DEVELOPMENT OF AN E-BUSINESS SELECTION FRAMEWORK FOR MANUFACTURING SMEs: A STUDY OF THE PRINTING INDUSTRY

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Thesis Summary

The aim of the research is to develop an e-business selection framework for small and medium enterprises (SMEs) by integrating established techniques in planning. The research is case based, comprising four case studies carried out in the printing industry for the purpose of evaluating the framework. Two of the companies are from Singapore, while the other two are from Guangzhou, China and Jinan, China respectively.

To determine the need of an e-business selection framework for SMEs, extensive literature reviews were carried out in the area of e-business, business planning frameworks, SMEs and the printing industry. An e-business selection framework is then proposed by integrating the three established techniques of the Balanced Scorecard (BSC), Value Chain Analysis (VCA) and Quality Function Deployment (QFD). The newly developed selection framework is pilot tested using a published case study before actual evaluation is carried out in four case study companies. The case study methodology was chosen because of its ability to integrate diverse data collection techniques required to generate the BSC, VCA and QFD for the selection framework.

The findings of the case studies revealed that the three techniques of BSC, VCA and QFD can be integrated seamlessly to complement on each other's strengths in e-business planning. The eight-step methodology of the selection framework can provide SMEs with a step-by-step approach to e-business through structured planning. Also, the project has also provided better understanding and deeper insights into SMEs in the printing industry.

Keywords: E-Business, Selection Framework, Quality Function Deployment, Balanced Scorecard, Value Chain Analysis, Small and Medium Enterprise

Dedication

To the late Dr. Nelson Tang, a mentor and friend.

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GLOSSARY

B2B	Business to Business
B2C	Business to Customer
BSC	Balanced Scorecard
CRM	Customer Relationship Management
CTP	Computer to Plate
DFM	Design for Manufacturing
DOE	Design of Experiments
EC	European Commission
ERP	Enterprise Resource Planning
EU	European Union
FTA	Fault Tree Analysis
GOAL	Growth Opportunity Alliance of Greater Lawrence
GDP	Gross Domestic Products
HOQ	House of Quality
HR	Human Resource
ICT	Information and Communication Techniques
IDEF	Integrated Computer-Aided Manufacturing Definition or Integrated Manufacturing
JIT	Just in time
JSQC	Japan Society for Quality Control
MBA	Master of Business Administrations
MBNQA	Malcolm Baldrige National Quality Award
MNC	Multi-national Corporation
OECD	Organisation for Economic Co-operation and Development
OS	Operating System
PESTL	Political, Economic, Social, Technological, Legal
QFD	Quality Function Deployment
ROI	Return on Investments
SARS	Severe Acute Respiratory Syndrome
SCM	Supply Chain Management
SME	Small- and Medium-Enterprise
SPC	Statistical Process Control
TQM	Total Quality Management
VCA	Value Chain Analysis
WHO	World Health Organisation

1. Introduction

1.1 Aims and objectives of the thesis

e-Business represents both potential opportunities and threats to businesses of any size. Small-and medium-sized enterprises (SMEs) in particular, are coming under increasing pressure to implement e-business applications if they are to continue to supply "larger trading partners" who have already implemented e-business solutions. e-Business solutions also represent a potential opportunity for SMEs to gain direct access to new markets, but the main driving force is the fact that should the companies not implement these business solutions, they will lose custom and ultimately not survive.

Being less able to shape their business environment, SMEs must go along with any changes in response to those brought about by e-business applications. Although SMEs have realised the need to implement e-business solutions in order to survive, many of them are not able however, to appreciate the potential threats and benefits or do not possess the know-how knowledge to manage change of this complexity. SMEs require both social and technical knowledge to assist them in identifying, prioritising, planning and implementing the necessary changes. Current e-business models are found to be lacking in areas crucial to SME e-business strategy planning, as these models are developed with larger companies in mind. A selection framework based on quality function deployment (QFD), the balanced scorecard (BSC) and value chain analysis (VCA) is the subject of this project.

1.2 The research context

Growing numbers of companies are embracing e-business, a trend which will continue to grow in pace, making e-business implementation inevitable for all businesses as the next big wave of change, in ways of managing, operating and transacting in a business (Barnes et al., 2003; Biggs, 2000; Waters, 2000). While authors like Barua et al. (2001), Ferguson (2000), Hackbarth and Kettinger (2000), Butler (2000) and Rodgers et al. (2002), have argued on the benefits of e-business, there are few proven planning frameworks to assist managers in e-business planning, especially for SMEs. The more popular planning frameworks including (1)

Hayes's (2000) seven steps to e-business success, (2) Kalakota and Robinson's (2000, 2001) e-business application architecture, (3) Tetteh and Burn's (2001) SMALL framework and (4) Intel's e-business strategy (Phan, 2002, 2003), though each has had some proven successes credited to them, are, nonetheless, frameworks created with big companies in mind and would not be applicable to SMEs (Tesar and Moini, 2001; Zheng et al., 2003). There will be more discussions on these in Chapter 2.

SMEs are different from large companies in that SMEs are often limited in resources including personnel, finances and knowledge. The problems encountered by SMEs are frequently unlike those encountered by large companies and would therefore require different methods (Blili and Raymond, 1993). Moreover, as the author will further discuss in Chapter 3, these frameworks either lack the ability to correctly identify both the internal and external critical needs and demands, or lack the ability to incorporate these needs and demands into the analysis on the feasibility of e-business initiatives.

SMEs, often with limited resources, are the ones that require as much assistance as they can possibly have, in order for e-business planning and ultimately, e-business implementation to be successful. However, at the start of the research, there were no proven e-business planning frameworks to assist SMEs in selecting the most appropriate e-business applications. The purpose of this research was therefore to investigate, develop and evaluate an e-business selection framework for SMEs during e-business planning through four case studies in the printing industry. Figure 1.1 shows the e-business selection framework.

