to reduce costs, improve customer service and offer more customised services has resulted in many mergers and acquisitions. The costs of maintaining the infrastructure and investing in information technology have increased the significance of economies of scale to the disadvantage of small players. Equally, pressure to maintain low prices and support diverse customer needs have increased the importance of economies of scope, which has forced many companies such as Powergen to become multi-service utilities.

These developments all represent significant risks for existing players. At the same time they offer new entrants opportunities that did not exist until a few years ago. To thrive in this dynamic marketplace today's energy companies must cut costs, reduce time to market for new products and services, and adapt their business processes. In addition, they must successfully attract new customers while retaining existing ones.

To maintain their competitiveness, companies in most industrial areas are moving quickly to capitalise on the Internet as a medium for conducting business. The growing importance of the Internet has also created a range of new opportunities in the electricity industry especially as seen currently in the supply sector. However, it also represents a major threat for traditional operators, who in the past may have been too slow to change.

e-Business is not just about enabling business interactions over the Internet. Internal networks are equally important. Companies that implement e-Business need to automate all their core business processes across multiple systems and extend these processes to trading partners where appropriate. The main goals of e-Business are to make critical business processes faster, more effective, more dependable and more responsive to changing conditions. All these improvements are as relevant to the electricity industry as in other industries. For example, e-Business introduces the potential for electricity companies to achieve goals such as gaining all round visibility and control of information across the organisation, developing closer and more transparent relationships with business partners and customers, reducing administrative costs, and helping to respond rapidly and effectively to changes in regulatory and business environments.

5.2 Conclusions On Each Research Question

In this section, findings on the main research questions are discussed further and summarised based on the analysis conducted in Chapter 4.

5.2.1 RQ1: What are the implications of e-Business for the electricity industry

It can be observed that when an industry goes from being heavily regulated by the government to being deregulated, or even partially deregulated, the value of information increases significantly as has been the case of the telecommunications and airline industries (Howe and Cuccaro, 2001). For example, in the airline industry, information such as the ticketing pricing formula (which depends on time, location, class, airline type, and travel agent details) is some of the vital information that have helped the industry in the areas that have been affected significantly by competition such as *"significant lowering of distribution costs"* (mainly distribution of airline tickets) and the *"considerable expanding of the direct relationship between the airlines and their customers"* (Pappas, 2001). In the electricity industry the importance of information is also increasing as electricity companies face new information demands due to the pressure of competition not only from the competitive environment but also from regulators and the broader market that includes customers, suppliers, and business partners. These information needs include real time data on the company's own current generation capability, generation costs, competitors' pricing structures, competitors' current generation capabilities, customer power demand, line congestions and network constraints, financial transactions, and competitors' bidding strategies, among others. The need for this information is not just about reporting to investors and other stakeholders. In the long term it is about managing the company more effectively. With the introduction of competition, electricity companies need to develop strategies not only to retain their existing customers but also to expand their customer base and increase market share.

In the regulated monopoly model of the utility industry, utilities tried to minimise their information technology (IT) investments for several reasons. First, because there was no assurance that regulators could be convinced of the need for sophisticated IT systems and the recovery of considerable investments in IT was therefore uncertain. Second, there was no clear-cut way that regulated utilities could make profits from investments in IT because in most regulations for utilities, any profits earned from investments such as IT systems were either completely or partially shared with

customers by means of electricity rate cuts. Therefore the desire to make these investments was not particularly attractive to the electricity utilities.

In the deregulated model, new sets of rules have been developed for providing electricity. The industry has become more competitive especially in its generation and supply sectors and to support this competitive electricity marketplace a high degree of infrastructure change must take place, such as in the areas of:

- *"Electricity balancing and settlement systems"*: For electricity balancing and settlement systems, issues such as how to coordinate usage of the transmission system by multiple suppliers and customers need to be dealt with. Under vertically integrated monopolies, since one company produced and delivered the electricity, there was not much of a problem in determining how much each customer used and how much to bill that customer. However, in the deregulated system, multiple suppliers are selling electricity to many different customers and there is a need to find ways to determine which electricity supplier has provided electricity to which customer and how much money each customer should pay to the supplier. This is known as balancing and settling.
- *"Customer services and marketing"*: Customer services and marketing are becoming increasingly important in the competitive electricity industry. In the past, vertically integrated utilities installed customer services and marketing systems with the primary concern of ensuring that customers' use of the product was accurately measured, priced, and billed. The utilities were also concerned with receivables such as cash receipts, credit, and collections. For traditional utilities, the business environment had not changed in decades and, because of this, little innovation was necessary in the customer services and marketing areas. Efforts were more focused on engineering and financial issues. However, in the new competitive environment and in the information economy, electricity utilities are redefining their definition of successful customer service. Customer services vary depending on the business focus of the company. For example, the transmission and distribution businesses may decide to provide their customers with real-time information regarding the performance of their networks. In comparison, companies focussing on the energy supply business may be interested in providing a twenty-four hour self-service capability over the Internet such as

online application and registration, online bill enquiries and payment, and online account management (meter-reading, history of electricity usage, etc.).

- *"Automatic metering systems"*: Automatic meter reading (AMR) has been around for quite a long time. Traditionally, a team of meter readers would walk daily routes to manually read the utility's meters, and then report those results at the end of the day. This was most frequently done through a handheld computer that resembles a very large palm-computing device. In contrast, AMR approaches the problem of collecting electricity consumption information through more embedded and networked methods. For example, a sophisticated Cellnet system utilised cellular technology to report data back to a central data clearinghouse, or a semi-automated system where a vehicle drives by, sensing the consumption statistics on the premises from several yards away (Howe and Cuccaro, 2001). Since AMR are less reliant on human activity, they are theoretically more accurate and timely. In a monopoly environment, investments in AMR were seen as unnecessary and unjustifiable. However, in more competitive power markets, there is a need for increased emphasis on accuracy and timeliness of data. Therefore the need to consider AMR has become more important. The need for AMR equipment for smaller customers cannot be justified financially at the time of writing due to the small energy transaction values. However, there is a growing trend to implement AMR equipment for large power consumers (LPCs). AMR facilitates timely and accurate meter reading capability and this can help both utilities and customers. In the case of the utility companies, AMR assists not only in their billing processes but can also provide sufficient information on consumer consumption trends in order to help utilities plan their forward energy contracts. Also, information from AMR systems can help utilities optimise their transmission and generation systems. For example, the information gathered from customers' readings can be aggregated to form a localised demand profile to help utilities plan for future substations or transmission expansion. AMR devices can benefit large power consumer customers who pay wholesale market electricity prices as they can immediately see how much electricity they are using and how much it is costing them, and this allows them to adjust their load profiles accordingly and helps reduce their energy payments.

The structural changes in the energy industry are driving change in information needs and associate systems for the electricity companies, and e-Business concepts were seen as possible solutions to these needs. From the research findings it can be observed that the electricity utility industry is also not immune from the impact of e-Business. Websites have been built, energy marketplaces and global portals are emerging, particularly for joint procurement, and there are also various Internet-based projects and applications taking place within the electricity industry (as summarised in Table 4.5 in the previous chapter). But beyond the building of these websites and applications, the question asked in this research is, what is the evidence that electricity utilities are making the most of e-Business and are ready to meet the challenges?

When it comes to e-Business implementation, experience from other industries has shown that e-Business can lead to reduced time frames (from years to months) for product and service development (Rodgers et. al, 2002). For example, in the car industry, Rover used electronic product definition and links with suppliers through the RED-X programme to deliver six-month reductions in production introduction time and a seventy-five percent (75%) reduction on building time (Norton, 2000). This has brought with it a new management dynamic for both business and systems development. The cost reduction potential and new business models of e-Business could provide on the one hand an opportunity to improve business performance and maintain competitiveness and, on the other, a threat from the non-traditional players that take the e-Business lead and overpower the incumbents. Without the appropriate level of e-Business strategy, the requisite level of skills, and project alignment, utilities could fail to maintain their market positions and competitiveness.

Electricity companies need to keep pace with the changes around them in order to survive and grow. This requires stamina, new skills and appetite for adapting even further, supported by an understanding of what is realistic to achieve. Within the environment of the electricity industry, this research demonstrates that e-Business is not an end in itself, but it is more of a means to an end. The basics of corporate and business strategy still apply and the requirement for structured implementation persists. Therefore, in terms of e-Business strategy, the key is to ensure that the e-Questions are asked of each and every business unit and activity within the

organisation. This needs to be done within a structured and co-ordinated framework (such as the ones suggested in section 5.2.4, 5.5.1, and 5.7) to ensure that appropriate priorities are set.

To summarise, the deregulated electricity industry has introduced a new competitive business environment in the electricity industry. Companies need to adapt quickly to this dynamic environment and e-Business has emerged as one of the possible solutions for companies to maintain their competitive advantage. However, just like any other business strategy, e-Business roles and potentials for the companies must be evaluated thoroughly before any implementation takes place. Companies can then decide how much emphasis should be given to it and in which area.

5.2.2 RQ2: What are the potentials of e-Business for the electricity utilities?

Based on the analysis from the previous chapter, Figure 5.1 summarises the potential of e-Business for electricity companies, focussing on the three main models of e-Business discussed in this research, which consist of B2C, B2B, and B2E relationship models.

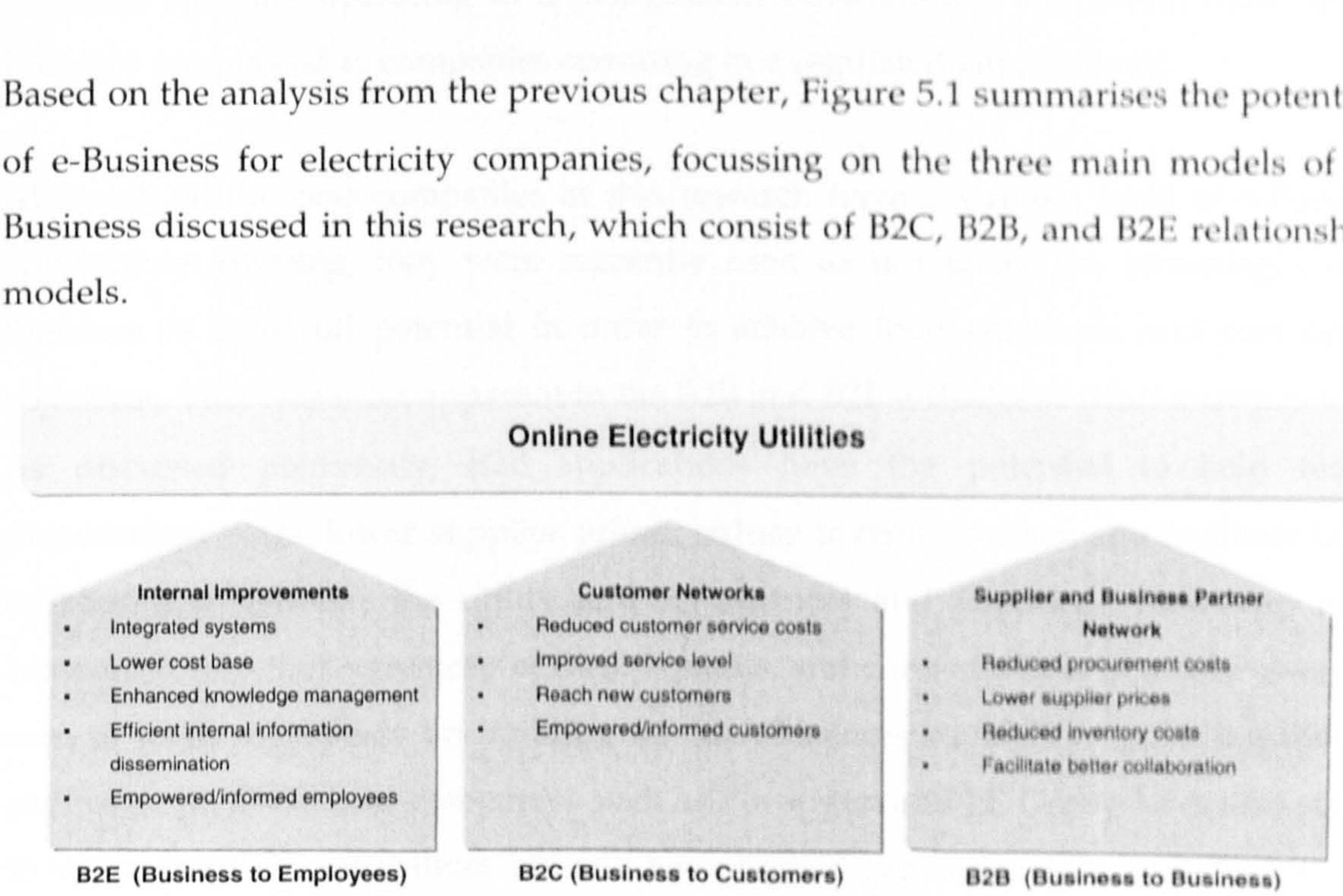

Figure 5.1 Summary of Key e-Business Opportunities for Electricity Utilities

There are varying degrees of effort invested by the case companies in trying to meet the e-Business potentials above. From the research findings analysed in Chapter 4, it can be observed that electricity utilities dealing with bulk and retail electricity sales

have put more emphasis on B2C applications. One of the reasons for this is to project a good image to their customers as being modern and moving with the times. This image is important to the utilities as one of the ways to ensure customers' loyalty and attract new ones, as the main part of their profits comes directly from electricity sales and therefore, they wish to have a high profile in both the physical and online environment. In the case of the more regulated sectors of the industry, such as transmission and distribution, these companies are more concerned with maintaining system efficiency and reliability to meet regulator determined indices. As far as the companies operating in the regulated environment are concerned, their income comes from the successful five yearly negotiations with the regulator rather than the electricity consumers. For example, according to one of the respondents in ScottishPower, in the case of SP PowerSystems (a subsidiary of ScottishPower in the transmission sector), successful negotiations can mean profits of up to £30 billion within five years. Thus, it is safe to conclude that companies with a higher customer exposure who are operating in a deregulated environment will invest more in e-Business as opposed to companies operating in a regulated environment.

Although all the case companies in this research have a varying level of e-Business applications running, they were currently seen as not using the advantages of e-Business to their full potential in order to achieve their corporate and commercial objectives. This was most apparent in the B2B and B2E e-Business relationship models. As discussed previously, B2B applications have the potential to help reduce procurement costs, lower supplier prices, reduce inventory costs, and facilitate better collaboration between the utility and its partners and suppliers. However, many companies were not convinced of these benefits, and currently only ScottishPower was seen to focus vigorously on building up its e-Business capability, including the B2B environment. Other case companies such as Powergen and LE Group have also started to tackle their B2B capabilities but still have limited capacities. B2E applications were also seen to be limited with companies preferring to maintain the status quo with regard to channels for knowledge sharing between employees and the process of handling employee administrative matters. This does not mean that companies do not see the benefits of e-Business in the long term, but rather reflects their belief that B2E applications at present would not bring about significant benefits when compared to the B2C initiatives indicated in Table 4.12 in the previous chapter.

To summarise, e-Business applications were seen to be concentrated on B2C and were mostly undertaken by companies operating in the competitive sectors of the industry. This was because most companies appear to relate to e-Business as a tool to help sell their products. B2E and B2B applications were not pursued actively as many companies do not see these applications as critical at the moment.

5.2.3 RQ3: What are the current approaches and practices of e-Business strategy and implementation in the electricity utilities?

At present, e-Business approaches by the majority of case companies in the electricity business do not quite have the urgency and vigour of other industries such as telecommunications or the financial markets. Companies in other industries such as telecommunications have been seen to make far more sophisticated use of e-Business platforms. For example, many leading telecom service providers use e-Business platforms to support convergent or single billing and CRM applications for voice and data customers. These telecom companies are seeing many benefits from these ventures, including a single view of customers across product lines, customer self-service, and integration of operational support systems with back-office systems. Companies in the power industry also require similar applications. This is because, with e-Business platforms, they have the opportunity to automate their processes to a degree that was not possible in the past. These platforms support the seamless integration of computer systems and business processes throughout the electricity value chain. Studying the experience of the telecom industry may help electricity companies to identify the optimal route to competitive success. Despite various e-Business implementations within the electricity companies, the electricity industry as a whole has been very conservative in its approach to e-Business. Most of the applications used currently are limited in scope and do not make full use of e-Business capabilities.

The research findings show that most electricity utilities appreciate that e-Business can help increase revenue for their companies. However, many of these electricity companies are not fully convinced of the returns on investment when implementing e-Business on a large scale. Consequently, many companies preferred to take the

"wait and see" approach, or view e-Business only as a technology issue (rather than a business one) as shown in Table 4.12 in Chapter 4. In addition, the benefits of e-Business are not very apparent during the initial stages of implementation and companies need to fine-tune their applications before major results can be seen in the medium or long term. The advantage for the *"early adopters"* or *"pioneers"* is that they would have more time to improve their systems as opposed to the *"trend followers"*. Table 4.9 in Chapter 4 supports this statement, where it can be seen that the current level of implementation of e-Business for ScottishPower (which fall into the *"pioneers"* category) is ahead in all business models.

The above discussion shows that companies' approaches towards e-Business were determined by their perception of e-Business. For example, a Level 3 company (see Table 4.12 in Chapter 4) is likely to approach e-Business with more caution unless they can see proof that it is essential for survival. Another factor that determines the companies' approach is the business environment itself. Companies operating in the regulated environment would be more likely to be classified as Level 3 companies and approach e-Business in the same manner (see Table 4.2, 4.3,4.4 in Chapter 4). Based on Table 4.12 in Chapter 4, Table 5.1 illustrates these two factors that help determine companies' approach towards their e-Business implementation.

	e-Business Perception		
Business Environment	**Level 1**	**Level 2**	**Level 3**
Deregulated	✔	✔	
Regulated			✔

Table 5.1 Factors Determining Companies' Approach Towards e-Business

Based on the findings from Table 4.5 in Chapter 4, e-Business practices are concentrated on B2C applications, which can be seen in the development of many customer oriented applications such as online registration, billing, payment and energy calculator. The research findings show that electricity utilities are placing an over-emphasis on B2C e-Commerce activities and may risk overlooking the more significant benefits of enabling B2B and B2E transactions and processes. These

findings are in line with PA Consulting Group (2000) analysis where according to the group, *"utilities are focusing the majority of their effort and attention on business to consumer applications, whereas most of the bottom line gains possible now are in the business-to-business and business-to-workforce (or internal) arenas"*.

Among the case companies researched, at present only ScottishPower can be seen to have implemented a variety of B2B applications such as Internet invoicing, triad (the three half-hours of the year with the highest (peak) electricity demand) warnings and day-ahead forecasts, and have a utility e-Marketplace that buys and sells power transmission and distribution hardware. The company believes that these applications can help improve its communication channels with suppliers and partners and increase its efficiency in business transactions. In addition, ScottishPower have also invested heavily in setting up B2E Intranet sites to disseminate company wide internal information and facilitate knowledge sharing among employees. Other case companies are also looking at improving their B2E and B2B capabilities. For example, it can be seen that both Powergen and LE Group are developing e-Procurement applications to enhance their B2B initiatives. Similar efforts can also be seen to have been made by GPU Power UK with its materials management system.

As discussed earlier, e-Business could provide various opportunities to cut costs through better procurement and supply chain management, facilitate better and faster access to lowest-cost suppliers, more effective field forces and reduced sales forces, greater automation, and increase the ability to outsource business functions. There are benefits to be gained via improved customer services and collection of customer data. For the workforce, improved access to mission-critical systems, linking of remote management teams, and knowledge sharing could be some of the various benefits gained from e-Business B2E initiatives.

However, it is by no means easy to complete the transition to e-Business. Even interim solutions can be labour intensive and time consuming. The process of integrating the company's internal information systems requires a great deal of effort if it involves a mixed collection of packaged and custom applications. The same applies to automating all the processes that coordinate interactions with customers,

employees and trading partners. Furthermore, companies need to continuously analyse these processes in real time so that they can adapt them to support the changing needs of customers. Business processes also have to be tied to the company's information infrastructure. High levels of security and reliability must be maintained when exchanging business information. To meet these challenges, companies need an integrated e-Business platform to support real-time business interactions over both internal and external networks. A comprehensive platform could help make it much easier to automate core business processes across multiple systems and to extend them to trading partners. Scalability is an important feature, because the complete process is built up gradually, often from small beginnings.

To summarise, although the majority of electricity companies appreciate the benefits that e-Business can bring, most companies' approach to e-Business applications were seen to be conservative especially in the B2B and B2E areas, having preferred to take the *"wait and see"* attitude. Implementations of existing applications were seen to be concentrated in B2C as most companies were quick to recognise the potential in that area. Enthusiasm for e-Business and level of implementation are directly related to the companies' perception of what e-Business is.

5.2.3.1 RQ3.1: What can be learned from the current e-Business experiences of these electricity companies?

The electricity companies in this research appear to be very careful in their decision making process in terms of deciding on whether or not to implement e-Business applications. These decisions were made based on their business environment and their organisational focus. So far, none of the case companies has reported any major regrets regarding implementing or not implementing their e-Business plans. However, some electricity companies believe that e-Business ventures may not be entirely suitable for the monopoly components of the electricity supply chain, which include the transmission and distribution companies, and is more suitable for the competitive supply and generation companies.

In this research there are companies with diametrically opposing thoughts on e-Business implementations. There are companies, which believe in it and are willing to

invest, as is the case with ScottishPower. Others are not at all keen, as can be seen in the case of GPU Power UK. In the case of the latter, there is an apparent reason as to why GPU Power did not embark on large-scale e-Business applications, namely that they operate in a non-competitive regulated environment. The company feels that in a regulated environment e-Business does not play an important role. This was seen as one of the main reasons in determining whether or not companies will invest in e-Business.

There may not be much difference with respect to the number of e-Business applications between companies operating in the competitive market (see Table 4.8 in Chapter 4). However, the major difference lies in the perception of e-Business by these companies (see Table 4.12 in Chapter 4). These perceptions determine whether the companies aim to be a *"pioneer"*, *"trend follower"* or a *"late adopter"* of e-Business strategy. This difference of perception also appears to affect the level of implementation of e-Business as indicated in Table 4.9, Table 4.11, and Table 4.12 in Chapter 4. These tables show that the level of e-Business implementation is higher when the company has a positive attitude towards e-Business.

Previous sections have demonstrated that the focus of e-Business applications is in the B2C area. However, it was seen that the take-up by online customers is very low (see Table 4.10 in Chapter 4). According to LE Group only one out of twenty of its new customers were captured online. This is not due to the lack of technology or security but rather to the lack of Internet trust amongst customers and at some part it is also due to the lack of customers' Internet access. Although this is the case now, companies are still maintaining their B2C capabilities, as they believe that online transactions will increase as customers become more comfortable with online transactions and Internet access becomes available to a wider range of customers.

Based on Porter's Three Generic Competitive Strategies framework (see Figure 4.6 in Chapter 4), some companies are seen to be moving away from the *"cost leadership"* strategy to the *"differentiation"* strategy of their products or services. e-Business provides a different avenue for promoting this differentiation. An example of product differentiation using a B2C application can be seen in the case of ScottishPower and Powergen e-Business applications in which customers can input

their electricity meter readings and pay their bills online. Further, since these transactions save electricity companies' administrative costs, domestic customers have also benefited and have received approximately five percent off on their usual bills.

To summarise, the case companies believe that for now at least (at the time of research) they have made sensible decisions on whether or not to commit to e-Business strategy. These decisions were made based on each individual companies' environment (deregulated or regulated) and business focus. The business environment further affects the companies' perception of e-Business and directly impacts the extent of e-Business applications that they run. At the moment, B2C e-Business applications are not attracting significant numbers of customers as compared to traditional methods but companies believe that this number will rise eventually. Finally, e-Business is employed as a new approach for companies attempting to offer a unique service or product to customers.

5.2.4 RQ4: What are the problems or barriers for effective implementation and use of e-Business?

In Table 4.16 (discussed in Chapter 4), this research has highlighted the various problems or barriers faced by the case companies in implementing their e-Business strategies. Even though all these problems were rated as high or moderate in their level of seriousness to the companies, the benefits of e-Business along the electricity industry value chain can be seen to have high potential that mostly outweighs its problems. For example, one of the problems mentioned by the case companies in implementing e-Business was the migration from old legacy systems to new systems. For this situation, problems arise from the high cost of migration and the disruption of everyday operations during the transition. One of the ways believed to be able to help this situation is in creating awareness of the e-Business potentials. If companies can invest in educating its management and employees to understand the benefits of e-Business, and convince them of the revenues gained in the long term, companies might be able to continue investing and persevering to complete the e-Business transformation successfully.

Another barrier for effective implementation of e-Business is the cultural issue. In general, electricity utilities are not used to operating in short time frames as their lead-time for major generation or transmission projects can take years. There are also other cultural issues such as the resistance to change and trust issues regarding data security and safety. In certain cases, the marketing department leads e-Business projects, as e-Business was mainly perceived as more of a B2C exercise. However, e-Business requires a holistic approach to business rather than being just about selling, thus requiring a total business understanding.

The perception of the majority of the case companies is at Level 2 (see Table 4.12 in Chapter 4) and reflects the lack of total management support for e-Business initiatives. This inherently de-prioritises e-Business and limits the spending available to overcome the major technical issues mentioned above. In many cases, budgetary constraints compound an already difficult situation.

As discussed earlier, in order to overcome these barriers, management must be convinced of the benefits of e-Business. There must be a strategy to educate management and key personnel on the benefits of e-Business. In addition, the execution of e-Business projects must be carefully planned. This has the double advantage of minimising implementation costs and ensuring that the e-Business project achieves its maximum effect by integrating the needs of all parties within the organisation. The plan could mirror the three-stage strategy developed by ScottishPower discussed in section 4.2.1.1 in Chapter 4, which comprises what the company calls *"Educate"*, *"Commit"* and *"Execute"* stages. External influences must also be reviewed continuously as changes in the environment can occur during transformation. This measure ensures that the e-Business implementation matches the dynamic market conditions.

Figure 5.2 below summarises the continuous assessment required for e-Business for it to create value based on ScottishPower's strategy and PA Consulting Group's framework (PA Consulting Group, 2001). This framework enables an understanding of the breadth of activities associated with developing e-Business rather than just those associated with technology implementation. This framework emphasises six stages of the e-Business value life cycle, consisting of:

- **Innovate**: educate and create e-Business awareness; promote enthusiasm for change; develop e-Business vision; and identify e-Business goals.
- **Focus**: create an e-Business portfolio; identify e-Business projects and justify the business case for each project; and develop overall e-Business plan and programme.
- **Execute**: manage the changes and change processes (cultural change, structural change, mission change); deliver e-Business projects; deliver e-Business gains; and monitor e-Business implementation through feedback on benefits gained and lesson learnt from successful and unsuccessful initiatives.
- **Earn**: harvest the benefits gain from the e-Business success and look into any other area that can benefit from the same implementation.
- **Manage**: operate the e-Business applications implemented and perform maintenance and trouble-shooting activities to any problems that arise; and look into any teething-problems and monitor their progress.
- **Review**: re-assess e-Business plan by identifying to what degree the e-Business investment was really being focused on delivering business differentiation for the company, what is the ultimate role for the e-Business strategy and applications, and what areas of e-Business within the e-Business life cycle required most improvement?

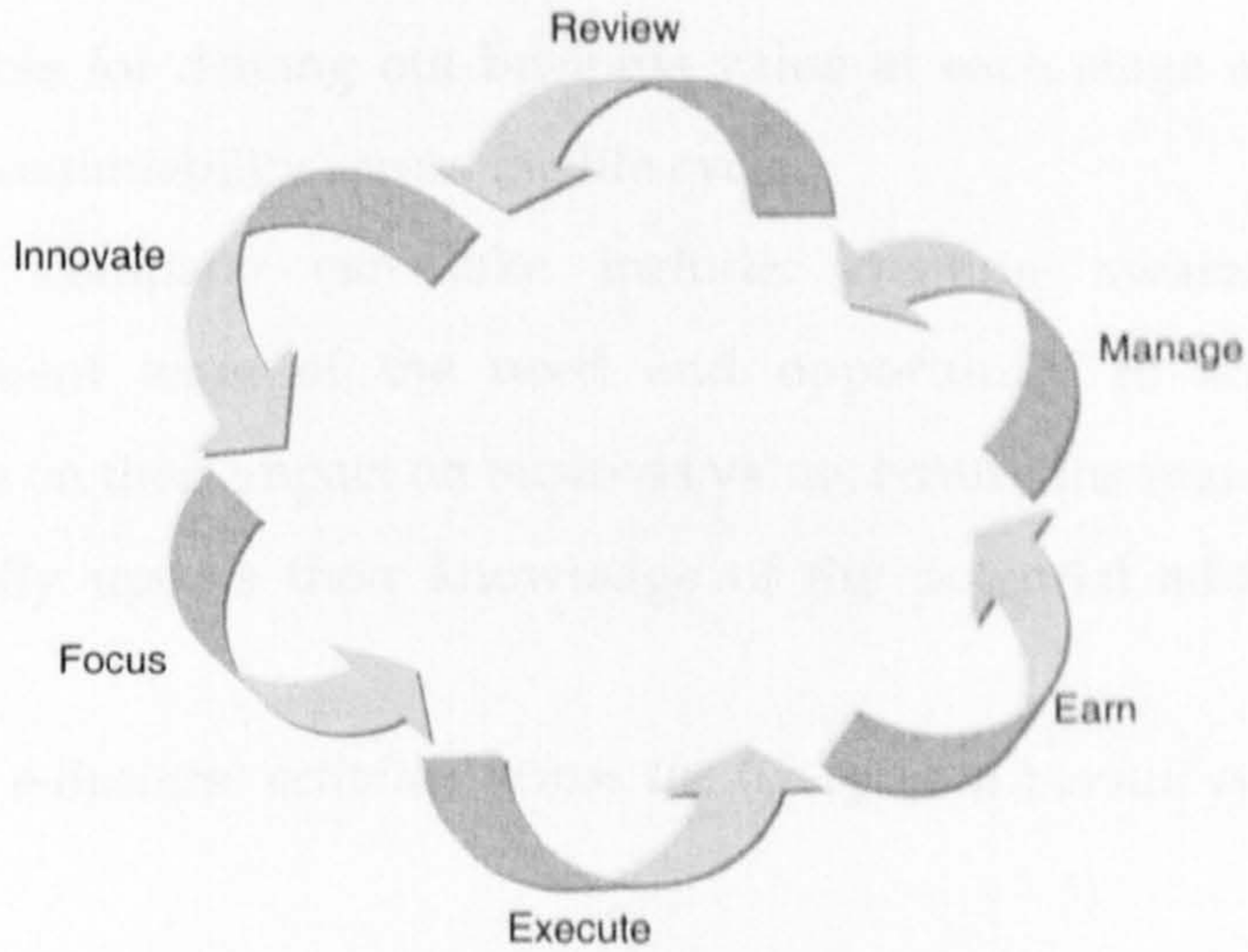

Figure 5.2 e-Business Value Life Cycle – A Framework for Improvement

The framework can help companies to think about the complex issues, opportunities and trade-offs involved in making improvements in their e-Business capability. By using this framework, it can be concluded that electricity companies that seek to maximise their e-Business value need to concentrate on:

- *Agreeing what drives value in their business based on their business focus so that senior management can target the appropriate opportunities provided by e-Business:*
  - If senior management can create a shared sense of what drives value in the business, this understanding will then provide a powerful push for focusing e-Business initiatives and investment. This relies on the identification of a number of critical factors (from the customers' and shareholders' perspective) that set the business position and performance of the company apart from its competitors.
  - Steps that can be taken include: improve focus by identifying the business characteristics or functions that can or could differentiate the company from its competitors and invest in e-Business to support these characteristics or functions; determine the key business value drivers for these focus areas and set value targets for each drivers.
- *Agreeing on who and which department is responsible for realising the business value of e-Business:*
  - Companies should carefully and actively consider every aspect of the business value life cycle from *innovation* to *review*, and define clearly who is responsible for driving out business value at each stage and who will take overall accountability across the life cycle.
  - Steps a company can take include: creating awareness among the management team of the need and opportunity to base all e-Business decisions on their impact on business value; ensure the management team can continually update their knowledge of the potential added value from e-Business.
- *Directing all e-Business activities across the life-cycle in pursuit of the business value anticipated:*
  - As well as defining the roles and responsibilities across the e-Business value life cycle, a company should consciously plan how to drive all e-Business activities in pursuit of maximising business value. A critical issue is to ensure

that e-Business investment decision-making puts the value drivers of the company as a whole before the interests of individual departments

- Steps that can be taken include: to terminate all projects that do not have a positive impact on the business value drivers, which can also provide the e-Business team and senior management the space to review and re-think; monitor the remaining of the high-potential projects that target the key focus areas and actively manage the projects to achieve maximum results; ensure the next business planning cycle incorporates innovative ideas by focussing on the future and not the past, and prioritising all business and e-Business initiatives by looking into the potential value they provide against, the risk, time and cost factors.

To summarise, e-Business implementation faces resistance for technological and cultural reasons, which can originate internally and externally. These obstacles can be overcome with the right strategy and require total commitment especially from the organisation's leadership. Companies must be prepared to invest heavily in new hardware, retrain their staff and change their mindset if they want to become successful fully-fledged e-Business driven organisations.

5.3 Conclusions On The Research Problem

This section discusses the conclusions derived for the main research problem, which is *'What are the impacts of e-Business on the electricity industry, both in the regulated and deregulated power markets?'* The issue is divided into three discussions in separate sub-sections. Due to the qualitative methodology and limited claims for generalisability, these conclusions refer specifically to the companies interviewed.

5.3.1 Is there e-Business potential for electricity utilities?

From the analysis discussed in Chapter 4, it appears that there is considerable potential for e-Business in the electricity industry. At the moment, the supply business is becoming more active with more customers becoming aware that changing suppliers would result in cost savings. e-Business B2C applications can be

seen as another channel to reach customers. Although the number of online transactions may not have risen in the B2C areas, companies have no intentions of scrapping their applications just yet. This is because it is believed that as more people get on to the Internet, the percentage of people who feel safer using online transactions will also increase. It can be observed that in the UK, US, and Europe there is higher Internet penetration, which is one of the reasons for the increase in e-Business take-up in these countries (Norton, 2000; PA Consulting, 2000; Cap Gemini Ernst and Young, 2000). By comparison, in Asian countries such as Malaysia, Internet penetration is considered low and has been associated with the low e-Business take-ups here (Asia Pacific Energy Research Centre, 2000).

The case companies' e-Business status based on the S-Curve concept (see Figure 4.3 in Chapter 4) also indicates that e-Business applications in the electricity industry have not yet reached their full maturity. This means that there is still some progress to be made in overcoming the barriers to achieve full e-Business potential. e-Business has yet to meet its full potential especially in the B2B and B2E areas. Based on the previous literature discussion and case companies' comments it would appear that these areas are going to be priorities in further e-Business implementations. If a project is well implemented, value can be enhanced and this will put significant pressures on other companies, which may have relied only on *"cost leadership"* strategies to stay ahead.

5.3.2 Will e-Business become one of the more important if not the main strategy for electricity companies in the near future?

Based on the research findings and analyses, e-Business seems to have gained the attention of many competing electricity companies. However, it can be observed that for most electricity companies interviewed e-Business is not going to be their main strategy for the near future. This is because they feel that e-Business is just a tool to enhance their business processes and is more about technology. Nevertheless, from the case studies discussion on the companies (see Chapter 4, section 4.2.1 through 4.2.3), it is foreseen that there will be an increase in e-Business applications and that

these applications will play a significant part in the companies' business processes in the future, even though the business strategy will not be centred on e-Business.

This forecast is, exceptionally, not the case for ScottishPower as it views e-Business as a holistic approach to doing business. The company plans to have all of its business processes integrated and to improve its knowledge sharing systems and applications. To do so, ScottishPower has continually invested in e-Business in terms of preparing its infrastructure and employees to operate in an e-Business environment. It is very clear that when the entire infrastructure is in place, ScottishPower will have its business strategy centred on e-Business.

5.3.3 What could be the impact of e-Business on overall organisational performance and the electricity industry performance as a whole?

In the case of organisational performance, e-Business can increase process efficiency by integrating different processes in an almost paperless environment where information can be disseminated quickly to all related parties. Business areas such as supply chain management, procurement and inventory management are some of the areas that can be directly improved with e-Business. e-Business also promotes faster communications internally and externally with employees, business partners and customers. Customer service levels can be improved with e-Business applications for two reasons. Firstly, knowledge sharing allows companies' representatives to better handle customer requests. Secondly, customers have a new channel to communicate with the company and have the opportunity of working more efficiently in an online environment. All this adds up to making the company's transactions and processes more streamlined, thereby projecting a good brand image and ultimately improving its profitability.

The use of e-Business applications in the energy trading market has revolutionised the way in which energy is traded. This has made it possible for the NETA balancing mechanism market to operate in real time and within specific timelines. The use of this technology has made energy trading more representative of the features of

instantaneous supply and demand. This promotes efficiency in terms of generator despatch (selection of generators to supply the load at any one time) and transmission, as market players will continuously want to improve their energy forecasts and reduce imbalance in transaction costs. Even in non-real time markets, energy transactions can be done electronically at electronic energy markets such as UKPX (UK Power Exchange). At the moment only the wholesale market is conducted in real time. The retail business is still a time consuming process and poses challenges to both suppliers and consumers. In the future, it will be possible for major consumers to switch suppliers on an hourly basis in response to the offers made by supply companies. If e-Business can prove to all parties that it is indeed indispensable, it will transform the landscape of the industry, affecting not only players who are the most technologically keen but also those who are currently technologically cynical.

5.4 Theoretical Implications of the Research

This section provides the overall picture of the research's findings within the body of knowledge. That is, it provides the theoretical implications of the research and together with Section 5.3, offers the conclusions to the whole research and the answer to the research problem.

As discussed in Chapter 2, throughout history technological change and innovation have been two of the major driving forces for economic growth and development. e-Business, with its heavy emphasis on the Internet, is one of these developments and has had major impacts on how markets interact and has fundamentally changed the economics of transactions between buyers and suppliers. In addition, well-implemented e-Business applications allow a rapid flow of information, which allows them to constantly update customers as to the status of transactions. For instance, UPS provides global package tracking through the input of transaction numbers. The benefit of convenient information control and access changes the speed of transactions and data flow. This benefit affects other businesses such as commodity and share trading, airlines, shipping, telecommunications and vehicle production, amongst many others. The growth of the Internet and web technology has been

substantial and it can be seen that many aspects of the traditional power business have also been altered considerably.

Some of the changes brought by the Internet and e-Business have already been experienced by electricity utilities in deregulated power markets in the UK, Europe and the US, and the pressure in Asian utilities such as TNB in Malaysia to master the concepts of e-Business and use the Internet technology effectively is growing. Although there are a number of issues facing the use and development of e-Business for electricity companies and their customers, there are two major factors, which could determine the economic benefits that e-Business and the Internet can bring for power market participants. These are the rate of Internet penetration and the state of market liberalisation and deregulation of power markets. However, the potential economic benefits of the Internet for the power sector need to be analysed before these factors are taken into account.

From an economic perspective the major impact of the Internet is that by improving the flow of information between buyers and suppliers it causes the costs of market interactions to fall and reduces the barriers to entry. e-Business using Internet technologies helps companies and consumers find easier and less costly ways of doing the things they are already doing as well as discovering that they can do entirely new things. This applies to a greater degree to liberalised markets and to a lesser degree to monopolistic markets. The main reason is that business opportunities tend to increase as markets open up for competition.

Historically, it has been very difficult for new entrants to make a significant impact in the power market, which has traditionally been dominated by large vertically integrated utilities. The advantages of well-established electricity utilities range from market power, brand dominance, existing infrastructure and scale economies, to customer inertia. However, over the last years, new and smaller companies have sprung up due to the unbundling of the electricity industry, both in business-to-business and business-to-consumer markets, as the Internet makes it cheaper to reach customers, lowers transaction costs, and thus enables new entrants to challenge established power utilities. A major advantage of these new companies is their cost structure, flexibility, and adaptability in a continuously changing market

environment. Some new entrants offer composite services (electricity, gas, water, telecommunication), provide online enrolment, billing and account management services, and offer opportunities for customers to review and pay all utility bills on-line.

The Internet also allows for intermediaries who act as agents either for the buyer or seller to enter the power market. Intermediation is a central activity in a market-oriented economy, bringing buyers and sellers together and therefore reducing transaction costs. Intermediaries in the power sector include power exchanges, business-to-business procurement exchanges, auctions and buyer groups amongst others.