This research has contributed to the literature of e-business, planning frameworks, QFD, the BSC, VCA and SMEs in the printing industry. A specific contribution has been made to e-business planning. This research has fulfilled the dual goals of contribution to knowledge and practice, and will assist senior managers in structured planning and prioritisation during e-business planning.

Figure 1.1: The e-business selection framework

Step 1

Financial
"To succeed financially, how should we appear to our shareholders?"

Customer
"To achieve our vision, how should we appear to our customers?"

Vision and Strategy

Internal Business Processes
"To satisfy our shareholders and customers, what business processes must we excel at?"

Learning and Growth
"To achieve our vision, how will we sustain our ability to change and improve?"

Balanced Scorecard
Identify internal and external needs

Processes / Requirements

How?

Weights

What?

Step 3
Completing QFD eMatrix I: Prioritising business process

Impor-tance

Absolute imp
Relative imp
Prioritising

Step 4
Identification of critical business processes.

Step 6 - Proposed e-business applications

Step 2

Firm Infrastructure					Margin
Procurement					
Selling					
Technology development					
Human Resource Management					
Inbound Logistics	Operations	Outbound Logistics	Marketing and Sales	Service	Margin

Value Chain Analysis
Identify business process

Applications / Processes

e-business applications

Weights

Step 5
Critical Processes - Identified from Step 4

Step 7
Completing QFD eMatrix II: Prioritising e-business applications

Impor-tance

(see above)

Absolute imp
Relative imp
Prioritising

Step 8
Identification of critical e-business applications

Action

1.3 Key research questions

1. Why is the implementation of e-business beneficial for SMEs?

2. How can we formulate structured e-business planning for SME managers?

3. How can we create a selection framework to work as part of an e-business strategy for SMEs in the printing industry?

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4. How can e-business plans be prioritised while including both internal and external factors in the planning process?

5. How can we use QFD to transform customer needs and demands into e-business plans for SMEs in the printing industry?

6. How can we integrate the BSC, VCA and QFD to enhance the effectiveness and efficiency in e-business planning for SMEs in the printing industry?

1.4 Research methodology

The research methodology used in the research project is the case study methodology. Four data collection techniques have been employed during data collection:

- Gathering of information through documentations and records
- Observations
- Semi-structured interviews
- Survey forms

Information from documents has been used to form the basis for understanding the background of the companies, the roles of senior personnel and the workflow of the company. This information could also provide further evidence to other data collected through interviews and observations, as well as providing triangulation to data collected. During observations, the researcher took on the role of a complete observer with no social interaction with the subjects, in order to minimise any potential obtrusiveness to the normal functions of the subjects. This stage sought to clarify whether the business processes were as in the documentation and as the researcher had been told during the semi-structured interviews, therefore again providing triangulation of data collected.

In semi-structured interviews, the managing director or general manager was interviewed to provide the broader aspects of the company's strategies. The finance, sales, operations and human resources managers were also interviewed to provide further insights into their departments. These managers were selected in correspondence with the four levels of the BSC. Data from the interviews have been analysed together with information from documentation and data from observations,

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to develop the BSC and VCA of the case study companies. Survey forms were given out to the interviewees, staff representatives and key customers in order to seek an average of the ratings on the "what" factors and inter-relationships between the "whats" and "hows".

Two sets of pilot studies were also carried out before actual data collection. The first set was done by utilising a data set from a comprehensive published case study on Marshall Industries, US (Olofson, 1999). With the assistance of nine invited candidates, who are doing their MBA at Aston Business School, taking up the roles of managers and key customers, data were generated to test the framework. The second set of pilot studies were carried out using a data set gathered from the initial visit to the company, United Printing, by the researcher. The selection framework was pilot-tested for the second time with the assistance of a senior manager from the printing industry. The framework was fine-tuned during this pilot study process (Tan and Tang, 2002; Tan et al., 2003). Tan et al. (2004) further presented the selection framework. After the completion of the research, the opportunity also arose to evaluate the framework in 2 companies in other industries through MBA project works.

1.5 Structure of the thesis

In Chapter 2 of the thesis, there is a discussion on the background to the literature reviewed for the project. After this, the chapter talks about the growth of importance in e-business, covering the present and the past of e-business in section 2.3.1, benefits of e-business in section 2.3.2 and the driving trends and pitfalls to implementing e-business in section 2.3.3. Next, four frameworks that are currently being employed in e-business planning are discussed, followed by an evaluation of the frameworks and why there is a need for a new e-business selection framework, especially developed with SMEs in mind.

In Chapter 3, there is a discussion on SMEs, covering the definitions of SMEs and what constitutes an SME in the research project. Also, the characteristics of SMEs are looked at and the chapter also examines the relationships between SMEs and e-business in section 3.3; why do SMEs resist e-business? This further strengthens the need for the research project to develop an e-business selection framework for

SMEs. Section 3.4 looks at the rationale behind choosing the printing industry for the purpose of the research case studies. Section 3.5 provides an overview of the printing industry, while examining particularly closely the advancement of technologies and problems faced by SMEs in the industry.

In Chapter 4, literature on business planning frameworks is discussed, including what constitutes a good framework through the work of Wu (1992, 1994). Planning frameworks discussed in the chapter include the Mintzberg model (Mintzberg et al., 1976) and IDEF (U.S. Air Force, 1981). Two other planning frameworks, by Lee and Ko (2000) and Lee et al. (2000b) respectively, which are currently not deployed in e-business planning, are also examined, in order to establish their feasibility of being employed in e-business planning, as these frameworks are able to structure and prioritise planning. Following that, it is established that a selection framework should include the following three techniques: BSC (Kaplan and Norton, 1992), VCA (Porter, 1985) and QFD (Akao, 1972). Literature on these three techniques is reviewed, presented and discussed in the later sections in Chapter 4.