Electricity is an ideal product for on-line trading as it has no physical presence and can be delivered automatically. Various power exchanges for buyers, sellers, and traders have been established in liberalised markets round the world. Power exchanges work in a similar way to existing financial and commodity markets, where buyers and sellers can observe the prices of transactions as they occur before placing their bids. Business-to-business procurement exchanges have also been established in the power industry. A procurement exchange allows utilities to coordinate the purchase of products and services and substantially reduce procurement costs by streamlining the processes for bids and decreasing traditional procurement processing costs. Internet technology also significantly reduces the costs of running auctions. As technology progresses, customers will be able to bypass their utility suppliers and make their own arrangements for procuring electricity.

New entrants and intermediaries are transforming the way traditional power services are delivered and offer a considerable variety of new services. At the same time the Internet creates new opportunities for established utilities and allows them to reduce costs by taking advantage of this new way of interacting with its customer base. To succeed as an electricity utility in a deregulated energy market, companies need to develop a strategy on how to market their product effectively and cost efficiently. e-Business and the Internet can help provide an important electronic medium to achieve this.

Advances in technology, the Internet and e-Business hold great promise for reducing transaction costs and increasing efficiency in the energy industry. However, the slow pace of deregulation in most Asian power markets including power markets in Malaysia, together with a relative low Internet penetration rate imposes a natural limitation on the economic benefits of e-Business for utilities and their customers. Even in fully deregulated European and US power markets, where Internet access is widespread, the volume of online trading has never taken off mainly because many customers are still concerned about the risks of doing business online. There are issues of reliability, security, and privacy involved. In Asia especially, customers are still sceptical about buying products online or handing over personal information such as addresses and names.

5.5 Implications For Policy And Practice

This section deals with the practical implications of the findings for the policy and practice of the electricity utilities in the new deregulated environment. The implications for policy makers and analysts were also examined from the findings of the research.

5.5.1 Electricity Utilities Management

The opportunities for utilities to capitalise on the benefits of e-Business and to protect their competitive position are there to be realised. Studying the current ways of doing things across the business, and a review of the potential for improvement through the adoption of e-Business, provides a good starting point and helps to ensure a broad and inclusive view of the opportunities.

It was observed that B2C initiatives have received the most attention from electricity utilities as they see B2C as a useful customer service strategy and/or tool. The effort is justified as industry trends indicate that more customers are thinking of switching suppliers and B2C can enhanced a company's ability to capture and retain customers. The industry players are seen to maintain and fine-tune their B2C efforts. At the same

time some companies have developed several B2B and B2E applications and this indicates a strengthening of their e-Business policies.

The research findings have concluded that e-Business is one of the ways forward for electricity utilities as all utilities have multiple business processes and can benefit from the integration of these processes. It was seen that some case companies, such as ScottishPower, took e-Business very seriously and included e-Business in most of their applications and strategies. Other companies view it as a tool to streamline their operations. Whatever their perceptions, both types of approach have a policy of putting e-Business at the forefront of their business strategy. There are companies, who prefer to take the *"wait and see"* approach to e-Business. These companies do not feel e-Business advances by their competitors can threaten their operations and are quite content to continue doing business the *"traditional"* way. Finally, there are companies, which operate in the regulated environment and who do not foresee e-Business influencing their operations at all at any stage.

For the companies that plan to embark on e-Business applications, this research has identified a *"10 Key e-Business Implementation Stages"* (see Table 5.2) that need to be taken to help achieve their targets using e-Business. The stages were adapted from Figure 5.2 and ScottishPower's *"Educate"*, *"Commit"* and *"Execute"* e-Business strategy. These stages provide a more detailed and logical approach to implementing e-Business. The stages may also be considered as a checklist for managers responsible for their companies' e-Business implementation.

Stages	Activities
1. Set Targets	Companies need to clearly define their business objectives.
2. Information Gathering	Companies need to look at their external and internal environment to assess their capabilities to meet defined objectives. This can include assessing staff, partner, and customer readiness for e-Business change.
3. Determine if e-Business is the way forward for the company	Managers must be convinced as to the benefits of e-Business before going forward to avoid misplacing resources. There is a need for priorities to be clearly articulated so that resources can be directed towards improvements that will lead to the creation of the greatest value.

Stages	Activities
4. Convince Management	The leadership or top management must be convinced of the benefits offered by e-Business, and briefed at all times to maintain support for project.
5. Commit	Organisation must be brave and commit resources throughout the project to be able to hit targets along the project timeline.
6. Educate Staff and Business Partners	Companies must train their staff and business partners to maintain enthusiasm and participate in the e-Business initiatives
7. Execute	e-Business initiatives must be based on thorough understanding of the business environment to achieve defined targets. Implementation plans must be flexible to adapt to environmental changes.
8. Attack areas with high returns on investment or high profile areas	Maintain morale and support from management, staff, partners, and customers throughout implementation.
9. Re-assess Effort	Go through the initial objectives and previous stages to identify failure and success of the initiatives.
10. Re-do step (1)	As in activities in 1.

Table 5.2 e-Business Implementation Checklist

If these stages are followed closely and necessary issues within the stages can be dealt with early on in the implementation, it will help generate more interests for further expansion in the future if necessary. As indicated in Figure 5.2, the whole process needs constant evaluation to maximise the e-Business effects and can possibly help companies in creating value from their e-Business initiatives.

Utilities have embraced e-Business either by design or pressure from competitors. In this research it is believed that the framework for further e-Business expansion already exists in some utilities. As they increasingly become more confident in their e-Business initiatives, by overcoming barriers of implementation, it is believed that the number of e-Business applications will increase to accommodate more business processes and knowledge sharing in utilities. The immediate effect for internal processes may possibly be seen rapidly after implementation as it is considered still within the companies' control, but success in initiatives, which depends on external factors such as customers, and business partners might take time.

5.5.2 Regulators and Policy Analyst

In the early stages of the competitive electricity market, the reluctance of many customers to shop around for cheaper electricity and switch suppliers sustained the price of electricity at the same level. However, as more transparent mechanisms for comparing electricity prices became available, combined with more aggressive marketing by suppliers, it can be anticipated that customers will become more willing to switch. In this scenario, regulators may want to look at the industry wide effect of customers switching suppliers in the industry. In many cases, these processes were made easier with the use of B2C applications offered by electricity companies. However, many customers who have switched suppliers encountered numerous problems with their billing. This was mainly due to the difficulty of getting customer data from the old supplier and old inefficient internal processes. In the light of increasing discontent among customers due to switching suppliers, regulators may want to re-assess their rules, impose tighter procedures or even make it compulsory to have a B2C common platform for all suppliers to share.

The NETA system is very competitive and forces generating companies to lower their wholesale prices. This erodes their profit margins and generating companies may end up with insufficient resources to build extra generating capacity to cater for future increases in demand. Experience has shown that giants such as British Energy have required government bailout to stay afloat (Macalister, 2002). Regulators need to fine-tune the market (by being more pro-active to market changes) rather than just leaving it to market forces so that the whole industry can survive.

5.6 Deregulation Impact on TNB and its Subsidiaries

In the light of the inevitable deregulation of the Malaysian Electricity Supply Industry (MESI), TNB must be aware of the possible structure of the new market. As has been shown in many cases, the deregulation of electricity markets was usually done in stages, whereby the competition would be introduced first to the generation, supply and retail sectors respectively. In order to analyse the impact of deregulation to TNB, this section will discuss the effects of deregulation based on its evolutionary phases.

5.6.1 Projected Scenario in Phases

Based on the UK market experience specifically and other markets in general, it is believed that the MESI will liberalise the electricity market in phases. These phases were introduced in Chapter 2 (see Section 2.3), where the deregulated electricity market can be seen to evolve from complete regulation to complete competition through three general phases: the *"single purchasing agent"*, *"wholesale competition"*, and *"retail competition"*. However, some markets can be seen to jump straight into the second phase, for example the Pennsylvania-New Jersey-Maryland market in the US, bypassing the *"single purchasing agent"* phase.

The MESI is projected to evolve through all three phases mainly due to two reasons. Firstly, the MESI is a strategic industry, which affects the nation's economic growth. It is believed that the regulators will want to play it safe to avoid consumer price volatility, which in turn can affect economic growth. By going through the first phase, customers will be protected as TNB can absorb any price fluctuations from the generators. Secondly, given Malaysia's inexperience in handling a competitive market (many products such as cars, petrol, sugar and rice are protected by high import tariffs or price controls), the regulators would be more comfortable if they introduce a step-by-step transformation. This tentativeness is also partly due to the California energy crisis in 2001 where electricity prices had shot up to unrealistic levels due to extreme weather effects and flawed market rules. It is believed that total market transformation can take more than ten years even with a wealth of expertise, as the UK market has shown.

The following sections discuss the projected scenario in the Malaysian context. Based on the government's cautious approach to electricity deregulation, it is assumed in the following discussions that TNB will still maintain its interests (with some limited) in all four sectors of generation, transmission, distribution and supply of the future MESI.

5.6.1.1 Single Purchasing Agency

The first phase will start with competition only in the generation sector, in which generators will compete to sell their electricity to a single purchaser. The single purchaser will be TNB, by virtue of its asset ownership in the transmission and distribution sectors. Some form of this competition already exists in the Malaysian market as TNB only controls sixty percent (60%) of the generating capacity in Malaysia and in order to supply all of its customers, TNB will have to negotiate with numerous Independent Power Producers (IPPs). In this phase, the wholesale prices that TNB pays to IPPs can fluctuate but the prices that TNB charges to its consumers are fixed. This can expose TNB to high prices on the generation side, which can be due to generation shortage, but at the same time, they cannot pass the increasing costs to the consumers. On the other hand, wholesale competition presents an opportunity for TNB to develop new strategies, which could improve profitability during energy procurements. This can be in the form of long-term power purchase agreements with competitive generators.

On the technical side, TNB's operation would vary as well. This is because generators are selected based on their individual bid price, which means that the transmission company will choose a cheaper generator (rather than an expensive ones), regardless of its location. This can incur higher overall system losses (such as heat loss), or complications (such as line instability) in the network. To alleviate this problem TNB needs to consider the selection of generators based on both price as well as location criteria.

In this phase, consumers pay a fixed tariff to TNB for their energy usage. They cannot be actively involved in determining the tariff unless they are in the large power consumers (LPC) category. However, their interest will be overseen by the regulator who will ensure that TNB charge a fair price in this monopoly area.

5.6.1.2 Wholesale Competition

The second phase would involve generators dealing directly with brokers and supply companies without the need to engage a transmission company. In this environment,

generators and supply companies need to understand market demands and contract optimally (prior to delivery time) to avoid mismatches between contracted electricity and actual demand. Failure to do so can mean high losses as the surplus or shortage of electricity has to be bought and sold in real time and these transactions can be very expensive. Some of these supply companies can be directly owned by TNB. Therefore, TNB as a supply company faces issues with respect to forecasting electricity demand for each individual area, instead of for the overall system as it used to do in the regulated era.

This phase presents the most challenging period to TNB for two reasons. Firstly, some portion of TNB's supply business will have to be divested to future competitors. This effectively reduces TNB's customer base to a level, which is allowed by the Regulator. Secondly, it is foreseen that TNB will also have to divest some of its generation assets. This may be unavoidable, as the Regulators would want to ensure that fair competition can occur and that TNB's large generation capacity might hamper this objective.

With regards to the transmission and distribution sector of TNB, it is foreseen that they will remain intact as the Malaysian electricity network is spread over regions of high and low load densities, similar to the Scottish network. When the Scottish electricity supply industry (ESI) was deregulated, ScottishPower and SSE maintained its transmission and distribution interest. This is important because if the transmission and distribution sectors were broken up into smaller entities in a low load region, it may not be able to make a profit as the maintenance costs can overshadow its revenue. At the same time, having one company which operates regions of high and low loads allows it to balance its costs and simplifies the transmission and distribution tariff calculation. If the Scottish model is adhered to in the second phase, TNB will control fully the wires business, which is the transmission and distribution. At the same time, it is foreseen that TNB, or one of its subsidiaries, will become the facilitator for the power market due to its previous experience. The running of the power market is a highly complex exercise where multiple transactions between generators and supply companies will have to be scheduled. This requires TNB to develop further expertise in areas such as trading electricity in real time.

5.6.1.3 Retail Competition

In the final phase, the market will be fully liberalised and retail customers can directly deal with generators or supply companies to supply their electricity. The remnants of TNB's supply business will face new challenges to compete to keep its existing customers and attract new ones. One of the effects of this phase on the distribution sector is in the metering of retail consumption, as this would involve introducing new procedures for forwarding meter readings to suppliers. For instance, a distribution company would have to formulate procedures to read a customer's meter in their control area and will have to forward it to a different supplier. The actual distribution and transmission system operation is unchanged from the previous phase. As the market stabilises, some of TNB's distribution entities can appear as attractive investments due to their improved performance after deregulation. If required these entities can be sold off to other companies. This is the final form of market transformation and is evident in many electricity markets worldwide.

5.6.1.4 Summary

Based on the discussions above, the new challenges, which affect TNB, are summarised in Table 5.3 below:

Phases	New Challenges
1. Single Purchasing Agency	• Generators have to compete with other IPPs • Need to facilitate new bidding process • System operation is markedly different from regulation era • Fluctuation of wholesale prices
2. Wholesale Competition	• Loss of supply business monopoly • Reduction of generation capacity • Surplus liquidity • Operate a complex power market in which transactions can occur between any generator and supply company
3. Retail Competition	• Remaining supply business open to competition • Focus on maximising profits from the regulated wires business • Identify new investments or business ventures locally and internationally

Table 5.3 Summary of New Challenges for TNB Based on the Deregulation Phases

The biggest impact on TNB's business will occur in phases one and two (see Table 5.3) as competition to generation and supply is introduced. In phase one, TNB has to ensure that its generators are competitive to maintain its electricity sales. Further, its market operations and transmission services must adapt to the new market environment to facilitate smooth and secure electricity transactions. Finally, this phase exposes TNB to the California syndrome where wholesale prices can rise drastically when retail prices are fixed. In phase two, TNB will have to divest a significant percentage of its generation and supply business. This creates a huge impact on its asset and customer base and affects its income. However, TNB will then be left with ample liquidity and needs to strategise on how it can use its newfound wealth to generate new income bases. In this phase, TNB must also improve its market operation capability, as the number of electricity transactions increased. In the third phase, TNB's supply business will be divested. This will lead to further shrinking of TNB's customer base. In this phase, TNB must ensure that it maintains its existing retail customers and tries to attract new ones.

5.7 Recommendations

This section summarises the recommendations and proposals provided in the previous sections on appropriate strategies for effective implementation and management of e-Business applications and resources, and also adds further suggestions for electricity companies, specifically TNB for executing their deregulation exercise and implementing their e-Business strategies.

5.7.1 General Recommendations

In section 5.2.4, a framework for improving the e-Business implementation process by identifying important issues within the e-Business value life cycle (see Figure 5.2) has been discussed. An e-Business implementation checklist for managers involved in the implementation process has also been discussed in section 5.5.2 (see Table 5.2). To add to these recommendations, this section deals with the overall picture of the opportunities for e-Business implementation recommended in the electricity supply industry. In order to analyse these opportunities, this research focuses on the

electricity industry supply chain, which include the generation, transmission, distribution, and supply sectors. (This section concludes with a graphical summary highlighting the main e-Business opportunities and the inter-relationships between sectors, see Figure 5.3). The operations of all these sectors are unique as opposed to other industries as most electricity must be generated when it is required. This means that each sector must be able to react immediately to the fluctuating demands of its customers. e-Business as discussed earlier has shown various potentials to help electricity companies in all four sectors to operate successfully in this fast moving market. These opportunities include:

Generation sector: This sector deals with producing electricity for customers through the use of generators, which run on fossil fuels (gas, oil and coal), hydro, nuclear or renewable energy (wind, wave and solar). In the case of thermal generation, which runs on fossil fuel, they have to have a fuel procurement strategy to determine the quantity of fuel that they need to buy. This is important, as they have to balance the level of fuel stockpiled against the cost of storage and lost opportunity of buying fuel at cheaper prices when the fuel market is depressed. In the case of renewable generators such as hydro, wave or wind, these companies need to be able to predict natural phenomena to determine the availability and quantity of their supply. With regards to generator operation, one of the main exercises is maintenance of the generators themselves. Their maintenance intervals must be optimised as taking their machines off-line for maintenance too often would mean not being able to sell electricity at that period, but not maintaining them often enough could mean sudden breakdowns that can be very costly.

Based on the discussions above, e-Business B2B models can be applied in two general areas for the generation sector: fuel procurement and generator operations. In the case of fuel procurement, e-Business applications can be used to optimise operations by analysing customer load forecasts, prices of fuel and their forecast, long term bids by suppliers, storage capacity and weather effects. All this information can be integrated by e-Business applications so that the generating company can come up with a total fuel strategy. In the case of generator operations, e-Business can help by integrating generator utilisation data (such as power output or period of operation)

with manufacturer recommendations and come up with a justifiable maintenance strategy.

Transmission and Distribution sectors: The transmission and distribution sectors provide network services for all market players. Their main aim is to facilitate power transfer between market players reliably and expand the wires business in-line with load growth. In the former, they need to ensure that all energy transactions between market players can occur. To do so, they need to make adjustments to the network during operation and also ensure that all their assets are operating within limits and schedule asset maintenance at optimal intervals. In the latter, they also need to forecast future load levels in order to plan for future network expansion.

In order to facilitate power transfer between users of the network, the transmission and distribution companies will need to receive real time data from market players regarding power transactions. These data can be transferred to the transmission and distribution companies through an infrastructure in the form of electronic links. This is where e-Business B2B models can play a significant part as these transactions are numerous and are constantly updated. In the area of maintenance, e-Business can play a part similar to the generation sector by creating a database of the thousands of critical network components and monitoring their performance and scheduling optimal maintenance intervals. Finally, e-Business can help the transmission and distribution sectors in system expansion as it can identify fast expanding areas in the network through efficient monitoring of customers' loads over a period of time.

Supply sector: Companies in this sector deal with buying and selling of electricity. Their main activity is buying electricity in bulk from generators, brokers or the power exchange and selling it to customers. In this environment, supply companies must focus on two main areas. Firstly, in order to be able to market their product effectively, this sector focuses on marketing electricity through offering good customer service. This can mean ease of transfer from the old supplier to a new one, fast response to customer queries and sales of other services such as gas and telephone. Secondly, companies in this sector must be able to forecast customer demands accurately and contract with generators or brokers accordingly to meet that demand. This is because, by nature of the electricity business (which requires

instantaneous generation to meet demand), any imbalance between the contracted generation and demand would incur losses to the supply company, as the power has to be generated or absorbed by other parties.

As electricity cannot be discriminated from one company or the other, electricity companies need to differentiate their product through good customer service. This has prompted many supply companies to set up websites (i.e. B2C models) in order to enable their customers to gain extra information and offer electricity and other services through the Internet. This can be a part of the marketing strategy and can promote brand recognition. Another opportunity for e-Business in the supply sector is in load forecasting. This is seen as a significant exercise as it can make, or cost, companies millions of pounds. In order for companies to make accurate forecasts, e-Business can help by having applications, which can integrate databases of historical customer demand data, load growth and even weather effects. At the same time e-Business B2B models can be seen to play a very significant role in the area of electricity trading. This is because the trading activity is fast paced to match the continually changing demand and requires trading parties to have electronic links with each other. Without these applications, supply companies would be unable to make continuous changes to their electricity portfolio. This can prevent companies from taking advantage of cheaper wholesale electricity prices at certain times or even worse, being exposed to the imbalance costs mentioned earlier.

Figure 5.3 (which is based on the electricity financial and supply arrangement model, discussed in Chapter 2, see Figure 2.22) summarises the above discussion and highlights some of the main e-Business potentials in all sectors of the electricity industry.