In Chapter 5, the author follows up on the previous chapter by discussing the research methodology required for the purpose of testing the proposed e-business selection framework. The research methodology must be able to fit the demands of the three different techniques deployed, which is further looked at in section 6.2. In section 5.2, there is also a discussion on the underlying paradigms of the research project. The hermeneutical and qualitative approach are examined and there are discussions on how these paradigms, together with the nature of the research problems, including the question of longitudinal or cross-sectional sampling and the sample size of the study, have influenced the research methodology of the project.

In section 5.4, the case study methodology is discussed as the data collection technique chosen for the research project and how this impacts on the actual data collection process and how exactly data collection can be structured (Easton, 1994; Eisenhardt, 1989; Gillham, 2000; Hakim, 1987; Miles and Huberman,1994; Parkhe, 1993; Tsoukas, 1989; Yin, 1993, 1994). The potential limitations of the case study methodology are appraised within the section. Guidelines to data collection as suggested by Stake (1995) are also discussed in the context of the research project. These guidelines were: forming initial research questions; first visit to the case study

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sites; further preparation for data collection; further development of conceptualisation; gathering the data; and validating the data. In section 5.6, the actual preparation for data collection is discussed, including the use of a pilot study to evaluate the proposed e-business selection framework (Tan and Tang, 2002; Tan et al. 2003). A mixture of data collection techniques are used in the research project for the purpose of evaluating the selection framework. These are: gathering of information through documentations and records; observation; semi-structured interviews; use of tape recorders to record interviews; and the use of survey forms, all of which are discussed in section 5.7. Section 5.8 looks at the techniques employed in the analysis of data collected in the case studies and the specialised computer programme used in the testing of the framework is discussed in section 5.9. The topics of triangulation, ethics and timing of the research project are also discussed in the later sections of Chapter 5.

In Chapter 6, the author presents and discusses the e-business selection framework for SMEs. The chapter starts with a discussion on the nature of data collection methodology for the three techniques employed in the selection framework in section 6.2. In section 6.3, each of the eight steps to building the selection framework is presented and discussed. The eight steps are:

Step 1 – Using BSC to develop "what" for QFD eMatrix I
Step 2 – Using VCA to develop "how" in QFD eMatrix I
Step 3 – Completing QFD eMatrix I
Step 4 – Identification of critical business processes from QFD eMatrix I
Step 5 – Inputting critical business processes to QFD eMatrix II's "what"
Step 6 – List of e-business applications to QFD eMatrix II's "how"
Step 7 – Completing QFD eMatrix II
Step 8 – Identification of critical e-business applications from QFD eMatrix II

In Chapter 7, the four case studies carried out for the purpose of evaluating the e-business selection framework are presented. Two case studies were carried out in Singapore: Atlas Paper Products Private Limited and Fun Press Private Limited; and two case studies in China: Guangzhou United Printing Company Limited and Shandong Xunda Print Company Limited. For each of the case study companies, a section is provided for the purpose of discussing the background of the case study

company. Following that, the test results of the e-business selection framework in each of the company are presented and discussed. These results are presented in eight sections to correspond with the eight steps of the e-business selection framework.

In Chapter 8, the results of the four tests are further analysed and there is discussion on the implications of these results in a wider context. There is also discussion on two other case studies deploying the newly developed e-business selection framework, carried out by MBA students from Aston Business School in other industries.

In Chapter 9, the key academic contributions of the research are presented and discussed. Section 9.3 presents and discusses the managerial implications of the research. Section 9.4 talks about reflection from the research, covering issues of bias. Section 9.5 discusses the limitations of the research project, while section 9.6 lists the potential areas for future research. Figure 1.2 shows the overall structure of the thesis.

Figure 1.2: Structure of the thesis
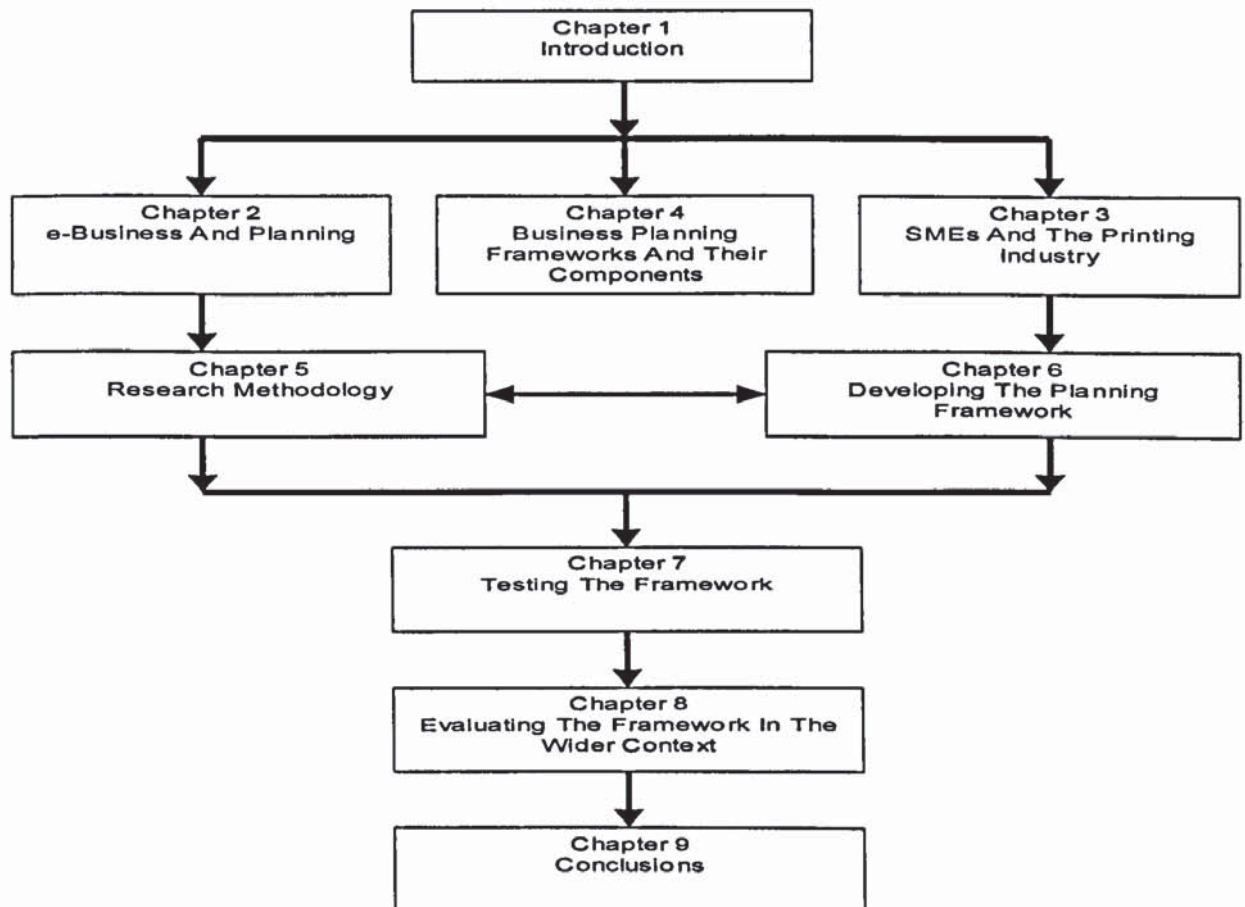
2. e-Business And Planning

2.1 Chapter introduction

The bearings were set in the previous chapter as to how the thesis will be written. In this chapter, the author discusses the background to the literature reviewed for the purpose of this Ph.D. project. The purpose of these reviews is to enable the researcher to establish a knowledge gap that requires further research, in order for the gap to be filled. However, though an extensive literature review is normally encouraged, an initial project boundary would also be required at this stage to confine reviews to relevant materials. This is further discussed in section 2.2, which provides a background to the literature reviewed.

Next, the author discusses the e-business phenomenon and examines the current e-business planning framework being used by managers. In section 2.3, the present and the past of e-business are covered. There is also discussion of the benefits of e-business implementations and the driving trends and pitfalls behind them. In section 2.4, four available frameworks in e-business planning are critically reviewed. The four frameworks are (1) Hayes's (2000) seven steps to e-business success, (2) Robinson's (2000, 2001) e-business application architecture, (3) Tetteh and Burn's (2001) SMALL framework and (4) Intel's e-business strategy (Phan, 2002, 2003). In section 2.5, the author evaluates the need for a new e-business selection framework before concluding the chapter with a chapter summary section.

2.2 Background to the literature reviewed

To form the initial boundary for the research project, key topics are identified: 1. e-business, 2. the business planning framework, 3. the balanced scorecard, 4. value chain analysis, 5. quality function deployment, 6. small and medium-sized enterprises and 7. the printing industry. Although an initial study into the literature taken without limiting the number of years was useful in building up knowledge on the topics; it was nevertheless a task of huge magnitude when trying to keep up-to-date with what has been going on in the past two decades, especially so for e-business where speed is critical. Thus, it was important to establish a time boundary on certain key topics.

Porter (1985) published the concept and uses of Value Chain Analysis (VCA) to assist in the development of a clearer understanding of how business operates, where value is generated and how existing elements can be reconfigured or re-engineered to meet the strategic intentions. However, it was only in the early 1990s when the importance of looking at the series of trading relationships between firms that add values to a product or service became apparent, that value chain analysis became a research focus (Drew, 2003). On the other hand, e-business only came about in the late 1990s with the emergence of dotcoms (Cross, 2000; Gromov, 2000; KPMG Consulting, 2000; Lang et al., 2001; Forrester Research, 2002; Cheung and Huang, 2003; Chen, 2003).. The balanced scorecard (BSC) was first created in 1987 to help improve organisational performance and competitiveness, and the uses of the framework, were published only in the Harvard Business Review by Kaplan and Norton (1992). Quality function deployment (QFD) was originally created in Japan in the 1970s but has only been widely used, especially in the US, from the 1980s. In 1988, Hauser and Clausing (1988) engaged the use of "house of quality" (HOQ) to simplify QFD applications into a series of related matrices.

Given this brief understanding of the key topics, it makes sense why the literature search on available planning frameworks for e-business is narrowed to "happenings" within the field in recent years prior to the commencement of the research project. The search for all literature has done using the library catalogues and online databases including Emerald, Proquest, ScienceDirect, Scircus, Web of Science, as well as the World Wide Web, using search engines like google.com and yahoo.com.

2.3 The growth in importance of e-business

e-Business started as a marketing catchphrase for technology organisations. It can be defined as a way of integrating applications including enterprise resources planning (ERP), customer relations management (CRM) and supply chain management (SCM) in order for them to work together and help in the managing, organising, routing and transforming of information, or simply, doing business digitally (Brache and Webb, 2000; Kalakota and Robinson, 2000, 2001). In the words of Weill and Vitale (2001: 5), e-business engages in "marketing, buying, selling, delivering, servicing, and paying for products, services and information across (non-proprietary) networks linking an enterprise and its prospects, customers, agents, suppliers,

competitors, allies and complementors". Costello and Tuchen (1998) had a similar definition, defining e-business as the interchanging of goods, services, property, ideas or communications through an electronic medium for the purposes of facilitating or conducting business. e-Business provides links between all stakeholders of an organisation through the use of the Internet, intranets and extranets to produce business value (Rodgers et al., 2002; Schlenker and Crocker, 2003).

2.3.1 e-Business: the present and the past

A growing number of businesses are on the way to becoming an "e-business" (Barnes et al., 2003). e-Businesses were first founded in the early 1990s and have grown in importance ever since (Drew, 2003). Waters (2000) stated that e-business had become an inevitable fact of life, nearly as vital to commerce as the telephone. Biggs (2000) also suggested that e-business could be the next wave in the technological revolution created by the Internet. Society is now moving towards cashless, while business communications are moving to a higher level beyond basic computer-to-computer exchange of information (Hussain and Hussain, 1991; Zwass, 2002). Internet technology has made it possible for online transactions to occur and to use digital technologies to streamline operations. It is predicted that online retail sales in the United States alone would have reached US$100 billion by 2004, while business-to-business (B2B) in the USA would have topped US$2.7 trillion by 2004 and worldwide B2B value would be at US$4.3 trillion by 2005 (Forrester Research, 2002; Lumpkin and Dess, 2004). In fact, Malone (2001) is so confident about the future being e-business's that he made the following statement in the section "The View From 2006":

"Nowadays, virtually all companies use the Internet in some way, and every year dozens of new uses emerge".