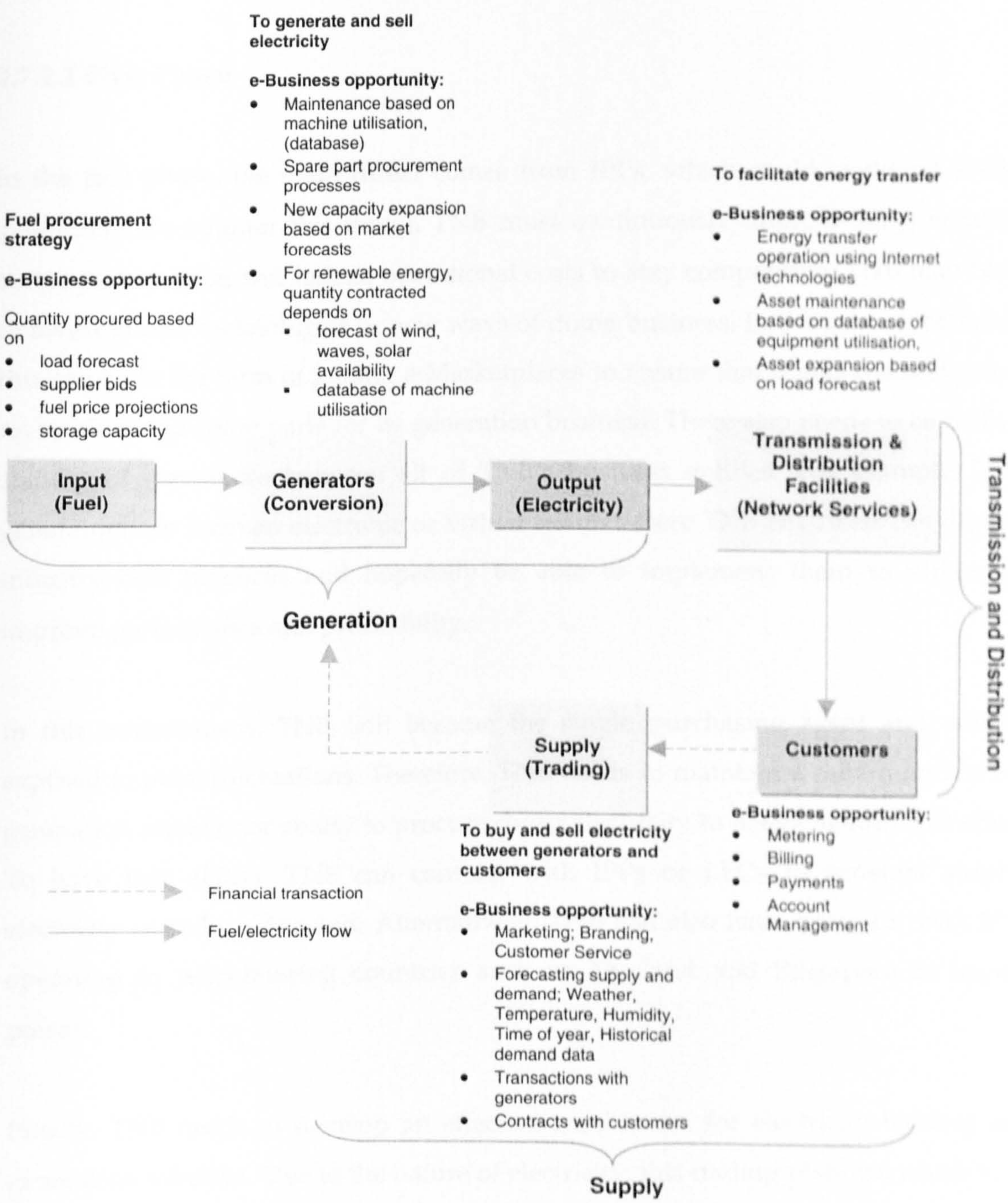

Figure 5.3 e-Business Opportunities in the Electricity Industry Supply Chain Systems

5.7.2 Recommendations for TNB

This section will address the challenges listed in section 5.6 and suggest relevant recommendations for TNB in order to improve the chance of surviving in the deregulated environment. Some of the recommendations are general and do not warrant any e-Business applications whilst others require TNB to consider e-Business applications explicitly to help ensure its competitiveness.

5.7.2.1 First Phase

In the first phase, the main threat comes from IPPs, which could undercut TNB's generators. To counter this threat, TNB must continuously improve its generation sector performance and reduce operational costs to stay competitive. TNB may have to invest in new technologies or new ways of doing business. In the case of the latter, this can be in the form of joining e-Marketplaces to ensure that it gets the best prices on services and spare parts for its generation business. There also needs to be further sharing of experience between all of TNB's business entities. For example, TNB generators can form an electronic or virtual forum where TNB engineers can discuss industry best practices and hopefully be able to implement them to ultimately improve performance and profitability.

In this environment, TNB will become the single purchasing agent and will be exposed to price fluctuations. Therefore, TNB needs to maintain a minimum level of generation capacity or ability to procure cheap electricity to hedge against this effect. To have that ability, TNB can contract with IPPs or LPCs to generate surplus electricity or reduce demand. Alternatively, TNB can also have contracts with IPPs operating in neighbouring countries such as Thailand and Singapore to import power.

Finally, TNB needs to develop an effective mechanism for electricity bidding and generation selection. Due to the nature of electricity, this trading platform needs to be electronic to be able to cater for the instantaneous demands and supply of the power system. This is where e-Business is necessary as it provides the mechanism to handle multiple bids and offer in real-time. In this bidding system, generators and supply companies will submit their bids to TNB. TNB must then continually monitor the system demand and select appropriate bids. Therefore, TNB must develop its e-Business capability to run the market and facilitate competition. Failure to do so could mean that TNB may lose its transmission and distribution license and be divested even further.

5.7.2.2 Second Phase

In the second phase, the loss of customer base and reduction of generation capacity due to the divestment of some parts of its business, will force TNB to look at new businesses to generate income. Based on the experience of UK companies such as NGT, Powergen, and ScottishPower, this can involve setting up new ventures in other non-electricity businesses locally (such as telecommunications or gas supply) or applying its electricity utility expertise internationally. As it is, TNB has some experience in setting up Liberty Power, an IPP venture in Pakistan. This type of outward focus will be necessary to maintain TNB's profit margin and future growth. As mentioned above, TNB will have to divest a major portion of its assets. This means that TNB would have surplus funds, which can be utilised to develop new business ventures.

In this phase, generators and supply companies are going to be clients of TNB's transmission and distribution network. TNB needs to produce justifiable charging rates for all its network users, which in turn would promote competition. TNB must also be seen to develop a trading platform for all electricity companies to make deals, if necessary, in real time. This is important as network services business is regulated and TNB needs to project itself to its clients, regulators and the public as a pro-competition, efficient, and competent network operator.

With regards to the new market structure, TNB needs to lobby or persuade regulators to allow for the implementation of a fair transmission services charging method, which is based on location. This charging method should reward generators, which are close to load centres, and penalise those which are further away and incur greater losses to the transmission and distribution network. This locational based charging method would give the right market signals to new generation development and will benefit network users as the network will be more efficient. Additionally, TNB has always built its generators near load centres (with higher land costs) and thus incurs a higher capital cost. The implementation of a fairer locational charge would benefit TNB's generators.

5.7.2.3 Third Phase

Although this phase encourages a higher degree of competition, it does not appear that TNB will be affected drastically as in the previous phase because most of the market re-structuring has occurred and hopefully the generation, transmission and distribution has consolidated. However, the opening up of the retail supply business requires TNB to strategise on how to sell electricity to customers, something it has always taken for granted. In other words, TNB lacks the ability to market its products especially in the retail business. This will require TNB to come up with new ways of selling, which can include improving its e-Business applications. As can be seen in the UK case studies, all supply companies offer varying degrees of services over the Internet, underlining its importance in the overall marketing plan. At the same time, TNB must also be aware of its competitors' strategy and use that to formulate the company's next step.

5.7.2.4 Conclusion

Throughout all the three phases, TNB will face different and distinct challenges. One of the most important issues is the loss of customer base, which leads to loss of income. Being a regulated company for so long, TNB is unfamiliar with the rigours of competition and will find it difficult to find new ways to operate their business. In order to counter this effect, TNB must firstly change its mindset to *"think commercially"*. This means that every business decision that TNB makes must be justified. TNB could follow ScottishPower's policy of looking for *"short, sharp deliverables"* and be prepared to terminate any unprofitable ventures quickly.

With regards to countering the loss of customers base and income, TNB will require different strategies in which:

- TNB must strengthen the core business and minimise operating costs. In this area TNB needs to invest in new technologies, which can minimise the workforce and also speed up engineering processes such as automatic re-connection of transmission lines after a lightning strike or remote meter reading. At the same time, TNB must improve its internal business processes. e-Business initiatives such as the self-service e-Office applications used by ScottishPower and Powergen can

help in this area by creating more efficient paperless procedures and speeding up internal communication and processes.

- TNB needs to keep existing customers and attract new ones. As product differentiation is difficult to achieve in the electricity market, TNB must offer better services to customers than its competitor (service differentiation). At the same time, TNB must use brand recognition to market its products by stressing that it is a premier electricity company with decades of experience.
- TNB must develop new businesses locally and abroad. It should look at its relevant subsidiaries as implementors of new business as their functions are specific and can save valuable time in the initial stages of the new ventures. TNB subsidiaries are identified to be implementors as they are already positioned to develop non-core businesses. For example, one subsidiary, TNB Fuel, who currently handles bulk fuel procurements for TNB power stations, can also look for external clients who are interested in procuring fuel. The subsidiary can also use its skills to enter the retail gas market to supply households or possibly develop petrol stations to serve motorists. Another example is for TNB Property to venture into property development such as development of housing estates, industrial parks, or office blocks, instead of just concentrating on acquiring land for TNB facility developments or managing maintenance of TNB buildings. At the moment, these subsidiaries and many others are not seen to be proactive in looking for new businesses or expanding their operation into the wider market. This is possibly due to the fact that TNB's overall strategy inherently limits these subsidiaries' business scope to supporting the core business and not more. In the deregulated market, these subsidiaries must form a greater function as an independent business and must generate its own income through its own initiatives rather than relying on TNB for business or financial support.

In all of the above areas, e-Business can play an important role by linking relevant parties through B2B, B2C, and B2E applications. These applications if applied carefully, can help increase company efficiency. However, TNB must also appreciate that in order to apply e-Business in the organisation, TNB must be able to break down its internal and external business processes and reconfigure them if necessary when implementing e-Business applications. Additionally, TNB's business operations and e-Business applications need to be flexible enough in order to react to market

changes. Finally, TNB must assess its performance and update its strategy if necessary continuously.

5.7.3 Summary of Research Contributions

Table 5.4 below lists the research contributions of this thesis.

Research Contributions	Descriptions
1. Provided insights into the level of e-Business strategy within the electricity industry	The research dealt with all sectors of the industry and determined their perceptions with respect to e-Business. These perceptions were linked closely to the level of their e-Business activities.
2. Provided insights into major problems faced by electricity utilities with regards to e-Business implementation	Problems faced by utilities in terms of e-Business implementation can be overcome as the technology exists but requires the full commitment of the management.
3. Provided insights into case companies' perceptions and views on e-Business specifically for the electricity industry	From the research findings it can be concluded that currently e-Business is not seen as the most important strategy for competing in the deregulated environment of the energy market.
4. Provided insights into the e-Business application and levels of implementation within the electricity utilities.	Research findings identified key e-Business areas which case companies focus on. The levels of e-Business activity in these areas are determined by the number of applications implemented and its effectiveness.
5. Identified B2E and B2B as areas, which can add value to the business by streamlining internal and external processes.	These areas were seen to be lagging in terms of the number of applications as opposed to B2C. This was most apparent in companies with a cost leadership strategy (SSE) and companies operating in the regulated market (GPU)
6. Highlighted the fact that the levels of e-Business implementation within the electricity utilities are heavily related to the business focus and perceptions of the electricity utilities.	Based on the literature reviewed it can be observed that the link between the business focus of electricity utilities and their level of e-Business enthusiasm has never been explored in any depth. Based on this pattern it can be seen that companies on Level 1(see Table 4.12) would have the highest number of e-Business application and their levels of implementation are quite advanced.
7. Highlighted two different approaches towards e-Business that are equally	The analysis chapter discussed the different e-Business approaches of both ScottishPower and

Research Contributions	Descriptions
"effective" and *"successful"*. (Adopted by ScottishPower and Powergen).	Powergen. This analysis also justified the approaches and the results of the initiatives were discussed at length.
8. Projects the future of e-Business applications in the electricity industry especially for TNB in the Malaysian environment.	The literature review chapter details the environment of the electricity market and the analysis chapter discussed the perspectives of the electricity company. This provided the basis for the forecast of the future effects of e-Business.
9. Provided insights into the e-Business opportunities in each sector of the electricity industry	In order to identify the e-Business opportunities within the electricity industry, this research focuses on the electricity industry supply chain, which include the generation, transmission, distribution, and supply sectors. The operations of all these sectors are unique, as most electricity must be generated when it is required, which mean that they must be able to react immediately to the fluctuating demands of their customers. Based on the research findings, e-Business has shown various potentials to help electricity companies in all four sectors to operate successfully in this fast moving market.

Table 5.4 Summary Listing of the Research Contributions

5.8 Limitations

The research strategy was developed to be consistent with the purpose of the study, the resources available, the questions and issues asked and the constraints faced, with the recognition that there are no perfect designs. One of the weaknesses or limitations of the chosen approach to the research strategy was the lack of a pilot study, which according to Yin (1984) can help to refine data collection plans with respect to both the content of the data and the procedures to be followed. Although a pilot study was planned in the initial strategy, difficulties in getting participation from more than a few companies as well as time constraints hindered the plan.

Another limitation of this research is concerned with the reliability issues. As discussed in Chapter 3, a case study database, which consists of a collection of interviews notes and reports, interview direct transcriptions, observations notes,

documents collected from case companies, audio tape and digital recording of interview sessions and newspaper clippings, was developed in order to address the reliability issues of the study. However, due to limited resources and time constraints, this database is not in a formal and easily retrievable manner that can be reviewed and accessed directly by other researchers in order to look at the evidence of the cases studied and not be limited to the written reports only. The lack of a formal database for most case study efforts is considered as one of the shortcomings of case study research and should be corrected in the future (Yin, 1984).

As mentioned in Chapter 3, reliability of the research was susceptible to various factors, which include researcher bias. In this research, the researcher's position as part of the system, in which the researcher is also an employee of one of the case companies can be considered as one of the limitations of the research. The researcher can be assumed as having the opportunity to influence the research findings. For example, the researcher may be thought to have been massaging the findings in order to build a good image of the case company she works for. Although care has been taken in this research to ensure objectivity and unbiased data collection and analysis, there may still be questions on the level of intervention by the researcher. This can lead to the reduction of the reliability level of the research.

The trade-offs or compromises made in the methodology used may pose some issues concerning the quality of the research. One such issue was having to dispense with the initial research design that originally included two other hierarchical levels within the case companies, which comprised the operational managers and non-managerial personnel positions. According to Perry (1998), *"PhD interviews would ideally involve about three interviews at different hierarchical levels within the case study organisations"*. It was anticipated that operational managers who actually implement the e-Business strategies in the companies could have much to offer in terms of describing the problems that they faced during implementation and operation and how they solved these problems. It would also be useful if the research could have got some input from non-managerial personnel, for example people who are on the frontline, to give their comments on how e-Business applications have made their job more efficient or otherwise. Also, it would have been beneficial for the research to determine what their roles were in implementation and how e-Business affected them, or what the

impacts of e-Business were for them, specifically in their job performance and level of motivation. However, as described previously, due to the difficulty in getting access this initial plan had to be restricted. Because of this limitation, the information collected may lack the depth promised by a pure qualitative research.

5.9 Further Research

Based on this study, further research can be conducted to also include other electricity utilities in the UK as well as in the other countries with regulated and non-regulated environment. The purpose of further research would be to subject the findings of this research to further examination within the UK electricity industry, and to subject the findings to comparative analysis with the electricity industry of other countries with similar and different regulatory or competitive conditions. Further research could also be conducted to include comparative analysis in similar industries such as other utilities, for example gas, water, or telecommunication industries.

The findings of this thesis were mainly based on inputs from in-depth interviews with policy or strategy makers of the case companies. Therefore, these inputs can be expanded to also include other levels of personnel within the organisation being researched, such as the operational managers and non-managerial employees. A combination of both quantitative and qualitative approach could be used to collect and analyse the data within these categories to ensure more thorough examination of the results. The variety of input and research approach could help to further understand and help increase the generalisability of the issues studied.

With regards to e-Business implementation, potentials of the other e-Business relationships models that are rapidly gaining importance such as the B2G model for the interactions between electricity companies and regulators could also be considered. This is because the electricity market is continually evolving (with issues such as the ten percent renewable energy generation in the UK by 2010) and requires continuous interactions between electricity companies and the regulator in order to fine-tune the market. Another example of the evolving nature of the electricity industry can be seen in Asia. In this region many economies are experiencing

phenomenal energy growth. For example, China recorded a nearly twenty percent jump in electricity demand in the first two months of 2003 (China Daily, 2003). This could possibly accelerate the move to deregulate markets and could attract new international investments. The introduction of e-Business B2G applications could help speed up the decision-making process for both the investor and the government. Thus, further analysis of the B2G model would provide a more thorough discussion on the e-Business opportunities in the electricity industry.

Other areas that could be examined in future research are developments in the electricity markets. For example, the UK electricity grid is currently being improved and will have increased capability to transfer power to its neighbours. This in turn will increase the potential of cross border trades and requires some level of integration between different national energy markets and associated systems. In this case, it would be interesting to investigate how different markets can be integrated and examine the challenges that this issue poses to market participants.

The compulsory introduction of renewable generation, which is usually produced by embedded generators, is a big issue in the electricity industry at the moment. Embedded generators are also known as distributed generators (DG) - they are smaller generators less than 1MW which are placed in the distribution network and are not connected to the transmission system. Common types of DG are combined heat and power plants (which uses fossil fuels) run by factories mainly for their own consumption, or renewables (which are powered by wind or solar). Distributed generators present new challenges not only to the technical but also to the business side of operations. One of the main challenges is integrating the embedded generators into the market. These embedded generators are mainly operated by small companies and have limited ability to invest in a complex electronic trading application to enable them to participate in the greater market. Thus, further research could be targeted on understanding this issue, which may be beneficial to these smaller generating companies.

To conclude, the electricity industry is in a position where it is undergoing profound fundamental change at a time when technology offers possibilities never before seen. Strategic transformation in today's business environment requires that a company

understands the forces that are re-shaping the industry and those forces that are driving change in the broader business landscape. The ideas presented here offer a systematic approach for understanding: how the industry will unfold, the distinct business models enabled by technology, the specific capabilities a company must have, and the actions it will need to take today to initiate its transformation.

Many electricity companies have begun to embrace the opportunities made available to them by these changes, others must begin to view their businesses less as part of a sluggish regulated company and more as mainstream organisations with assets and capabilities that stretch beyond power plants and load forecasting. The opportunities and enablers are already there; seizing them is the next step.

References

Albrecht, M.M. (2002). ***Building e-Marketing Programs on a Brick and Mortar Foundation.*** Proceeding of the Annual Meeting of the Association of Collegiate Marketing Educators, St. Louis, Missouri, 6-9 March 2002.

Aljifri, H. A., Pons, A., Collins, D. (2003) ***Global e-Commerce: A framework for understanding and overcoming the trust barrier,*** Information Management and Computer Security, Volume 11, No. 3, Pp 130-138

Alomaim, N., Tunca, M. Z., Zairi, M. (2003) ***Customer satisfaction @ virtual organisations,*** Management Decision, Volume 41, No. 7, Pp 666-670

Amor, D. (2000). ***The e-Business (R) evolution: Living and Working in an Interconnected World.*** Hewlett-Packard Company. Upper Saddle River, NJ, Prentice Hall, Inc.

Andrea, D. (2000). ***The Risks of e-Business.*** Automotive Industries Magazine, Issue February 2000, available from *http://ai-online.com/articles/feb00/0200d1.htm* last accessed 25/10/2002

Anfara, V. A. J., Brown, K. M., Mangione, T. L. (2002) ***Qualitative Analysis on Stage: Making the Research Process More Public,*** Educational Researcher, Volume 31, No. 7, Pp 28-38.

Angeles, R. (2001), ***Creating a digital marketspace presence: Lessons in Extranet implementation,*** Internet Research: Electronic Networking Applications and Policy, Volume 11, No. 2, Pp 167-184

Arthur, C. (2002). ***Inland Revenue abandons 'insecure' e-mail facility.*** Independent news, UK, 27th June 2002, available from *http://news.independent.co.uk/digital/news/story.jsp?story=309481* last accessed 1/7/2002

Asia Pacific Energy Research Centre, (2000) ***Electricity Sector Deregulation in the APEC Region,*** Tokyo: Asia Pacific Energy Research Centre, Institute of Energy Economics.

Averett, R. W. (2000). ***With Deregulation and Competition, Energy Companies Embrace EBPP as an Effective CRM Tool.*** Princeton eCom.

Bangkok Post. (2000) ***Focus Now Is on M-Commerce.*** Anywhereyougo.com , available from *http://www.canvasdream.com/articles/* last accessed 30/01/2002

Bartlett, M. (2001) ***Mobile Commerce To Hit $230 Bill by 2006 – Study.*** Newsbytes, Boston. Massachusetts, USA 17th January 2001, available from *http://www.newsbytes.com/news/01/160643/html* last accessed 30/01/2002

Barua, A., Konana, P., Whinston, A.B., Yin, F. (2001) ***Driving e-Business Excellence,*** MIT Sloan Management Review Volume 43, No. 1, Fall 2001, Pp 36-44

Berryman, K., Harrington, L. Layton-Rodin, D., Rerolle, V. (1998) ***Electronic commerce: three emerging strategies.*** The McKinsey Quaterly, No. 1, Pp 129-139.

Bontis, N., De Castro, A. (2000). ***The First World Congress on the Management of Electronic Commerce: Review and Commentary.*** Internet Research: Electronic Networking Applications and Policy Volume 10. Number 5. 2000. Pp. 365-373. MCB University Press.

Boote, J., Mathews, A. (1999) ***"Saying is one thing; doing is another": the role of observation in marketing research.*** Qualitative Market Research: An International Journal, Volume 2, No. 1, Pp 15-21

Brache, A., Webb, J. (2000). ***The eight deadly assumptions of e-Business.*** The Journal of Business Strategy; Boston; May/Jun 2000; Volume 21; Issue 3; Pp 13-17. Copyright Faulkner and Gray Inc.

Braun, H., Lai, L.L. (2001) *Application of the Internet to Power System Monitoring and Trading,* Chapter 12 in Power System Restructuring and Deregulation: Trading, Performance and Information Technology. John Wiley & Sons Ltd. England. Pp. 416-460

Bray, P. (2000) *The new high-tech marketplace,* The Sunday Times, UK. 3/12/2000, P 4

Broadbent, M. (2000). *A Board Guide to e-Business.* Gartner TechWatch, Gartner Group, Inc. available from *http://www.gartnertechwatch.com* last accessed 30/01/2002

Broersma, M. (2000) *M-Commerce will flop – Forrester Report,* available from *http://www.zdnet.co.uk/news/2000/35/ns-17737.html* last accessed 30/01/2002

Brynjolfsson, E., Urban, G. L. (2001). *Strategies for e-Business Success.* MIT Sloan Management Review. Massachusetts Institute of Technology. Jossey-Bass A Wiley Company. Pp 1-4

Clarke, T. (2001) *The Knowledge Economy,* Education and Training, Volume 43, No. 4/5, Pp 189-196

Campbell, D., Stonehouse, G., Houston, B. (1999). *Business Strategy: An Introduction.* Butterworth-Heinemann, Oxford.

Cane, A. (2000) *More than mobile.* Financial Times, Understanding WAP, Summer 2000.

Cap Gemini Ernst & Young. (2000). *e-Business in European Energy Companies.* Summary Findings of An Independent European Survey.

Carter, S. (1999) *Anatomy of a Qualitative Management PhD. Part One – Getting Started,* Management Research News; Volume 22, No.11, Pp 9-22

Carter, S. (1999) *Anatomy of a Qualitative Management PhD. Part Two – Getting Finished,* Management Research News; Volume 22, No.12, pp 1-18

Champy, J. (2002) *X-Engineering The Corporation: Reinvent Your Business in the Digital Age.* Hodder & Stoughton, London.

China Daily (2003) *China's Electricity Demand to Rise,* China Daily, April 16, 2003, available from *http://www.china.org.cn/english/2003/Apr/62377.htm* last accessed 10/11/2003

Coppel, J. (2000) *e-Commerce: Impacts and Policy Challenges.* OECD Economics Department Working Papers No. 252, Paris. ECO/WKP (2000) 25. Disrtibute 30th June 2000.

Dalton, G. (1999). *E-Business Evolution,* InformationWeek, June 7, 1999, Pp 737, 50-66, available from *http://www.informationweek.com/737/ebiz.htm* last accessed 30/01/2002

De Figueredo, J.M. D. (2001). *Finding Sustainable Profitability in Electronic Commerce* Chapter 1 in Strategies for e-Business Success. MIT Sloan Management Review edited by Brynjolfsson, E., Urban, G. L.. Massachusetts Institute of Technology. Jossey-Bass A Wiley Company. Pp 7-33

De, R., Mathew, B., Abraham, D. M. (2001) *Critical Construct for analysing e-Businesses: investment, user experience and revenue model.* Logistic Information Management. Volume 14, No.1/2 Pp 137-148. MCB University Press

Deavers, K. L. (1997) *Outsourcing: A corporate competitiveness strategy, not a search for low wages* Journal of Labour Research, Volume 18, No. 4, (Fall 1997), Pp 503-519

Denzin, N.K., Lincoln, Y.S. (2000) *Handbook of Qualitative Research, Second Edition.* Sage Publications, Inc.

DeWeese, J. (2000). *E-Energy: The Impact of the Internet on the Energy Industry.* Enermetrix.

Dey, I (1993) *Qualitative Data Analysis, A User-Friendly Guide for Social Scientists,* London: Routledge.

Dyson, S. (2000). *e-Business in a Competitive Utility Industry: Managing to become an e-Business.* IBM Utility and Energy Services Industry.

e-CRMGuide.com Staff (2001). *Survey: Quality Service, Cost Control Are Top Customer Service Challenges* Ed., Toronto: John Wiley & Son Inc. available from *http://www.ecrmguide.com/news/print* last accessed 1/02/2002

Edrich, C. (2000). *Managing e-Business Risks.* ZDNetUK. Available from *http://www.zdnet.co.uk/itweek/brief/2000/16/management/01.html* last accessed 1/02/2002

Elmuti, D., Kathawala, Y. (2001) *An overview of strategic alliances.* Management Decision, Volume 39, No. 3, Pp 205-217.

Englehardt, C. S., Simmons, P. R. (2002) *Organisational flexibility for a changing world,* Leadership and Organisation Development Journal, Volume 23, No. 3, Pp 113-121

Evans, P., Wurster, T. S. (2000). *Blown to Bits: How The New Economics of Information Transforms Strategy.* Harvard Business School Press. Boston. Massachusetts.

Fish, J. (2000). *The Global Energy Retailing Revolution.* PricewaterhouseCoopers.

Forbes.com (2002) *The International 500* , available from *http://www.forbes.com/2002/07/03/internationals.html* Last accessed 25/10/2002

Fox, B. (2000) *WAP blues.* Mobile Choice, May 2000

Franceschini, F., Galetto, M., Pignatelli, A., Varetto, M. (2003) *Outsourcing: guidelines for a structured approach* Benchmarking: An International Journal, Volume 10, No. 3, Pp 246-260

Fraser, F., Fraser, N., McDonald, F. (2000). *The Strategic Challenge of Electronic Commerce*. Supply Chain Management: An International Journal. Volume 5, No. 1, Pp 7-14. MCB University Press.

Fridman, S. (2000) *Companies Transform Way They Do E-Business*. BizReport.com Network, e-Business, 16th May 2000, available from *http://www.bizreport.com/ebiz/2000/05/20000516-2.htm* last accessed 01/02/2002

Garvey, M.J. (2002), *Information Powers Energy Business*, Informationweek (Manhasset, N.Y.), No.907 (September 23 2002), Pp 95-6,99.

Gibb, F. (2002) *Information Strategy*. Glasgow: University of Strathclyde Graduate Business School. 2002.

Glass, R. L. (2001) *What can we learn from the dot-com debacle?* Database for Advances in Information Systems, New York; Spring 2001; Volume 32; Issue 2; Pp 8-10.

Goldberg, B. (1999). *Customer Relationship Management, What Is It All About?* ISM, Inc.

Gomm, R., Hammersley, M., Foster, P. (2000) *Case Study Method*, London: Sage Publications Ltd.

Gordijn, J., Akkermans, H. (2001). *Designing and Evaluating e-Business Models*. IEEE Intelligent Systems, July/August 2001, Vol. 16, No. 4, Pp 11-17.

Green, S. (2001), *A Global Opportunity*, Power Engineering International, Volume 9, No.3, P 34.

Grimes, B. (1999) 7 *Lesson From MindSpring*. Fortune Magazines, available from *http://www.spl.co.za/e-business/mindspring.htm* last accessed 01/02/2002

Hackbarth, G., Kettinger, W.J. (2000). ***Building an e-Business Strategy: Foundations of a Comprehensive Methodology***. Information Systems Management, Volume 17, No. 3. Pp 78-93

Hanfiah, M. (2002). ***Landmark power pact signed***. The Star Online: Business News. Malaysia, Wednesday, 15th May 2002, available from *http://biz.thestar.com.my/news/story.asp?file=/2002/5/15/business/mmegat&sec=business* last accessed 25/10/2002

Hansen, T. (2001). ***E-Marketplaces Vie for Utilities' Business***. Utility Automation Journal, Volume 6, No. 3, P 28+. April 2001. Associate Publisher.

Harmon, C. (2000). ***Growth Strategies for Energy Companies***. PriceWaterhouseCoopers, Strategic Change Practice.

Harris, S., Ghauri, P. (1998) ***Strategy formation by business leaders. Exploring the influence of national values***. European Journal of Marketing. Volume .34, No. 1/2. Pp 126-142. MCB University Press.

Hart, C. (2000). ***Doing a Literature Review: Releasing the Social Science Research Imagination***. SAGE Publications. London, Thousand Oaks, New Delhi.

Healy, M., Perry, C. (2000) ***Comprehensive Criteria To Judge Validity And Reliability Of Qualitative Research Within The Realism Paradigm***, Qualitative Market Research: An International Journal, Volume 3, No. 3, Pp 118-126.

Howe, D.J., Cuccaro, J.E. (2001), ***Electricity Deregulation: IT's New Bonanza***, Information Systems Management, Volume 18, No.3, Summer 2001, Pp 83-91.

Intel Corporation (2001) *How do I build the e-Business infrastructure I need?* Strategies and Trends, available from *http://www.intel.com/ebusiness/technology/implement/3/* last accessed 01/02/2002

Intel Corporation. (2001) *e-Commerce will transform supply chain management* available from *http://www.intel.com/eBusiness/bu0siness/manage/3/hi010502_p.htm* last accessed 01/02/2002

Jefferies, D.G. (2001). *Foreword* in Power System Restructuring and Deregulation: Trading, Performance and Information Technology. John Wiley & Sons Ltd. England. P.xv

Johnson, G., Scholes, K. (1999). *Exploring Corporate Strategy.* Fifth Edition. Prentice Hall, Europe.

Jutla, D.N., Craig, J., Bodorik, P. (2001) *A Methodology for Creating e-Business Strategy,* Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS-34), Volume 7, January 03-06 2001, Institute of Electrical and Electronics Engineers (IEEE), Pp. 1-10

Kalakota, R., Robinson, M. (2001). *e-Business 2.0, Roadmap for Success.* Second Edition. Addison Wesley. US

Kalakota, R., Whinston, (1996). *Frontiers of Electronic Commerce* Addison-Wesley Publishing Company, Inc.

Kehoe, C. F. (2000) *M-commerce: Advantage, Europe.* The McKinsey Quartely 2000 Number 2:Europe. Dow Jones & Company, Inc.

Koushik, S. (2000). *Understanding B2B e-Business Solutions, An Executive's Guide to Business-to-Business e-Business.* IBM Global Services.

Lai, L.L. (2001) *Power System Restructuring and Deregulation: Trading, Performance and Information Technology.* John Wiley & Sons Ltd. England

Laudon, K.C., Laudon, J. P. (2000). *Management Information Systems, Organisation and Technology in the Networked Enterprise.* Sixth Edition. Prentice Hall, Inc.

LeCompte, M. D. (2000) *Analysing Qualitative Data,* Theory into Practice, Volume 39, No. 3, Pp 146-54

Lee, A. (2002). *Beckham's new role is Captain Fantastic.* Scottish Daily Express, Saturday, 8th June, 2002, Pg. 4.

Lo, K.L. Yuen, Y.S. (2001) *Deregulation of Electric Utilities* Chapter 2 in Power System Restructuring and Deregulation: Trading, Performance and Information Technology. John Wiley & Sons Ltd. England. Pp 50-74.

Lonergan, E. (2000). *B2B E-Marketplaces : A Study of the Current Industry.* Masters Thesis, Department of Information Science, University of Strathclyde, Glasgow.

Lord, C. (2000). *The Practicalities of developing a successful e-Business strategy.* The Journal of Business Strategy, Boston. Volume 21. Issue 2. Start Page 40-43. ISSN 02756668

Lowson, R. H., Burgess, N. J. (2003), *The building blocks of an operations strategy for e-Business,* The TQM Magazine, Volume 15, No. 3, Pp 152-163

Lozano Moncada, C. A. (2002). *Game Theory Application to the Analysis of Wheeling Charges Allocation and Bidding Strategies.* PhD Thesis, Department of Electronic and Electrical Engineering, University of Strathclyde, Glasgow.

Macadie, I. (2000). *Alternatives to Retail: An Empirical Examination of Four different E-Commerce Approaches.* Masters Thesis, Department of Information Science, University of Strathclyde, Glasgow.

Macalister, T. (2002), *British Energy Seeks Bailout,* The Guardian, Friday September 6, 2002, available from

http://www.guardian.co.uk/business/story/0,3604,787199,00.html last accessed 10/11/2003

Mandal, P., Love, P.E.D, Irani, Z. (2003) ***Pre-alliance planning: development of an information system infrastructure to support strategic alliance activities,*** Management Decision, Volume 41, No. 2, Pp 132-140

Martinsuo, M. (2001) ***Balancing large scope and project manageability in a qualitative research design,*** Management Decision, Volume 39, No. 7, Pp 539-550

McGee, J.V., Prusak, L., Pyburn, P. the Ernst & Young Centre for Information Technology and Strategy (1993) ***Managing Information Strategically.*** John Wiley & Sons, Inc.

McIvor, R. (2000) ***A practical framework for understanding the outsourcing process,*** Supply Chain Management: An International Journal, Volume 5, No. 1, Pp 22-36

Means, G., Schneider, D. (2000). ***MetaCapitalism: The e-Business Revolution and the Design of 21st-Century Companies and Markets.*** John Wiley & Sons, Inc.

Mesenbourg, T.L. (2000). ***Measuring Electronic Business: Definitions, Underlying Concepts, and Measurement Plans.*** United States Bureau of the Census, available from *http://www.census.gov/epcd/www/ebusines.htm* last accessed 01/02/2002

Mihlmester, P. E., Mckelvey, M. (2000). ***The e-Business Revolution in Energy Services.*** Proceedings of the ACEEE 2000 Summer Study on Energy Efficiency in Buildings. Washington D.C.

Miles, M.B., Huberman, A.M. (1994), ***An Expanded Sourcebook: Qualitative Data Analysis,*** 2nd ed., Thousand Oaks, CA: SAGE Publications.

Milroy, M., Li, F. (2001). ***Internet Billing: the experience from four UK utility companies.*** International Journal of Information Management. Volume 21, Pp 101-121.

Mintzberg, H., Quinn, J.B., Ghoshal, S. (1995) ***The strategy process***. European Edition. Prentice Hall London.

Morrill, G. (2001). ***Big Picture***. Conspectus: The IT Report For Directors And Decision Makers: E-Business Solutions. December 2001, Pp. 26-27.

Mullen, T. (2000). ***Deregulation and Web Collide –Utilities look to Internet to offer electricity in territories once controlled by monopolies***. Internetweek, Manhasset, Nov 20, 2000, Issues 838, P12-18.

Munoz, L., Schlosser, J., Sung, J. (2001). ***Dead and (Mostly) Gone***. Dot-Com Deathwatch 2001, Fortune 4th December 46-47.

Mustapha, I. (2001). ***Privatisation, Industry and Regulatory Reform And Corporate Governance in the Electric Utility Industry In Malaysia***. Commonwealth Association for Corporate Governance Conference on the Dynamic Developments in Corporate Governance, Kuala Lumpur, 12-13 November 2001.

Myers, M. D. (1997) ***Qualitative Research in Information Systems***, MIS Quarterly, Volume 21 Number 2, June 1997, Pp. 241-242

New Electricity Trading Arrangement (2001) ***NETA Summary***, available from *http://www.inencogroup.com/neta1.html#BackGround* last accessed 10/11/2003

National Grid Transco (2003) ***Interconnector*** available from *http://www.nationalgrid.com/uk/activities/other/nn_interconnectors_norway.html* last accessed 10/11/2003

Nicholls, J. (1995) ***The MCC Decision Matrix: A Tool For Applying Strategic Logic to Everyday Activities***, Management Decision, Volume 33, No.6 Pp 4-10

Norton, J. (2000) ***The e-Business imperative***, Info, Volume 2, No. 5, Pp 449-454

O'Brien, J. A. (1999). *Management Information Systems., Managing Information Technology in the Internetworked Enterprise.* Fourth Edition. Irwin McGraw Hill.

OECD (1998). *The Economic and Social Impacts of Electronic Commerce: Preliminary Findings and Research Agenda.* OECD Background Report. Ministerial Conference: Realising the Potential of Global Electronic commerce, Ottawa, Canada, 7-9 October 1998

Ofgem, Office of Gas and Electricity (2002). *About Ofgem.* January, Ofgem, London, available from *http://www.ofgem.gov.uk/* last accessed 10/11/2003

O'Mahony, M., Vecchi, M. (2001) *The Electricity Supply Industry: A Study Of An Industry In Transition,* National Institute Economic Review, No. 177 (July 2001), Pp 85-99.

Open Market, Business-to-Business White Paper (1999). *A Return on Investment Guide For Business-to-Business Internet Commerce.*

Osborne, S. (2001). *E-Business in hindsight.* IT Services and Solutions: Bringing the information gap between decision makers and their IT partners. e-Business History, November 2001, Pp 6-8.

Osterwalder, A., Pigneur, Y. (2002). *An e-Business Model Ontology for Modeling e-Business.* 15th Bled Electronic Commerce Conference, e-Reality: Constructing the e-Economy 2002.

PA Consulting Group (2000) *Potential e-nergy? Realising the full potential of e-Business in the utilities, A PA report covering the UK, Australia and Scandinavia,* London,available from *http://www.pa-consulting.com* last accessed 10/11/2003

PA Consulting Group (2001) *Increasing Business Value With Information Technology, PA's Survey On The Business Value Of IT,* London, available from *http://www.pa-consulting.com* last accessed 10/11/2003

Pant, S., Ravichandran T. (2001) *A framework for information systems planning for e-Business*. Logistics Information Management. V14. No. 1/2 85-98. MCB University Press

Patton, M. Q. (2002) *Qualitative Research & Evaluation Methods*, 3rd Edition, Thousand Oaks, CA: SAGE Publications.

Perman, R., Poulter, A. (2002) *e-Business and Enabling Technologies*. University of Strathclyde, Graduate School of Informatics, 2002, Glasgow.

Perry, C. (1994) *A Structured Approach To Presenting PhD Thesis: Notes For Candidates And Their Supervisors*. Paper presented to the ANZ Doctoral Consortium, University of Sydney, February 1994, available from *http://www.elec.uq.edu.au/doc/Thesis_guide/phdth1.html*. last accessed 02/08/2002

Perry, C. (1998) *A Structured Approach For Presenting Research Theses*. Australasian Marketing Journal, Volume 6, No. 1, pp 63-86.

Perry, C. (1998) *Processes Of A Case Study Methodology For Postgraduate Research In Marketing*. European Journal of Marketing, Volume 32 No. 9/10, pp 785-802.

Phan, D. D. (2001) *e-Business Management Strategies: A Business-to-Business Case Study*, Information Systems Management, Volume 18, No. 4, Fall 2001, I'p 61-69

Phan, D. D. (2002) *e-Business success at Intel: an organisation ecology and resource dependence perspective*, Industrial Management and Data Systems, Volume 102, No. 4, Pp 211-217

Phillips, E. M., Pugh, D. S. (2001) *How To Get A PhD: A Handbook For Students And Their Supervisors*, 3rd Edition, Open University Press, Buckingham

Popper, M. (2000). *That Crazy Patchwork Called Electricity Deregulation*. Special Report – Power Deregulation. December 6, 2000. BusinessWeek. The McGrawHill Companies Inc.

Porta, M. (2000). *E-Markets: Creating the Future of Business-to-Business Online.* PricewaterhouseCoopers Strategic Change Practice.

Porter, M.E. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance.* The Free Press, New York, NY.