The Internet, the main architecture behind e-business has evolved from a scientific network to a platform that enables new ways of doing business, providing almost unlimited reach and information to customers by allowing easier access to information anywhere, as long as computers and networks exist, thus opening new approaches to meeting needs and performing functions (Amor, 2000; Jordan, 2001; Porter, 2001). The evolution of the Internet architecture, currently in its third

generation, started in 1991 when Tim Berners-Lee posted the language of the WWW online at alt.hypertext (Duncan and Kenney, 2001). The first generation, which lasted up till the late 1990s, is used almost only for emails and websites. The second generation saw the creation of interactive services online, while WWW currently enables the development and deployment of industrial strength applications to help bring the Web and existing systems together (Schlenker and Crocker, 2003). Therefore, WWW is arguably one of the most significant driving forces in the business usage of the Internet and the popularity of WWW sites can be seen with about 1.5 million Web pages being born daily (Cockburn and Wilson, 1996; Chang and Cheung, 2001; Gromov, 2000; Turban et al., 1999). According to Kalakota and Robinson (2000, 2001), application integration is the key to e-business. Coincidentally, e-business is also in its third phase, with the first phase from 1994 to 1997 concentrating on making presence, the second phase occurring from 1997 to 2000 on e-commerce. The current third phase which started from 2000 is concentrated on the Internet's impact on profitability, more commonly known as e-business (Kalakota and Robinson, 2000, 2001).

Chen (2003) stated that there are currently as many as 29 different e-business models in use. While Mahadevan (2000) and Weill and Vitale (2001) pointed out there are only four key distinctions between these models:

- Supply chain model – The difference is whether it is a direct sale, an intermediary, a marketplace or some mixture of the three.
- Revenue model – There are two types of revenue models, one in which income is generated directly from the transaction while the second is through "free sites", where income is generated from advertising or sponsorship.
- B2C vs. B2B model – The choice of these models normally depends on the market that the company serves. Is it in a business-to-customers market or a business-to-business market?
- Clicks-and-mortar vs. pure-play model – The last key difference between e-business models is whether or not the e-business model is purely Internet-based or if it relies as well on offline assets.

Businesses are now performing and co-ordinating critical business processes such as product designing, incoming and outgoing transactions, manufacturing and

providing services through the extensive use of computer and communication network technologies (Alter, 2002). Ratnasingham (1998) and Teich et al. (1999) suggested that e-business will be able to improve the interchange of communication between parties by breaking down communication, negotiation and co-ordination barriers. Therefore, the Internet has created new business opportunities and allows businesses to operate at a more efficient and effective level (Lumpkin and Dess, 2004). The Internet has improved the speed of information gathering and increased the amount and diversity of information that can be assessed, allowing critical information to be sought out much more rapidly.

There are two main growth drivers behind the gain in importance of e-business: the facilitation of the "frictionless transaction" environment, and Metcalfe's law (Cross, 2000). The "frictionless transaction" environment includes the use of search engines, shopping "bots", trading hubs and server-to-server connections, to allow searching, qualification and transaction costs to drop to new lows. Metcalfe's law states that "the true value of a network is equal to the square of its number of participants", thereby suggesting that with more participants in a network, the success of finding the information, product or service one requires in the same network will be increased significantly. Rodgers et al. (2002) also states that the most important feature of e-business is its interconnectivity and its ability to allow seamless system interaction.

2.3.2 Benefits of e-business

Achievement of e-business operational excellence will lead to an improvement in financial performance, including an increment in revenue, lower transaction costs and acquiring new customers (Barua et al., 2001). Rodgers et al. (2002) stated that e-business will allow many processes within the company to be fully-automated, thereby improving the efficiency of business processes, while also removing the risk of potential errors caused by human interfaces. The sharing of information will also be allowed with the implementation of e-business applications, between all stakeholders of the business regardless of location so long as these stakeholders are able to be connected to the Internet.

Interconnectivity allows businesses to search from a wider source as location issue becomes minimised, leading to lower costs of supplies and thus increasing profitability. Communication quality and efficiency will also be increased dramatically

due to the fact that stakeholders are now connected, allowing collaborations and co-ordination to improve while reducing the overlapping of work tasks. The improved communication will result in a huge improvement in productivity in the business. Another benefit of e-business will be an increase in the speed of fulfilling orders, as interconnectivity with customers and suppliers will allow orders to be sent and received in a quicker time. e-Business will also allow companies to track their orders, thus allowing production schedules to be planned accordingly. The faster speed of delivery and tracking ability will in turn allow companies to reduce inventory levels as inventory re-ordering and delivery are now more predictable. This will consequently enable the companies to implement just-in-time (JIT) concepts.

A well-designed, well-executed e-business plan can send a consistent and positive message from the organisation (Butler, 2000). On the other hand, Ferguson (2000) and Hackbarth and Kettinger (2000) stated that an ineffective e-business strategy will ultimately result in the organisation being unable to achieve sustainable competitive advantages, thus causing the organisation to wind up. Organisations thus need to be strong and clear in their e-business strategies (Butler, 2000). The underlying question is how an organisation can be competent in doing that. One has to remember that digitising business processes breaks the company from its traditional ways of doing things.