Potter, C. (2001) *Managing e-Business Risk – A UK Perspective.* The IIA, available from *http://www.itaudit.org/forum/e-Commerce/f401ec.htm* last accessed 01/02/2002

Prigg, M. (2000) *How sharing can change way business works.* The Sunday Times, UK, 3/12/2000, Pp. 2-3

Prigg, M. (2000) *Join forces to move forward.* The Sunday Times, UK, 3/12/2000, P 9.

Quest, P. (2000). *Getting Real: The e-Business future in UK utilities.* PricewaterhouseCoopers, available from *http://www.pwcglobal.com/extweb/ncsurvres.nsf/DocID/C51EB52E7968AE688525691 50074007F* last accessed 01/02/2002

Quest, P. (2001). *Getting Real Insight: Issue 1: B2B in Utilities.* PricewaterhouseCoopers, available from *http://www.pwcglobal.com/extweb/ncsurvres.nsf/DocID/C51EB52E7968AE688525691 50074007F* last accessed 01/02/2002

Radding, A. (2000). *e-Business Infrastructure: Pressure Grows For e-Business Infrastructure.* Informationweek.com, September 25, 2000, available from *http://www.informationweek.com/805/bizinfra.htm* last accessed 01/02/2002

Rao, S.S. (2000). *E-commerce: the medium is the mart.* New Library World. Volume 101. Number 1154. 2000. Pp 53-59. MCB University Press.

Rappa , M. (2002). *Business Models on the Web.* Managing The Digital Enterprise, available from *http://digitalenterprise.org/models/models.html* last accessed 25/10/2002

Ratnasingam, P. (2002) *The importance of technology trust in Web services security,* Information Management and Computer Security, Volume 10, No. 5, Pp 255-260

Read, W.S. (2001). *Electric Utility Restructuring in North America.* IEEE Power Engineering Review, May 2001, Volume 21, No. 5

Repository Technologies, Inc. (2000). *Overview of Customer Relationship Management (CRM),* available from http://www.custfirst.com/crm/html last accessed 01/02/2002

Reynolds, J. (2000). *eCommerce: a critical review.* International Journal of Retail & Distribution Management. Volume 28. Number 10. Pp 417-444. MCB University Press.

Riggins, F.J. (1999) *A Framework for Identifying Web-Based Electronic Commerce Opportunities,* Journal of Organizational Computing and Electronic Commerce, Vol. 9, No. 4, 1999.

Riggins, F.J., Mitra, S. (2001). *A Framework for Developing E-Business Metrics Through Functionality Interaction.* Working Paper, DuPree College of Management's Information Technology partnership Program, January 2001.

Robert, M., Racine, B. (2001) *e-Strategy, Pure and Simple: Connecting Your Internet Strategy To Your Business Strategy,* NY: McGraw-Hill

Robson, W. (1997). *Strategic Management & Information Systems.* Second Edition. Financial Times Pitman Publishing, London

Rodgers, J. A., Yen, D. C., Chou, D. C. (2002), *Developing e-Business: A Strategic Approach,* Information Management & Computer Security, Volume 10, No. 4, Pp 184-192

Rogak, L. (2000) *Commerce Adds an M.* Business 2.0

Rotondaro, R. G. (2002) *Defining the customer's expectations in e-Business*, Industrial Management & Data Systems, Volume 102, No. 9, Pp 476-482

Rowell, Amy. (1999). *e-Business Strategies for the Enterprise.* Midrange Systems. Spring House. Volume 12, Issue 17. ISSN:10418237. Boucher Communications, Inc.

Rowley, J. (2002), *Synergy and strategy in e-Business*, Marketing Intelligence and Planning, Volume 20, No. 4, Pp 215-222.

Schafer, M. (2000) *How To Attract and Keep an E-Business Team.* Network Computing, available from *http://www.networkcomputing.com* last accessed 01/02/2002

Scottish Business Insider (2001) *Top 500 Leading Companies in Scotland*, available from *http://www.insider.co.uk/index-top500.cfm*. last accessed 25/10/2002

ScottishPower (2001) *Scottish Power Annual Report & Accounts/Form 20-F 2000/2001.* Glasgow, UK. Pp 23-28.

Sekaran, U. (1992) *Research Methods For Business: A Skill Building Approach*, 2nd Edition, Toronto: John Wiley & Son Inc.

Senia, A. (2000). *Utilities power up on the Internet.* Utility Business: Overland Park; May 2000; Volume 3; Issue 5; P28-32.

Seybold, P. B. (2000) *Dial M for Commerce.* Business 2.0 available from *http://www.busines2.com/content/magazine/ebusiness/2000/04/01/20758* last accessed 01/02/2002

Seybold, P.B. (2000) *How to Change Your e-Business Model (s): Morphing Your e-Business on the Fly.* Patricia Seybold Group's Customers.com Strategic Planning Service. 20th July 2000.

Shankar, V., Smith, R.H. (2000). *e-Business in the US Electric and Gas Industry*. Cap Gemini Ernst & Young.

Shaw, E. (1999) *A Guide To The Qualitative Research Process: Evidence From A Small Firm Study*, Qualitative Market Research: An International Journal, Volume 2, No. 2, pp 59-70.

Silverman, D. (1993) *Interpreting Qualitative Data, Methods for Analysing Talk, Text and Interaction*, Thousand Oaks, CA: SAGE Publications

Silverman, D. (2000) *Doing Qualitative Research: A Practical Handbook*, Thousand Oaks, CA: SAGE Publications.

Singh, M. (2002) *e-Services and their role in B2C e-Commerce*, Managing Service Quality, Volume 12, No. 6, Pp 434-446

So, M.W.C., Sculli, D. (2002) *The role of trust, quality, value, and risk in conducting e-Business*, Industrial Management and Data Systems, Volume 102, No. 9, Pp 503-512

Solon Consultants (2002). *Integrated European RTD Information System: Study Report*. Solon Consultants, London. March 2002. Pp 44-45.

Starr, M. K. (2003) *Application of POM to e-Business: B2C e-Shopping*, International Journal of Operations & Product Management, Volume 23, No. 1, Pp 105-124

Steinfield, C., de Wit, D., Adelaar, T., Bruins, A., Fielt, E., Hoesfsloot, M.,Smit, A., Bouwman, H. (2000). *Leveraging Physical and Virtual Presence in Electronic Commerce: The Role of Hybrid Approaches in the New Economy*. Paper presented to the International Telecommunications Society, Buenos Aires, Argentina, July 2-5, 2000, available from *http://www.msu.edu/~steinfie/steinfieldITS.html* last accessed 01/02/2002

Stenbacka, C. (2001) *Qualitative research requires quality concepts of its own*, Management Decision, Volume 39, No. 7, Pp 551-555

Stoft, S. (2002) ***Power Systems Economics: Designing Markets For Electricity,*** Wiley-IEEE Press, CA

Surry, D.W., Ely, D.P. (2001). ***Adoption, diffusion, implementation, and institutionalisation of educational innovations.*** In R. Reiser & J. V. Dempsey (Eds.), Trends & Issues in Instructional Design and Technology. Upper Saddle River, NJ: Prentice-Hall

Tabors, R.D. (2000). ***Electric Restructuring: A View from the Open Market.*** Tabors Caramanis & Associates and Massachusetts Institute of Technology.

Tapscott, D. (1996) ***The Digital Economy, Promise and Peril In The Age Of Networked Intelligence.*** McGraw-Hill, Inc.

Tapscott, D., Ticoll, D., Lowy, A. (2000) ***Digital Capital: Harnessing the Power of Business Webs.*** Harvard Business School Press.

Taylor, A. (2002) ***The last British power struggles.*** Financial Times, 30th April 2002, Pg. 23.

Tellis, W. (1997) ***Application of a Case Study Methodology,*** The Qualitative Report, Volume 3, No. 3, Pp 1-14.

The Electricity Association (1999). ***The UK Electricity System,*** available from *http://www.electricity.org.uk/* last accessed 25/10/2002

Thompson, J. (2000) ***From e-Commerce to T-Commerce.*** Information Age, September 2000, available from *www.infoconomy.com* last accessed 01/02/2002

Timmers, P. (1998). ***Business Models For Electronic Markets.*** Journal on Electronic Markets. Volume 8, No.2, Pp 3-8.

Treadway, M., Valocchi, M. (2000). ***E-Business in the Power Industry: Transforming the Competitive Landscape.*** PriceWaterhouseCoopers North American

Energy/Utilities Industry Consulting Practice. PriceWaterhouseCoopers Utilities Strategic Change Practice.

Udo, G. J. (2001) *Privacy and security concerns as major barriers for e-Commerce: A survey study*, Information Management and Computer Security, Volume 9, No. 4, Pp 165-174

Van Hooft, P.C. Stegwee, R. A. (2001). *E-Business strategy: how to benefit from a hype*. Logistic Information Management. Volume 14, No.1/2, Pp 44-53. MCB University Press

Vantage Systems (1999) *Future of e-Business: A Gartner Report – Part 1*. Vantage News Flash July 1999, available from *http://www.vantagesystems.com.au/news/back_issues/* last accessed 01/02/2002

Viehland, D.W. (1999) *New Business Models for Electronic Commerce*. Proceedings of the 17th Annual International Conference of the Association of Management/International Association of Management, San Diego, California, 6-8 August 1999, Volume 17, No. 2, Pp 141-143

Viehland, D.W. (2000). *Critical Success Factors for Developing an e-Business Strategy*. Proceedings of the 2000 Americas Conference on Information Systems, *Long Beach, California, 13 August 2000*, available from *http://www.massey.ac.nz/~Dviehlan/ebusinesscsf.html* last accessed 01/02/2002

Viehland, D.W. (2000). *Principles for e-Business Success*. Proceedings of the Fourth Pacific Asia Conference on Information Systems, Hong Kong, 2 June 2000, pp. 78-87.

Vinten, G. (1994) *Participant Observation: A Model For Organisational Investigation*, Journal of Managerial Psychology, Volume 9, No. 2, Pp 30-38.

Voon, S.C. (2000). How to Succeed in e-Business. Malaysia.CNET.com. CNET, Inc. Asiacontent.com. available from

http://malaysia.cnet.com/Ebusiness/Experthelp/000913/index.html last accessed 01/02/2002

Walters, D., Buchanan, J. (2001) ***The new economy, new opportunities and new structures***, Management Decision, Volume 39, No. 10, Pp 818-834

Weill, P. (2001) ***Atomic e-Business Models: Migrating from Place to Space*** MIT Sloan School of Management

Whyte, G. (2000). ***Electronic Commerce: A Beginners Guide.*** Article 6th March 2000. About.com, available from *http://ecommerce.about.com/library/weekly/aa030600a.htm* last accessed 01/02/2002

Wilhelm, F. (2000) ***Building Value Into Your Supply Chain.*** Wavebend Solutions, LLC.

Worzala, E. M., McCarthy, A. M., Dixon, T., Marston, A. (2002) ***e-Commerce and retail property in the UK and USA***, Journal of Property Investment & Finance, Volume 20, No. 2, Pp 142-158

Yin, R. K. (1984) ***Case Study Research: Design and Methods***, Applied Social Research Methods Series, Volume 5, Beverly Hills, CA: SAGE Publications

Yin, R. K. (2003) ***Case Study Research: Design and Methods***, 3rd Edition, Applied Social Research Methods Series, Volume 5, Beverly Hills, CA: SAGE Publications

Zhu, Z., Hsu, K., Lillie, J. (2001) ***Outsourcing – A Strategic Move: The process and the ingredients for success*** Management Decision, Volume 39, No. 5, Pp 373-378

Zwass, V. (1996). ***Electronic Commerce: Structures and Issues.*** International Journal of Electronic Commerce. Volume 1, No. 1, Fall 1996. Pp 3-23.

Appendix A: Sample of Interview Questions

Interview Questions (Strategy and Policy Makers)

Electricity Company :_____

Site Address :_____

Contact Person :_____

Position :_____

Date :_____

Time :_____

Questions

General Information (G)

1. Please describe your organisation and the environment that it operates in.
2. Please describe your role in this organisation.
3. Please describe your unit/department's role, in terms of the overall organisation's strategy, main business operation, employees, etc.
4. Who are your key business partners, suppliers etc.?
5. What type of customers do you have? (Both industrial/commercial and domestic)(Broad %)?
6. How many employees do you have working within your area of responsibilities?
7. What type of skills must your employees have?
8. What type of training do you provide for your employees in general?
9. What are the impacts of deregulation on your organisation?
10. How does your organisation cope with the changes caused by deregulation?
11. How does NETA affect your organisation?

e-Business Strategy (S)

1. How would you define e-Business?
2. What are your perceptions of e-Business?
3. How important is e-Business to your company with regards to your current business strategy?
4. What strategies are being pursued by your company to benefit from the e-Business environment?
5. Do you have any type of e-Business applications running? What are your current e-Business applications? What is the most valued e-Business application running currently and why?
6. What is your e-Business strategy for the future?
7. What other operational areas will the organisation develop e-Business application for in the future and why?

Questions
8. What factors are being considered as important in developing, planning and executing the strategy? 9. How does this strategy affect interactions with business partners and customers? 10. How do you prepare your business partners and clients to deal in the e-Business environment? 11. What are the potential benefits of e-Business in relation to your organisation's customers, suppliers, other business partners and internal processes? 12. How do you measure e-Business performance within your organisation? Do you have any data that shows e-Business has increased your organisation's performance (numerical or subjective data)? (What type of data do you collect to show increase in the organisational performance?)
e-Business Implementation (I) 1. In what way does e-Business affect the way you currently work? 2. What difficulties did you or the organization encounter in implementing the e-Business strategies? 3. Within your organisation, what do you think are the barriers to the effective use of e-Business with customers, suppliers and internal processes? 4. How do you cope with the rapid pace of e-Business technology developments? 5. Is the current e-Business training/exposure programme for managers adequate? (Are the facilities in training adequate?) 6. What kind of exposure do you think is needed to prepare managers for the e-Business environment? 7. How do you prepare your personnel for e-Business? If the training is done on-the-job, do you think it would be beneficial for them to have external training? What type of computer applications are your personnel using? 8. Does e-Business help increase employee motivation? If yes, in what way? 9. In what ways do you think could e-Business facilitate better customer services and relationships building?

Appendix B: List of Respondents From Case Companies

Electricity Companies	Respondents	Job Title
1. ScottishPower Plc.	1. Ms. Morag Liddel	1. Emerging Technologies Manager, Corporate IT
	2. Ms Freeda Chaudri	2. Emerging Technologies Manager, Corporate IT
	3. Mr. Colin Grant	3. Project Manager on Work24, R38
	4. Mr. Paul Selfridge	4. IT Business Analyst – e-Business Team, Customer Sales and Service
	5. Mr. Dennis Barr	5. Head of IT Selection Workstream on Eutilia project
	6. Mr. Chris Flanagan	6. Head of Group eCommunications
	7. Mr. Neil Clitheroe	7. Business Transformation Manager, Customer Sales and Service
2. Scottish and Southern Energy	1. Mr. Graham Juggins	1. Head of Business Development
3. Powergen	1. Mr. Paul Rutter	1. IT Strategy Manager, Group IT
4. LE Group	1. Mr. Bernard Cottrant,	1. Group Technology and Service Director
5. GPU Power UK	1. Mr. John Atkins	1. Supply Chain Director
	2. Mr Duncan Lewis	2. Logistics Manager
6. TNB	1. Mr. Tee Yee Suan	1. Managing Director of TNB-IT Sdn. Bhd.
	2. Mr. Haji Abdul Rahman Shafi	2. Head of Group Information Services Department
	3. Mr. Ahmad Amran Abu Hassan	3. Senior Manager (Planning and Strategy), Group Information Services Department
	4. Mr. Loo Kok Seng,	4. Manager, TNB Ventures Division

Appendix C

Electricity Association

Who owns whom in the UK electricity industry

Policy Research, 30 June 2003

MOST RECENT UPDATES:

30 June 2003
LE Group changed its name to EDF Energy. The retail brands are London Energy, SWEB Energy and Seeboard Energy. Network name EDF Energy. Generation name EDF Energy.

TXU Energi renamed Powergen.

22 May 2003
Scottish and Southern Energy announced it had agreed to purchase Aquila Sterling - holding company for Midlands Electricity which owns Aquila Networks. Transaction subject to agreement with bond holders. Completion due August 2003.

21 October 2002
National Grid Group completed merger with Lattice to form National Grid Transco plc.

Powergen bought TXU's retail and generation businesses in the UK, subject to regulatory approval. TXU's continental operations, and other parts of the UK business, are still owned by TXU Europe.

INTRODUCTION

Who Owns Whom in the UK Electricity Industry traces the ownership of the major British electricity companies that are the successors to the nationalised electricity industry Boards. It includes contact details, an indication of which main electricity businesses they are involved in (generation*, transmission, distribution and supply), and previous changes in ownership.

* Indicated only where generation is a major part of their activities. As power stations are bought and sold relatively frequently, 'major part' is something of a loose definition. Most of the other companies have some interest in generation, but turnover generally does not exceed £50m.

Contents:

To keep track of developments in chronological order, please refer to *Electricity companies in the United Kingdom - a brief chronology.*

Policy Research
Electricity Association
020 7963 5951
enquiries@electricity.org.uk

Electricity Association

Who Owns Whom in the UK Electricity Industry

SUMMARY of WHO OWNS WHOM 30 June 2003

Intermediate holding companies have been omitted for clarity. (The fate of the supply and distribution functions of the former Public Electricity Suppliers is indicated in brackets). More detail is given in the main table.

PARENT'S OWNER		PARENT		SUBSIDIARY Principal company (subsidiary names)
investor owned (USA)	*100%*	**Aquila Inc.^** *with FirstEnergy 20.1%*	**79.9%**	**Midlands Electricity (distribution (Aquila Networks))**
publicly quoted (UK) #	*100%*	**British Energy**	**..**	**..**
British Government (UK)	*100%*	**British Nuclear Fuels**	**100%**	**BNFL Magnox Generation**
publicly quoted (Germany)	*100%*	**E.ON**	**100%**	**Powergen (generation and supply, East Midlands Electricity distribution and supply, ex-Eastern generation and supply, ex-Norweb supply).**
investor owned (USA)	*100%*	**Edison International**	**100%**	**Edison Mission Energy**
*French Government (France)**	*100%*	**Electricité de France**	**100%**	**EDF Energy (ex-London Electricity supply and distribution, ex-SWEB supply, EPN Distribution - ex-Eastern Electricity distribution, SEEBOARD distribution and supply).**
investor owned (USA)	**100%**	**FirstEnergy^** *with Aquila Inc 79.9%*	**20.1%**	**Midlands Electricity (distribution (Aquila Networks))**
publicly quoted (UK)	*100%*	**International Power**	**..**	**..**
privately owned (USA) incl. Berkshire Hathaway	*100%*	**MidAmerican Energy Holdings** *with Xcel Energy 5.25%*	**100%** **94.75%**	**Northern Electric distribution and Yorkshire Electricity distribution**
publicly quoted (UK) #	*100%*	**National Grid Transco**	**100%**	**National Grid Company (transmission in England and Wales)**
investor owned (USA)	*100%*	**PP&L Resources**	**100%**	**Western Power Distribution (ex-SWEB and ex-SWALEC distribution).**
publicly quoted (Germany)	*100%*	**RWE**	**100%**	**Innogy (generation, and supply through npower: ex -Midlands Electricity supply, npower Yorkshire: ex-Yorkshire Electricity supply and Northern Electric supply)**
publicly quoted (UK) #	*100%*	**Scottish and Southern Energy**	**100%** **100%**	**merger of Scottish Hydro-Electric and Southern Electric (supply and distribution)** **SWALEC (supply business).**
publicly quoted (UK) #	*100%*	**ScottishPower**	**100%**	**Manweb (supply and distribution).**
publicly quoted (UK)	*100%*	**United Utilities**	**100%**	**United Utilities Electricity (Norweb distribution).**
publicly quoted (UK) #	*100%*	**Viridian Group**	**100%**	**Northern Ireland Electricity (supply and distribution).**
investor owned (USA)	*100%*	**Xcel Energy** *with MidAmerican 94.75%*	**5.25%**	**Yorkshire Electricity distribution**

* EdF's legal status may change in preparation for part-privatisation (announced 3 July 2002 by French Prime Minister).

government holds a 'golden share' - 1 share at a nominal £1. More detail after the main tables.

^ 22 May 2003 Scottish and Southern Energy agreed to purchase of Midlands Electricity Aquila and FirstEnergy, subject to transaction with bondholders. Completion due August 2003.

Electricity Association

Who Owns Whom In the UK Electricity Industry

PES* BUSINESS SEPARATION – Who owns the distributors / Who owns the suppliers — 30 June 2003

FORMER PES		BUSINESS NAMES	OWNERS	ULTIMATE PARENT
East Midlands Electricity	distribution	East Midlands Electricity	Powergen	E.ON - publicly owned German utility
	supply	Powergen UK	Powergen	E.ON - publicly owned German utility
Eastern Electricity	distribution	EDF Energy Networks	EDF Energy	EdF – French government
	supply	Powergen	Powergen	E.ON - publicly owned German utility
London Electricity	distribution	EDF Energy Networks	EDF Energy	EdF – French government
	supply	London Energy	EDF Energy	Edf – French government
Manweb	distribution	SP Manweb	ScottishPower	UK publicly owned
	supply	ScottishPower Energy Retail	ScottishPower	UK publicly owned
Midlands Electricity	distribution	Aquila Networks	Aquila 79.9% FirstEnergy 20.1%	USA investor owned utility USA investor owned utility
	supply	Npower	Innogy	RWE – publicly owned German utility
Northern Electric	distribution	Northern Electric Distribution	MidAmerican	Berkshire Hathaway – USA private
	supply	npower Northern Supply	Innogy	RWE – publicly owned German utility
Northern Ireland Elect'	distribution	Northern Ireland Electricity	Viridian Group	UK publicly owned
	supply	N'I' Elec' Supply; Energia	Viridian Group	UK publicly owned
Norweb	distribution	United Utilities Electricity	United Utilities	UK publicly owned
	supply	Powergen	Powergen	E.ON - publicly owned German utility
ScottishPower	distribution	SP Distribution	ScottishPower	UK publicly owned
	supply	ScottishPower Energy Retail	ScottishPower	UK publicly owned
Scottish Hydro Electric	distribution	S'H'E' Power Distribution	Scottish and Southern Energy	UK publicly owned
	supply	SSE Energy Supply	Scottish and Southern Energy	UK publicly owned
SEEBOARD	distribution	EDF Energy Networks	EDF Energy	EdF – French government
	supply	SEEBOARD Energy	EDF Energy	EdF – French government
Southern Electric	distribution	S' E' Power Distribution	Scottish and Southern Energy	UK publicly owned
	supply	SSE Energy Supply	Scottish and Southern Energy	UK publicly owned
South Wales Electricity	distribution	Western Power Distribution	PPL	USA investor owned
	supply	SSE Energy Supply	Scottish and Southern Energy	UK publicly owned
South Western Electricity	distribution	Western Power Distribution	PPL	USA investor owned
	supply	SWEB Energy	EDF Energy	EdF – French government
Yorkshire Electricity	distribution	Y' E' Distribution	MidAmerican (94.75%) Xcel Energy (5.25%)	USA owned private company USA investor owned utility
	supply	npower Yorkshire Supply	Innogy	RWE – publicly owned German utility

* The term Public Electricity Supplier was replaced by Distribution Network Operator (DNO) in April 2001, under the Utilities Act 2000.

Electricity Association

Who Owns Whom in the UK Electricity Industry

Who Owns Whom in the UK Electricity Industry

30 June 2003

Main Entries, arranged alphabetically.

Aquila Networks
see Midlands Electricity

BNFL Magnox Generation
Berkeley Centre
Berkeley
GL13 9PB
Tel: 01453 810451
Fax: 01453 812529
http://www.bnfl.com/

Generator (operates magnox type nuclear power stations in UK).

100% owned by: **British Nuclear Fuels plc**
Risley, Warrington, Cheshire, WA3 6AS
Tel: 01925 832000 Fax: 01925 822711

Previous history
Nationalised industry: nuclear plants run by Central Electricity Generating Board (CEGB) in England & Wales and South of Scotland Electricity Board (SSEB) in Scotland.
9 Nov 1989 nuclear stations withdrawn from privatisation.
31 Mar 1990 Nuclear Electric Ltd and Scottish Nuclear Ltd vested.
31 Mar 1996 British Energy plc vested - Nuclear Electric Ltd and Scottish Nuclear Ltd became operating subsidiaries; the magnox stations were transfered to Nuclear Electric plc which was vested as Magnox Electric plc.
30 Jan 1998 Magnox Electric became part of British Nuclear Fuels.

British Energy plc
3 Redwood Crescent
East Kilbride
G74 5PR
Tel: 013552 62000
Fax: 013552 62626
http://www.british-energy.com/

Generator (operates AGR and PWR type nuclear stations in UK as well as conventional thermal), and supply business.
British Energy Generation Ltd is successor to Nuclear Electric; British Energy Generation Ltd is successor to Scottish Nuclear.
Supply (British Energy Power and Energy Trading Ltd).

publicly quoted. Government 'golden share' in British Energy plc, and British Energy Generation Ltd, held by Secretary of State for Trade and Industry; and in British Energy Generation (UK) Ltd by Secretary of State for Scotland.

Previous history
Nationalised industry: nuclear plants run by Central Electricity Generating Board (CEGB) in England & Wales and South of Scotland Electricity Board (SSEB) in Scotland.
9 Nov 1989 nuclear stations withdrawn from privatisation.
31 Mar 1990 Nuclear Electric Ltd and Scottish Nuclear Ltd vested.
31 Mar 1996 British Energy plc vested - Nuclear Electric Ltd and Scottish Nuclear Ltd became operating subsidiaries; the magnox stations were transferred to Nuclear Electric plc which was vested as Magnox Electric plc.
15 Jul 1996 floated on the stock exchange.
1 Jan 1999 Nuclear Electric and Scottish Nuclear operations were merged.
23 Jun 1999 purchased SWALEC's supply business, completed 17 Feb 2000.
7 Aug 2000 SWALEC supply business sold to Scottish and Southern Energy.

East Midlands Electricity
Pegasus Business Park
East Midlands Airport
Derby DE74 2TU
Tel: 0800 096 3080
http://www.emc.co.uk/

Distribution business: East Midlands Electricity Distribution; East Midlands Electricity is the distribution brand. (Supply business is now part of the Powergen brand.)

100% owned by: **Powergen**
Westwood Way, Westwood Business Park
Coventry, CV4 8LG
Tel: 024 7642 4000 Fax 024 7642 5432
http://www.pgen.com/

Previous history:
Nationalised industry: East Midlands Electricity Board (EMEB).
31 Mar 1990 vested as East Midlands Electricity plc.
11 Dec 1990 floated on stock exchange.
10 Jan 1997 taken over by Dominion Resources (based in Richmond Virginia, USA).
27 Jul 1998 sold to PowerGen.
PLEASE SEE POWERGEN ENTRY

Eastern Electricity - see TXU
Europe for entries to 30 June 2003, -
then see Powergen

Electricity Association

Who Owns Whom in the UK Electricity Industry

EDF Energy plc
40 Grosvenor Place
Victoria
London
SW1X 7EN
Tel: 020 7242 9050
Fax: 020 7752 2104
http://www.le-group.co.uk/

Generation: EDF Energy (was London Power Company),
Distribution EDF Energy Networks (replaces London Power Networks, EPN Distribution ltd, SEEBORD PowerNetworks and 24 Seven Utilities Services).
Supply business names and brands: London Energy, SWEB Energy, SEEBOARD Energy (replace London Electricity plc, SEEBOARD Energy Ltd, SWEB). Also: supply brand: Virgin Energy (75% owned by EDF Energy)
Metering: ECS.

100% owned by:

Electricité de France International
a subsidiary of Electricité de France
2 rue Louis Murat, 75384 Paris, Cedex 08
Tel: +33 1 40 42 2222 Fax: +33 1 47 64 5894
http://www.edf.fr/

Previous history
Nationalised industry: London Electricity Board (LEB).
31 Mar 1990 vested as London Electricity plc.
11 Dec 1990 floated on stock exchange.
7 Feb 1997 taken over by Entergy Power UK plc, a subsidiary of Entergy Corporation (based in New Orleans, Louisiana, USA).
31 Dec 1998 sold to EdF International.
11 Jun 1999 bought SWEB's supply business, completed 30 Sep 1999.
Jan 2001 group structure changed to LE Group.
19 Nov 2001 announced purchase of TXU Europe Distribution.
18 Jan 2000 purchase of TXU Europe's distribution business completed - now called EPN Distribution Ltd, trading as EPN. TXU's 50% share in 24 Seven has also been acquired.
18 Jun 2002 AEP agreed to sell SEEBOARD to LE Group. Completion due mid to late July.
3 Jul 2002 French prime minister announced intended change in EdF's legal status that could allow a limited privatisation.
29 Jul 2002 LE Group completed purchase of SEEBOARD.
30 Jun 2003 LE Group changed name to EDF Energy.

Edison Mission Energy
Lansdowne House
Berkeley Square
London
W1X 5DH
Tel: 020 7312 4000
Fax: 020 7312 4040
http://www.edisonx.com
(Edison International website)

Generator (Edison Mission Energy is the international arm of an American utility group. This entry traces the history of the pumped storage business.)

100% owned by:

Edison International
2244 Walnut Grove Ave, Rosemead,
CA 91770-0800, USA
Tel: +1 626 302 222
http://www.edisonx.com

Previous history
Nationalised industry: pumped storage plants owned by Central Electricity Generating Board.
31 Mar 1990 CEGB split up, National Grid Company (owned by RECs) was vested and took responsibility for the pumped storage power stations.
17 Nov 1995 NGC became National Grid Group.
20 Nov 1995 NGC's Pumped Storage Business was incorporated as First Hydro.
11 Dec 1995 National Grid Group floated on stock exchange.
18 Dec 1995 First Hydro bought by Edison Mission Energy. Edison Mission Energy has also built IPPs and bought power stations from PowerGen.

First Hydro - see Edison Mission Energy

GPU Power UK
see Midlands Electricity

Infralec see Western Power Distribution

Electricity Association

Who Owns Whom In the UK Electricity Industry

Innogy Holdings
Windmill Hill Business Park
Whitehill Way
Swindon
SN5 6PB
Tel: 01793 877777
Fax: 01793 892525
http://www.innogy.com/

Generation business: Innogy. Supply businesses: npower (for Midlands area), npower Yorkshire Supply (100%), npower Northern Supply (100%). The supply brand for these areas is npower. In Yorkshire area it is 'YE powered by npower'.

100% owned by:

RWE AG
Opernplatz 1, D-45128 Essen, Germany
Tel: +49 (0) 201/12-00 Fax. +49 (0) 201/12-15199
http://www.rwe.com/

Previous history
Nationalised industry: generation in England & Wales was the responsibility of Central Electricity Generating Board (CEGB).
31 Mar 1990 vested as National Power PLC (CEGB split up).
12 Mar 1991 60% floated on stock exchange.
6 Mar 1995 40% floated on stock exchange.
30 Jun 1999 bought Midlands Electricity's supply business (trading as MEB).
9 Aug 2000 the government redeemed its golden share at the company's request.
2 Oct 2000 Innogy formally established from the split of National Power. (International Power took over the overseas business and Deeside power station).
2 Apr 2001 Bought 94.75% of Yorkshire Power Group. Xcel Energy retained 5.25%.
21Sep 2001 Completed acquisition of Northern Electric's supply business in exchange for Yorkshire Electricity's distribution business. Xcel Energy retained 5.25% of Yorkshire Electricity distribution. Yorkshire Power Group Ltd renamed npower Yorkshire Ltd.
22 Mar 2002 announcement of RWE AG (Germany) agreed takeover of Innogy Holdings.
27 May 2002 purchase by RWE completed.

International Power
Senator House
85 Queen Victoria Street
London EC4V 4DP
United Kingdom
http://www.inpplc.com/

Tel: +44 (0) 20 7320 8600
Fax: +44 (0) 20 7320 8700

publicly quoted

Previous history
Nationalised industry: generation in England & Wales was the responsibility of Central Electricity Generating Board (CEGB).
31 Mar 1990 vested as National Power PLC (CEGB split up).
12 Mar 1991 60% floated on stock exchange.
6 Mar 1995 40% floated on stock exchange.
25 Jul 2000 announced it was to split into two companies: Innogy, the UK business including the npower brand name; and International Power, the international business.
9 Aug 2000 the government redeemed its golden share at the company's request.
2 Oct 2000 International Power formally established from the split of National Power. (Innogy Holdings took over the UK business and the npower brand).

LE Group
see EDF Energy

London Electricity
see EDF Energy

Magnox Electric - see BNFL
Magnox Generation

Manweb
Sealand Road
Chester
CH1 4LR
Tel: 0845 272 3636
Fax: 01244 652 1199
http://www.scottishpower.plc.uk/manweb/

Distribution brand. For business details see ScottishPower.

100% owned by:

ScottishPower
Corporate Office, 1 Atlantic Quay
Glasgow, G2 8SP
Tel: 0141 248 8200 Fax: 0141 248 8300
http://www.scottishpower.com/

Previous history
Nationalised industry: Merseyside and North Wales Electricity Board (MANWEB).
31 Mar 1990 vested as Manweb plc.
11 Dec 1990 floated on stock exchange.
12 Oct 1995 taken over by ScottishPower.

Electricity Association

Who Owns Whom In the UK Electricity Industry

Midlands Electricity plc
Whittington Hall
Whittington
Worcester
WR5 2RB
Tel: 08457 353637
Fax: 01905 761464
http://www.aquila-networks.co.uk/

Distribution business: Aquila Networks plc - licence holder, Aquila Networks Services Ltd - operations, brand - Aquila.
(The supply business, MEB, was sold to National Power, now branded npower, part of Innogy)
Metering: Metering Services.

100% owned by

Aquila Sterling Ltd
Whittington Hall, Worcester — a subsidiary of.

79.9% **Aquila Inc**
20 West Ninth Street, Kansas City, Missouri 64106, USA
Tel: 00 1 816 527 1000
http://www.aquila.com/

20.1% **FirstEnergy Corp**
76 South Main Street, Akron, Ohio 44308-1890, USA
Tel: 00 1 330 384 5712 Fax: 00 1 330 384 3866

Previous history
Nationalised industry: Midlands Electricity Board (MEB).
31 Mar 1990 vested as Midlands Electricity plc.
11 Dec 1990 floated on stock exchange.
7 Jun 1998 taken over by Avon Energy Partners: a subsidiary of Cinergy Corp (based in Cincinnati, Ohio, USA) and GPU.
30 Jun 1999 Midlands Electricity's supply business (trading as MEB) sold to National Power.
6 Jul 1999 GPU bought Cinergy's 50% stake in Midland's Electricity.
20 Mar 2000 distribution business renamed GPU Power UK.
18 Oct 2000 UtiliCorp (renamed Aquila 18/3/02) offered to purchase Midlands Electricity from GPU.
7 Nov 2001 In the USA, GPU Inc merged with FirstEnergy.
8 May 2002 Aquila purchase of 79.9% stake in Avon Energy Partners completed. FirstEnergy retained 20.1%. 50% voting share each. GPU Power UK renamed Aquila Networks. Holding company later changed to Aquila Sterling.
7 Aug 2002 Aquila announced intention to sell holding in Aquila Sterling. FirstEnergy had already announced its intention to sell.
22 May 2003 Scottish and Southern Energy agreed terms for the purchase of Aquila Sterling and its subsidiaries. The acquisition is subject to agreement with bondholders and it is hoped the transaction will completed by end of August 2003.

National Grid Transco plc
National Grid House
Kirby Corner Road
Coventry
CV4 8JY
Tel: 024 7642 3000
Fax: 024 7642 3678
http://www.nationalgrid.com/

Transmission in England & Wales - National Grid Company plc.

publicly quoted

Government 'golden share' held by Secretary of State of Trade and Industry.

Previous history
Nationalised industry: transmission system in England & Wales part of Central Electricity Generating Board (CEGB).
31 Mar 1990 vested (CEGB split up). Owned by RECs.
17 Nov 1995 NGC became National Grid Group.
20 Nov 1995 NGC's Pumped Storage Business was incorporated as First Hydro.
11 Dec 1995 National Grid Group floated on stock exchange.
18 Dec 1995 First Hydro bought by Edison Mission Energy.
7 Jan 2002 NGG formed a new holding company (called New National Grid for an interim period - later called National Grid Group plc), upon completion of its merger with Niagara Mohawk Inc (USA) - 31 January 2002.
22 Apr 2002 National Grid and Lattice announced their merger, subject to shareholder and regulatory approval.
22 Oct 2002 National Grid Group and Lattice completed merger to form National Grid Transco plc

National Power
(see Innogy Holdings and International Power)

Electricity Association

Who Owns Whom in the UK Electricity Industry

Northern Electric plc
Lloyds Court
78 Grey Street
Newcastle-upon-Tyne
NE1 6AF
Tel: 0191 223 5151
Fax: 0191 223 5152
http://www.northern-electric.co.uk/

100% owned by:

CE Electric UK plc
9 Cheapside, London, EC2V 6AD

Subsidiary of: MidAmerican Energy Holdings Co.
(previously CalEnergy)
666 Grand Avenue, P.O. Box 657, Des Moines, IA 50303-0657, USA
Tel.: +1 402 341 4500 Fax:+1 402 345 9318
http://www.midamerican.com

Distribution (Northern Electric Distribution NEDL, and Yorkshire Electricity Distribution). Supply business now part of Innogy.

Yorkshire Electricity Distribution:
94.75% owned by:

Northern Electric plc

and
5.25% owned by:

Xcel Energy 414 Nicollet Mall, Minneapolis, Minnesota 55401-1993, USA

Previous history
Nationalised industry: North Eastern Electricity Board (NEEB).
31 Mar 1990 vested as Northern Electric plc.
11 Dec 1990 floated on stock exchange.
24 Dec 1996 taken over by CE Electric (now MidAmerican Energy).
2 Jan 1998 Peter Kiewit sold its share to MidAmerican Energy.
21 Sep 2001 Exchanged its supply business for Yorkshire Electricity's distribution business. MidAmerican owns 100% of Northern Electric plc, which in turn owns 94.75% of Yorkshire Electricity Distribution. Xcel Energy owns 5.25% of Yorkshire Electricity Distribution plc

Northern Ireland Electricity
120 Malone Road
Belfast
BT9 5HT
Tel: 028 9066 1100
Fax: 028 9066 3579
http://www.nie.co.uk

100% owned by:

Viridian Group
Danesfort House, 120 Malone Road, Belfast,
BT9 5HT Tel: 028 9066 9448
http://www.viridiangroup.co.uk/

Distribution and supply.
Distribution business: Northern Ireland Electricity.
Supply businesses and brands:
in NI regulated market: Northern Ireland Electricity Supply;
in NI and ROI deregulated market: Energia.
Metering: metering division.
Independent System Operator for NI: SONI.
Moyle Interconnector sold into separate company, Moyle Holdings Ltd.

Previous history
Nationalised industry: Northern Ireland Electricity Service (NIES) was responsible for generation, transmission and distribution, and supply in Northern Ireland.
1 Apr 1992 vested as Northern Ireland Electricity plc. Power stations were vested as separate companies.
21 Jun 1993 floated on stock exchange.
9 Feb 1998 group structure changed - NIE became part of Viridian Group.

Norweb
see United Utilities

Nuclear Electric - see British Energy

Electricity Association

Who Owns Whom in the UK Electricity Industry

Powergen
Westwood Way
Westwood Business Park
Coventry
CV4 8LG
Tel: 024 7642 4000
Fax: 024 7642 5432
http://www.pgen.com/

Generation and supply business: Powergen UK; supply brand: Powergen. Distribution business: East Midlands Electricity Distribution; distribution brand: East Midlands Electricity.

100% owned by

E.ON AG
Platz 1, 40479 Duesseldorf, Deutchland
Tel: +49 (0) 211 45 79 0; Fax: +49 (0) 211 45 79 5 01
http://www.eon-ag.com

Previous history
Nationalised industry: generation in England & Wales responsibility of Central Electricity Generating Board (CEGB).
31 Mar 1990 vested as PowerGen plc (CEGB split up).
12 Mar 1991 60% floated on stock exchange.
6 Mar 1995 40% floated on stock exchange.
27 Jul 1998 bought East Midlands Electricity.
22 Dec 2000 the government redeemed its golden share at the company's request.
1 Jul 2002 E.ON (Germany) completed its acquisition of Powergen.
22 Oct 2002 Powergen bought TXU's British generation and retail operations.
30 Jun 2003 TXU Energi changed name to Powergen.