2.3.3 Implementing e-business: the driving trends and the pitfalls

Currently, certain e-business patterns can be seen to be emerging in this digital economy, as can be seen in Figure 2.1. Regardless of which e-business pattern it is going after, the company will be required to change the way it currently interacts with suppliers and customers, as well as to face the challenges posed by current legacy systems, whilst deciding if these legacy systems are to be integrated into their e-business plans. The journey to e-business from a traditional set-up will require plenty of decisions and is frequently full of pitfalls (Eduard, 2001). In fact, it is not surprising that Kalakota and Robinson (2000, 2001) stated that an estimated one in every three e-business projects will fail, and that more than half will exceed their intended budget.

Therefore, in order to meet this change, companies must be able to develop a whole new generation of leaders that can create a digital future with intent. Kalakota and

Robinson (2000, 2001) further suggested a list of 20 trends driving e-business, which can be used by organisations to detect and prioritise drivers when formulating e-business plans, and this can be seen in Table 2.1. Companies, however, must also bear in mind not to focus too much on the "e", but more on the "business". The greatest threat to a company will be either failing to deploy the Internet at all or failing to deploy it strategically. Thus, Internet technology will not be strategically significant if the practical application of Internet technology does not have the ability to create new value for the companies (Porter, 2001; Schlenker and Crocker, 2003).

Figure 2.1: Evolution of Internet Architecture

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Illustration removed for copyright restrictions

Based on: Kalakota & Robinson (2000, 2001)

Table 2.1: 20 major trends driving e-business

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Illustration removed for copyright restrictions

Source: Kalakota & Robinson, 2000, 2001.

Lumpkin et al. (2002) added that the most important question is how to strategise in the era of the Internet. It is important to note that not all e-business mechanisms are right for every organisation (Lord, 2000). Rodgers et al. (2002) suggested that companies start with e-business applications that will be the most beneficial to them. On the other hand, one of the deadly assumptions will be to believe that technology is the answer. This was further stated by Lumpkin and Dess (2004) when they said that "firms are still struggling with the basic issue of how to use the Internet and digital technologies for their best advantage" and "a more fundamental reason is that companies are still not clear how the Internet adds value". Surveys have also shown that numerous organisations adopted e-business applications without knowing the impacts these applications will have on their organisation strategies (Barnes et al., 2003). Therefore, companies need to know that e-business is to be deployed only if e-business complements the companies' strategic needs. Tan and Tang (2002) further summarised a list of common pitfalls from various relevant literature, which can be seen in Table 2.2.

Table 2.2: Major pitfalls of e-business

Internal	External
Strategic We know what we want Technology is the answer e-Business is good for us Others' e-business models will suit our needs We will be able to gain market share with e-business We will be able to increase profit with e-business e-Business will enable us to become a global enterprise We have the budget for e-business implementation	**Customers** We know what customers want We know how to give customers what they want Our customers are e-ready
Processes Our internal business processes are in place and can support the migration to e-business We know how to achieve what we want The systems will integrate	**Suppliers** We know what suppliers want We know how to give suppliers what they want Our suppliers are e-ready **Competitors** They will not be able to lure our customers If they can go online, we can and should go online **Regulators** Our products can be sold anywhere in the world
Personnel We know who to appoint to champion/lead and/or be in the e-business project team Everybody in the organisation knows why we need to go "e"	**Processes** We can integrate the distribution channels to support e-business We can integrate the supply chain to support e-business

2.4 Available frameworks in e-business planning

From the results of the literature search, e-business planning frameworks have been identified. In this section, four of the e-business planning frameworks will be presented and discussed: (1) Hayes's (2000) seven steps to e-business success, (2) Kalakota and Robinson's (2000, 2001) e-business application architecture, (3) Tetteh and Burn's (2001) SMALL framework and (4) Intel's e-business strategy (Phan, 2002, 2003).

2.4.1 Seven steps to e-business success

Hayes (2000) identified seven steps to plan a successful e-business solution. The seven steps are:

1. Start high – this first step implies that top management must champion the e-business cause. e-Business must be recognised in the company as a strategic project, not a technical task.
2. Think fresh – the second step states that the company must develop new ways to conduct business and do away with old ideas and paradigms.
3. Know your market – the company's brand identity, customers, competition and suppliers must be analysed in this step.
4. Set vision – a vision must be set in order for strategies to be formed. The vision will be what the company wants to be.
5. Define strategy – strategies are to be defined to dictate how the company is to achieve its mission.
6. Create – the company would then "create" the e-business solutions.
7. Refresh regularly – the e-business solutions need to be revised regularly since speed and innovation are critical in the e-business economy.

The main drawbacks of this proposed framework to e-business include:

1. The e-business should be part of the overall business strategy. In steps 2, 4 and 5 of the framework, Hayes (2000) suggested that the company should start anew. This meant creating a whole new strategy in order to become an e-business while the reverse, having e-business strategies to support the overall business strategy, would be more ideal.

2. The framework failed to take into account internal business processes. The underlying reason for this criticism is that the company needs to establish whether the internal business processes will be up to the task of transforming a traditional business set-up into one that includes e-business applications.

3. Although the framework allowed input from numerous stakeholders, it did not allow prioritisations of these needs from the stakeholders. The framework also failed to provide prioritisation of e-business applications to meet these needs.

2.4.2 e-business application architecture

The e-business model by Kalakota and Robinson (2000, 2001) showed seven different application clusters that are designed in a way to integrate an array of internal business functions. The model can be seen in Figure 2.2. The seven different application clusters are:

1. Customer relationship management (CRM)
2. Enterprise resource planning (ERP)
3. Supply chain management (SCM)
4. Selling-chain management
5. Operating resource management
6. Enterprise application integration, and
7. Business analytics, knowledge management and decision support (knowledge-type applications)

This framework as argued by Kalakota and Robinson (2000, 2001), will allow managers to see the big picture, in order for them to set priorities as to the applications the company wants to apply. The company will then have to make sure that they keep their focus on the chosen application, till the end-to-end processes are fully deployed in the company. The framework also showed the importance of the interdependent nature of the applications that will be deployed in a company moving towards e-business. All the applications have to be working well for the whole e-business system to work. In the event that one of the applications should start to function sub-optimally, the whole e-business system will be affected.