Scottish and Southern Energy
200 Dunkeld Rd
Perth
PH1 3AQ
Tel: 01738 456 000
Fax: 01738 456 520
http://www.scottish-southern.co.uk/

Generation business (SSE Generation Ltd, Scottish and Southern Energy brand). Transmission (in Scotland only): Scottish Hydro-Electric Transmission. Distribution business: SSE Power Distribution Ltd, (S+S brand), and supply business (SSE Energy Supply Ltd, Southern Electric, Scottish Hydro Electric, SWALEC brands) in Scotland, England & Wales.

publicly quoted

Previous history
See also Scottish Hydro Electric, Southern Electric, and SWALEC.
14 Dec 1998 formed by the merger of Scottish Hydro-Electric and Southern Electric.
7 Aug 2000 bought SWALEC supply business.
22 May 2003 Scottish and Southern Energy agreed terms for the purchase of Aquila Sterling and its subsidiaries. The acquisition is subject to agreement with bondholders and it is hoped the transaction will completed by end of August 2003.

Scottish Hydro-Electric
200 Dunkeld Rd
Perth
PH1 3AQ
Tel: 01738 456 000
Fax: 01738 456 520
http://www.hydro.co.uk/

Scottish Hydro-Electric is a supply brand. See **Scottish and Southern Energy** for details of generation, transmission, distribution, and supply businesses.

Merged with Southern Electric to form:

Scottish and Southern Energy
200 Dunkeld Rd, Perth, PH1 3AQ
Tel: 01738 456 000 Fax: 01738 456 520
http://www.scottish-southern.co.uk/

Previous history
Nationalised industry: North of Scotland Hydro-Electric Board (NoSHEB).
31 Mar 1990 vested as Scottish Hydro Electric plc.
18 Jun 1991 floated on stock exchange.
14 Dec 1998 merged with Southern Electric to form Scottish and Southern Energy.

Scottish Nuclear
see British Energy

Electricity Association

Who Owns Whom in the UK Electricity Industry

ScottishPower plc
1 Atlantic Quay
Glasgow
G2 8SP
Tel: 0141 248 8200
Fax: 0141 248 8300
http://www.scottishpower.com/

Generation (Scottish Power Generation Ltd);
Transmission (SP Transmission Ltd, asset owner);
Distribution (SP Distribution Ltd in Scotland, SP Manweb plc in Manweb area - asset owners)
(SP Power Systems Ltd - asset managers for 3 companies above).
Supply (Scottish Power Energy Retail Ltd).
ScottishPower is a brand name for supply, and distribution in Scotland. Manweb is distribution brand.

publicly quoted.

Government 'golden share' held by Secretary of State for Scotland.

Previous history
Nationalised industry: South of Scotland Electricity Board (SSEB).
31 Mar 1990 vested as ScottishPower plc.
18 Jun 1991 floated on stock exchange.
12 Oct 1995 bought Manweb.

SEEBOARD
Forest Gate
Brighton Road
Crawley
RH11 9BH
Tel: 01293 565 666
Fax: 01293 657 327
http://www.seeboard.co.uk/

Distribution (SEEBOARD Power Networks) and supply (SEEBOARD Energy) businesses. SEEBOARD supply brand

100% owned by: **EDF Energy plc**
40 Grosvenor Place, Victoria, London, SW1X 7EN
Tel: 020 7242 9050 Fax: 020 7752 2104
http://www.le-group.co.uk/
a subsidiary of Electricité de France

Previous history
Nationalised industry: South Eastern Electricity Board (SEEB).
31 Mar 1990 vested as SEEBOARD plc.
11 Dec 1990 floated on stock exchange.
11 Jan 1996 taken over by Central and South West Corporation (CSW).
15 Jun 2000 CSW merged with AEP, 50% owners of Yorkshire Electricity. The new company is called American Electric Power (AEP).
18 Jun 2002 AEP agreed to sell SEEBOARD to LE Group. Completion due mid to late July 2002.
29 Jul 2002 LE Group completed acquisition of SEEBOARD.

Southern Electric
Westacott Way
Littlewick Green
Maidenhead
SL6 3QB
Tel: 01628 822 166
Fax: 01628 584 400
http://www.southern-electric.co.uk/

Southern Electric is a supply brand. See Scottish and Southern Energy for details of generation, distribution and supply businesses.

Merged with Scottish Hydro-Electric to form: **Scottish and Southern Energy**
200 Dunkeld Rd, Perth, PH1 3AQ
Tel: 01738 456 000 Fax: 01738 456 520
http://www.scottish-southern.co.uk/

Previous history
Nationalised industry: Southern Electricity Board (SEB).
31 Mar 1990 vested as Southern Electric plc.
11 Dec 1990 floated on stock exchange.
14 Dec 1998 merged with Scottish Hydro-Electric to form Scottish and Southern Energy.

SWALEC
Newport Road
St Mellons
Cardiff
CF3 5WW
Tel: 029 2079 2111
Fax: 029 2077 7759
http://www.swalec.co.uk/

Supply. SWALEC is a supply brand. See Scottish and Southern Energy for details of the group's generation, distribution and supply businesses (SWALEC's former distribution business is now part of Western Power Distribution).

100% owned by: **Scottish and Southern Energy**
200 Dunkeld Rd, Perth, PH1 3AQ
Tel: 01738 456 000 Fax: 01738 456 520
http://www.scottish-southern.co.uk/

Previous history
Nationalised industry: South Wales Electricity Board (SWaEB).
31 Mar 1990 vested as South Wales Electricity plc (SWALEC).
11 Dec 1990 floated on stock exchange.
29 Jan 1996 taken over by Welsh Water and became a subsidiary of Hyder.
23 Jun 1999 SWALEC's supply business was sold to British Energy, completed 17 Feb 2000.
7 Aug 2000 SWALEC supply business was sold to Scottish and Southern Energy.

Electricity Association

Who Owns Whom in the UK Electricity Industry

SWEB
300 Park Avenue
Aztec West
Almondsbury
Bristol
BS32 4SE
Tel: 01454 201101
Fax: 01454 452238
http://www.sweb.co.uk/

SWEB is a supply brand. See LE Group for details of group's generation, distribution and supply businesses. (SWEB's former distribution business: see Western Power Distribution)

100% owned by:

EDF Energy
40 Grosvenor Place, Victoria, London, SW1X 7EN
Tel: 020 7242 9050 Fax: 020 7752 2104
http://www.le-group.co.uk/
A subsidiary of EdF International

Previous history
Nationalised industry: South Western Electricity Board (SWEB).
31 Mar 1990 vested as South Western Electricity plc.
11 Dec 1990 floated on stock exchange.
18 Sep 1995 taken over by Southern Electric International, now called Southern Energy, a subsidiary of Southern Co.
1 Jul 1996 Southern Co. sold a 25% stake in SWEB to Power Markets Development Company, now called PP&L Global Inc, a subsidiary of PP&L Resources.
18 Jun 1998 PP&L Global Inc. raised its stake to 51%.
11 Jun 1999 SWEB's supply business was sold to London Electricity, completed 30 Sep 1999.

TXU Europe
PO Box 40
Wherstead Park
Wherstead
Ipswich IP9 2AQ
Tel: 01473 688 688
Fax: 01473 601 036
http://www.txu-europe.com/

TXU generation and retail in UK Generator. Supply business TXU (supply brand TXU Energi). Distribution business sold to LE Group

100% owned by:

TU Acquisitions plc
Subsidiary of: TXU (formerly Texas Utilities)
1601 Bryan St, Energy Plaza, Dallas
TX 75201-3411, USA
Tel: +1 214 812 4600 Fax: +1 214 812 3368
http://www.txu.com

100% owned by:

Powergen 21 October 2002

Previous history
Nationalised industry: Eastern Electricity Board (EEB).
31 Mar 1990 vested as Eastern Electricity plc.
11 Dec 1990 floated on stock exchange.
18 Sep 1995 taken over by Hanson plc.
24 Feb 1997 Eastern Electricity became part of Energy Group when Hanson was unbundled. Energy Group was floated on the stock exchange.
1 Sep 1998 Energy Group taken over by TXU.
9 Nov 1999 Energy Group renamed TXU Europe.
3 Aug 2000 purchased Norweb Energi, Norweb's electricity and gas supply business.
15 Aug 2001 announced that Norweb Energi and Eastern Energy will be relaunched as TXU Energi from September 2001.
18 Jan 2002 sale of TXU Distribution to LE Group.
14 Oct 2002 TXU announced that TXU Europe would sell all or part of its business.
22 Oct 2002 TXU's generation and retail business bought by Powergen.
30 Jun 2002 TXU Energi renamed Powergen.

United Utilities
Dawson House, Great Sankey,
Warrington, WA5 3LW
Tel: 01925 234000
Fax: 01925 233360
http://www.unitedutilities.com/

Distribution business, United Utilities Electricity plc.

publicly quoted

Previous history
Nationalised industry: North Western Electricity Board (NORWEB).
31 Mar 1990 vested as NORWEB plc.
11 Dec 1990 floated on stock exchange.
8 Nov 1995 taken over by North West Water to form part of United Utilities.
3 Aug 2000 TXU Europe purchased Norweb Energi, the electricity and gas supply business. Distribution business renamed Norweb Distribution.
1 Apr 2001 Norweb Distribution renamed United Utilities.
26 Nov 2001 renamed United Utilities Electricity.

Electricity Association

Who Owns Whom in the UK Electricity Industry

Western Power Distribution
Avonbank
Feeder Road
Bristol
BS2 0TB
Tel: 0117 933 2000
Fax: 0117 933 2001
http://www.westernpower.co.uk/

100% owned by:

PP&L Global Inc. a subsidiary of: PP&L Resources Two North Ninth St, Allentown, PA 18101-1179 USA
Tel: +1 610 774 5151 Fax: +1 610 774-4198
http://www.pplweb.com/

Distribution business covering areas formerly served by SWEB and SWALEC

Metering: MRSL

Previous history (South West England)
Nationalised industry: South Western Electricity Board (SWEB).
31 Mar 1990 vested as South Western Electricity plc.
11 Dec 1990 floated on stock exchange.
18 Sep 1995 taken over by Southern Electric International, now called Southern Energy, a subsidiary of Southern Co.
1 Jul 1996 Southern Co. sold a 25% stake in SWEB to Power Markets Development Company, now called PP&L Global Inc, a subsidiary of PP&L Resources.
18 Jun 1998 PP&L Global Inc. raised its stake to 51%.
11 Jun 1999 SWEB's supply business was sold to London Electricity, completed 30 Sep 1999.
1 Oct 1999 SWEB's distribution business was renamed Western Power Distribution.

Previous history (South Wales)
Nationalised industry: South Wales Electricity Board (SWaEB).
31 Mar 1990 vested as South Wales Electricity plc (SWALEC).
11 Dec 1990 floated on stock exchange.
29 Jan 1996 taken over by Welsh Water and became a subsidiary of Hyder.
23 Jun 1999 SWALEC's supply business was sold to British Energy, completed 17 Feb 2000.
17 Feb 2000 SWALEC's former distribution business was renamed Infralec.
15 Sep 2000 Hyder bought by Western Power Distribution. (Infralec distribution area rebranded as Western Power Distribution in early 2001)

Previous history (Oct 2000 -)
2 Oct 2000 Southern Company sold 19.7% of Southern Energy in an initial public offering and intends to sell the remaining shares in April 2001.
19 Jan 2001 Southern Energy renamed Mirant Corporation.
2 Apr 2001 Mirant Corporation became wholly independent from Southern Co.
6 Sep 2002 Mirant sold its 49% stake to PPL.

Yorkshire Power Group
Wetherby Road
Scarcroft
Leeds
LS14 3HS
Tel: 0113 289 2123
Fax: 0113 289 5611

Supply business: npower Yorkshire Ltd: see Innogy

Yorkshire distribution business: see Northern Electric.

Owned 100%:

Innogy Holdings
Windmill Hill Business Park, Whitehill Way, Swindon SN5 6PB
Tel: 01793 877777 Fax: 01793 892525
http://www.innogy.com/

Previous history
Nationalised industry: Yorkshire Electricity Board (YEB).
31 Mar 1990 vested as Yorkshire Electricity Group plc.
11 Dec 1990 floated on stock exchange.
1 Apr 1997 taken over by AEP and PS Colorado (now New Century Energies).
15 Jun 2000 AEP merged with CSW, owners of SEEBOARD.
21 Aug 2000 New Century Energies and Northern States Power merged to form Xcel Energy.
2 Apr 2001 Innogy purchased 94.75% of Yorkshire Power Group. Xcel retained 5.25%.
21 Sep 2001 Innogy acquired Northern Electric's supply business in exchange for Yorkshire Electricity's distribution business. (Xcel retained 5.25% of distribution business).

Electricity Association

Who Owns Whom in the UK Electricity Industry

Golden, or Special, Shares in UK electricity companies (January 2002)

The golden share is a special rights non-voting redeemable preference share of £1 in the share capital of the relevant companies, and is held by the Government. It is an arrangement put in place at the time of privatisation in order for the government to hold some control on the structure of the electricity industry.

'Golden Share' is a more common or popular name, but the official term, used in the RECs' privatisation prospectus, or Articles of Association for example, is 'Special Share'.

Company	Shareholder - relevant department
National Grid Group plc. *A new holding company, (called New National Grid for an interim period, then named National Grid Group plc again), was formed in January 2002, and the Golden Share was transferred to the top company accordingly.*	Secretary of State for Trade and Industry
British Energy plc *and its subsidiaries:*	Secretary of State for Trade and Industry
British Energy Generation Ltd (ex-Nuclear Electric)	Secretary of State for Trade and Industry
British Energy Generation (UK) Ltd (ex-Scottish Nuclear)	Secretary of State for Scotland
ScottishPower plc	Secretary of State for Scotland
Scottish and Southern Energy plc	Secretary of State for Scotland
Viridian plc	Department of Enterprise, Trade and Investment - Northern Ireland
Regional Electricity Companies in England and Wales	*shares redeemed 31 March 1995 as scheduled at privatisation*
National Power	*share redeemed 9 August 2000 at request of the company*
Powergen.	*share redeemed 22 December 2000 at request of the company*

Electricity Association

Who Owns Whom in the UK Electricity Industry

Electricité de France, E.ON and RWE - a brief note on where they came from

Electricté de France (EDF), and Germany's E.ON and RWE own a fair portion of the UK electricity industry - including two of the CEGB's successor companies, four distribution businesses and nine of the former Regional Electricity Companies' supply businesses.

Electricité de France

Owner of EDF Energy:
1998 - bought London Electricity (distribution and supply) from Entergy;
1999 - bought SWEB (supply) from PP&L and Southern Company;
2002 - bought ex-Eastern Electricity (distribution) from TXU Europe;
2002 - bought SEEBOARD from AEP (distribution and supply).

History
EDF, was established in 1946 by nationalising and combining about 1,400 generators and network companies. In the late 1990s EDF was responsible for 94% of generation, 100% of transmission and international electricity trade, and 96% of distribution in France. Under legislation passed in 2000, a separate business unit, RTE, was created for managing the transmission network. RTE is 100% owned by EDF.

Ownership
EDF is 100% owned by the French Government, which is preparing to alter the company's statutes to allow partial privatisation.

Key figures
EDF has expanded globally, and aims to generate 50% of its turnover from activities outside electricity in France by 2005. In 2002 its global operations, including France, covered 121.1 GWe of power station capacity, €48.4 billion turnover, net profit of €481 million, 46.7 million customers, and 172,000 employees.

E.ON

Owner of Powergen
1998 - Powergen bought East Midlands Electricity (distribution and supply) from Dominion Resources.
2002 - E.ON bought Powergen
2002 - bought TXU Energi (ex-Eastern Electricity supply, ex-Norweb supply) from TXU Europe

History
E.ON was created in June 2000 by the merger of two German industrial conglomerates, VEBA and VIAG.

VEBA began life in 1929 as a financial holding company for the Prussian Government's power and mining activities. The Federal Republic of Germany placed the majority of VEBA shares with private investors in 1965, and completely privatised the company in 1987. VEBA's principal electricity concern was the generator PruessenElektra, which was one of the 'Verbund'1 utilities that accounted for 80% of production in the late 1990s.

VIAG was established in 1923 by the German Government to manage its industrial holdings. It purchased a stake in Bayernwerk - another of the Verbund utilities - in 1939. VIAG was privatised between 1986 and 1990.

Both VEBA and VIAG brought smaller electricity companies or holdings in energy companies to the merger along with the two big utilities, and following the parent company merger these were consolidated into E.ON Energie in July 2000. E.ON has many energy holdings in Germany and other European countries, and the cross ownership pattern is quite complex.

Following the merger, E.ON's 'traditional' territory now runs right through Germany from the northwest coast and Danish border down to Bayern in the south east.

---

1 The Verbund companies joined forces to form the interconnected system, operated by DVG. Each of the Verbund utilities owns its own transmission network - there is no one national grid utility owning the German system. There were seven west German Verbund companies originally in 1948, later joined by Berlin and then east German generator / transmission utility, Veag.

Electricity Association

Who Owns Whom in the UK Electricity Industry

Ownership

The latest shareholding details given for E.ON, based on the last survey in 2000 and some material changes since are not precise. The share ownership given below is indicative only (and does not total 100%): Institutional holders outside Germany: 40% of which UK about 14%; institutional investors in Germany: 35%, of which Allianz holds about 7.5%; retail investors in Germany 12% and E.ON itself 12%; State of Bavaria 4.5% and retail investors outside Germany 3%.

Key figures

In 2002, E.ON had sales of €37 billion, and net income of €2.8 billion. Employees 107,856. E.ON Energie had sales of €19.5 billion and 45,394 employees.

Rheinisch-Westfälisches Elektrizitätswerk (RWE)

Owner of Innogy

1999 - National Power bought Midlands Electricity (supply);
2000 - National Power changed name to Innogy;
2001 - bought Yorkshire Power Group (supply) from AEP;
2001 - bought Northern Electric (supply) from MidAmerican Energy;
2002 - RWE bought Innogy.

RWE was formed in 1898 from the Essen utility EAG and other companies in the area. EAG sold its shares in 1902 to industrialists Hugo Stinnes and August Thyssen. RWE expanded its supply base with acquisitions and concessions, and diversified into other sectors. Municipalities held shares in RWE, becoming majority shareholders in 1920 and acquiring multiple voting rights in 1924.

By 1990 further diversification prompted the group to reorganise into a holding company - RWE AG - and business divisions, which have continued to evolve and grow in number. The core electricity generation and distribution business became part of RWE Energie AG.

In 1998 municipal shareholder voting rights were reduced from 57% to just under 30% of the votes.

RWE merged with VEW, another Verbund utility, in 2000. The 'traditional' territory served is a block on the central part of the eastern border and a smaller area in the centre of the southern border.

The group structure changed again in 2000. RWE Power is responsible for generation, RWE Trading for energy trading, RWE Net for all the electricity network activities, and RWE Plus for electricity and energy services sales. Innogy is one of the businesses, and there are another seven covering renewables, gas, coal, oil, infrastructure engineering, IT and real estate services, environmental services and water (Thames Water).

Shareholder structure given on website (no date specified): Institutional investors 37%; Municipal investors 35%; Private shareholders 13%; Allianz 7%; Münchner Rück 5%; employees 3%.

Appendix D: Semi Structured Observation Form

Semi Structured Observation Form

Electricity Company :_____

Site Address :_____

Contact Person :_____

Position in the Company :_____

Date :_____

Time :_____

Observation of:

1. Site descriptions
   a. Location
   b. Building
   c. Environment surrounding the building
   d. Other activities in the surrounding area
   e. Others…

2. Reception Area
   a. Reception method used: computerised, traditional, manual, others...
   b. Attitude and Body language of personnel
   c. Tone of expression of personnel

3. Respondents description
   a. Office including furniture, computer, telephone, other technology used, etc.
   b. Body language
   c. Tone of expression: in general, and when discussing electricity industry, company's vision, e-Business, IT, Technology etc.
   d. Attitude: in general, and when discussing electricity industry, company's vision, e-Business, IT, Technology etc.

4. Other personnel
   a. Office including furniture, computer, telephone, other technology used, etc.
   b. Body language
   c. Tone of expression: in general, and when discussing electricity industry, company's vision, e-Business, IT, Technology etc.
   d. Attitude in general

5. Company website
   a. Static

Observation of:

b. Interactive
c. Adequate information
d. Online billing and payment, etc.?
e. Online meter reading?
f. Online trading?
g. Friendly, easy to use
h. Impressive

6. Other issues found relevant
   a. _____
   b. _____
   c. _____
   d. _____