Figure 2.2: e-Business Application Architecture

Aston University

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Source: Kalakota and Robinson (2000, 2001).

The set up of this e-business model is too extensive for SMEs. The framework is lacking a step-by-step guide for managers to plan e-business. Besides, much investment in terms of money and time is often required to plan these individual application clusters in the e-business model, with a view to implementing the applications. Larger companies will be more likely to be able to invest in innovations

like e-business, but this cannot be said of SMEs (Williamson, 1985; Peng and Illinitch, 1998). The framework also did not state how the prioritisation of e-business applications would work, in order to reduce costs while maximising benefits for an SME as a result of e-business. The framework seemed to be designed with the notion of "changing organisations to align with the technology", not on the notion that technology should be deployed only if it is able to meet the strategic needs of the company (Kalakota and Robinson, 2001: 167; Porter, 2001).

2.4.3 Intel's e-business strategy

Intel started their first e-business foray with the creation of a self-service extranet called E-Business Program that focuses on procurements and customer supports (Phan, 2002, 2003; Strategic Decision, 2002). According to Phan (2002), there are seven key success factors to Intel's e-business strategy, which enables a company to deploy e-initiatives to assist it in improving its performance. This is in contrast to a total transformation where companies become "click and no brick" enterprises due to the lack of strategic planning, a key reason that caused the downfall of many dotcoms in the late 1990s. These seven critical success factors are:

1. Tailor e-business to the customers' needs.
2. Avoid unfamiliar markets and risks.
3. Follow conservative and traditional management principles.
4. Deliver personalised Web content.
5. Focus on quality.
6. Use robust and flexible systems architecture.
7. Opt for the best security systems.

Phan (2003) listed the following steps as to how Intel successfully planned its e-business strategy:

1. Setting the project structure – the project team should include a project planning team, business analysts, sales and marketing staff, a planning and logistics group and the IT department.
2. Setting the mission and goals – this is to assist the project team in staying focused on what is to be achieved.

3. Decide the e-business strategies for the value chain – this will allow the company to decide how to achieve competitive advantage with e-business applications.
4. Deploying e-business applications – this can be an initial pilot or prototype to test the efficiency, effectiveness and reliability of the system.
5. Deploying an access manager application – this will automate the creation of account user identities and passwords to access the e-business applications.
6. Deciding on the e-business infrastructure – this will include decisions on servers, operation system and databases.

Although Intel succeeded in the implementation of its e-business strategies, the details on how Intel's worldwide team actually carried out the planning of the e-business initiatives are not disclosed in the papers. The seven key elements in Intel's strategy and its seven stated critical success factors to e-business are perhaps as much detail as one can get to see how e-business planning was carried out at Intel. It is also not discussed if and how customer needs can be incorporated into e-business planning. Also, the e-business strategy did not discuss whether internal business processes were up to the task, or if the overall business strategies are constantly adhered to during e-business planning. What Intel and Phan (2002, 2003) have provided is a list of key factors to consider for successful e-business strategies and not a structured approach to e-business planning (Strategic Direction, 2002).

2.4.4 SMALL framework

The SMALL framework (Tetteh and Burn, 2001) is centred on the assumption that SMEs will implement a global strategy as the main objective of e-business. Therefore, the model will function as the attributes analysis technique of business operations along the value chain, to support the transformation to e-business. These five attributes are:

1. Size/value of assets and resources – this will include the number of employees, offices, value of assets, annual turnover of business and investments in IT.
2. Market coverage and product mix – this will include the value of sales, the product mix and geographical area covered.

3. **A**ctivities and processes – this will include the nature of activities, information intensity of activities and products, level of electronic mediation and changes in products/processes.

4. **L**inkages and relationships within the environment – this will cover the number of strategic partners, nature of these partnerships and the type of contractual agreements.

5. **L**ocational diversity/scope – this will be looking at the geographical spread of the offices and the range of time zones covered for continuity working.

The negative aspects of this framework are that the SMALL framework assumed that the managers already knew how to plan and implement e-business successfully. Although the SMALL framework was created with SMEs in mind, it suggested looking at the number of offices, number of partners and geographical spread of the offices, implying that the "SMEs" the SMALL framework was developed for, might be a multinational or global company. Suggestions of attributes analysis merely allowed companies to know what they should do to be successful with a global online strategy. The framework did not inform or provide any guide whatsoever to allow for successful planning of e-business strategies. In addition, the SMALL framework also did not determine if global strategy should indeed be the preferred method for meeting the company's aims and objectives. The framework is not able to determine and prioritise which of the many e-business applications the company should be deploying first.

Having reviewed four e-business planning frameworks earlier in this section, the need for a new e-business selection framework for SME managers will be further discussed in the next section.

2.5 Evaluating the need for a new e-business planning framework

Planning is effectively a knowledge creation process that begins initially with data collection in an attempt to capture the current situation. This will usually be followed by creating a possible future scenario by applying models and frameworks to structure and analyse this data and finally implementing and monitoring the plan (Nonaka and Nishiguchi, 2001). Hsu and Pant (2000) noted that even though e-

business planning can basically comprise the general properties of strategic business planning, generic strategic frameworks such as Porter's (1980, 1985) Five Forces or value chain analysis lack enough focus when used in an e-business planning environment. Many traditional frameworks also failed to consider the radically new opportunities open to businesses, that are the basis for visionary strategic business plans. However, van Hooft and Stegwee (2001) opposed this view by arguing that existing models and theories still apply even though a new e-business perspective should be added to the strategic planning process. Michael Porter (2001) further noted that sustainable competitive advantage could only be achieved through a distinctive value chain which must be planned and aligned with business goals. The Internet should be seen as an enabler but not the primary driver of strategy. Porter (2001) also argued that virtual activities do not eliminate the need for physical activities, but often amplify their importance. Hence, the Internet does not render existing planning models obsolete but rather increases their importance and the necessity of rigorous application.

2.5.1 Limitations of current e-business planning frameworks

Currently, a number of tools and techniques have been deployed in helping to facilitate e-business planning. These tools and techniques include (1) Hayes's (2000) seven steps to e-business success, (2) Kalakota and Robinson's (2000, 2001) e-business application architecture, (3) Tetteh and Burn's (2001) SMALL framework and (4) Intel's e-business strategy (Phan, 2002, 2003), which were discussed in more detail above in section 2.4. However, these tools and techniques either lack the ability to correctly identify both the internal and external critical needs and demands, or lack the ability to incorporate those needs and demands into the analysis of the feasibility of e-business initiatives. They are unable to list the potential e-business initiatives according to criticality and feasibility in implementation. Most of these e-business planning frameworks are formulated from research in large companies or with large companies in mind, thus these models, in most cases, will not be applicable to SMEs (Tesar and Moini, 2001; Zheng et al., 2003). SMEs are different from large companies, which will be further discussed in Chapter 3.

The problems encountered by SMEs are frequently unlike those encountered by large companies and require different methods (Blili and Raymond, 1993). There is a need for a structured, prioritised planning framework to take into consideration the

aims and objectives of the business, the ability of the business processes to implement these plans, as well as the needs of the stakeholders involved. Therefore, an evolutionary approach to e-business is needed, one that will be able to integrate the selection of e-business applications to take into consideration both internal and external factors. The new selection framework will have to recognise the risk involved in completely digital business models, which have in the recent past simply reacted to the emergence of new technological opportunities without a focus on added value or profitability as the basis of strategy. In addition, the new framework will be required to minimise the common pitfalls in e-business planning.

According to Kalakota and Robinson (2000, 2001), strategic e-business planning can be categorised into top-down analytical planning and bottom-up tactical planning. The top-down approach seeks to define a vision as precisely as possible in order to assess cost and prepare a capital budget. Being number-driven and analytically focused, it is very well suited to stable business conditions which lend themselves to predictive analysis and modelling. However, in an e-environment characterised by uncertainty, customer-centrism and rapid process execution, this planning approach can be risky. A bottom-up planning approach takes the view that a quickly changing environment can best be assessed by the front-line employees, who are the first to be aware of changes. However, a rigorous adoption of bottom-up planning can also lead to a lack of planning discipline, and strategic decisions can be biased towards solving immediate problems rather than resolving long-term issues. Thus, there is a need for a new e-business selection framework to assist SME managers during e-business planning, as well as to avoid the common pitfalls identified earlier in Table 2.2.

2.6 Chapter summary

In this chapter were discussed the theories that will be employed in this research project. The author also talked about the background to the literature being reviewed. The theories covered in the chapter relate to e-business and frameworks in e-business planning.

In this chapter the growth in importance of e-business was reviewed and discussed. The author looked at the benefits of e-business and the driving trends and pitfalls of

implementing e-business. It was also established in this chapter that there is a lack of e-business planning frameworks to aid in e-business application selection for SMEs. The currently available e-business planning frameworks are mostly developed with big companies in mind, not SMEs. This is in stark contrast to the fact that SMEs, often with limited resources, are the ones that will require as much assistance as possible, in order for e-business planning and ultimately, e-business implementation to be successful. At the start of the research, there is no proven e-business planning framework for SMEs.

Therefore, this thesis seeks to develop an e-business selection framework for SMEs during e-business planning. On the other hand, before that can be done, there is a need to define SMEs and the relationships between e-business and SMEs, as covered in the following chapter. Other theories, including SMEs, the printing industry, business planning frameworks, BSC, VCA and QFD will be covered in later chapters.

3. SMEs And e-Business

3.1 Chapter introduction

In the last chapter, the growth in importance of e-business was discussed and four available frameworks for e-business planning were critically reviewed. It has been established that there is currently no available selection framework for SMEs in e-business planning. In relation to the research project, there is a need to clearly define SMEs and the special relationships between SMEs and e-business.

In this chapter, the author will first seek to define what small and medium-sized enterprises (SMEs) are and discuss the general characteristics of SMEs. Next, there will be a discussion on the implications of e-business on SMEs. The author will then talk about the rationale behind choosing the printing industry as the focused industry for the case studies. This will be followed by a more detailed discussion on the printing industry. The author will seek to provide an overview of the printing industry and its technologies. There will be discussions on the problems faced by SMEs in the printing industry and establishing why e-business can be the key to unlock these problems. These discussions will thereby underline the argument as to why SMEs, in the printing industry for the purpose of evaluating the selection framework, will actually require an e-business selection framework. Finally, a chapter summary section will conclude this chapter.

3.2 Small and medium-sized enterprises

In this section, there will be discussions on the definition of small and medium-sized enterprises (SMEs) used in the context of this study and on the characteristics of SMEs; how SMEs are different from their bigger counterparts.

3.2.1 Definition of an SME

The European Commission (EC) definition of small firms is based on the criteria of effective management independence and workforce categories of less than 250 salaried employees for medium-sized firms, less than 50 for small firms and less than 10 for micro-firms (European Commission, 2003). According to Eurostat, the statistical office of the EC, some 90% of firms are micro-firms and they account for one third of all jobs, though with very wide variations between member states, with

roughly half of all European Union (EU) jobs being in SMEs as a whole. In the UK there are more than three million of these firms accounting for half of private sector employment and one quarter of Gross Domestic Product (GDP) (DTI, 1998, 2001; ENSR, 1997). According to a report by the European Commission (2003), SMEs made up over 99% of all enterprises in the European Union in the year 2000, employing over 30% of all workforce and generating over 50% of all value added. In Organisation for Economic Co-operation and Development (OECD) countries, over 95% of enterprises are SMEs, accounting for over 60% of jobs in most countries (OECD, 2000).

SMEs are the life blood of modern economies as these companies are often suppliers of goods and services to larger organisations. All companies competing in an increasingly global market, independent of size or industrial sector, are reliant on SMEs to provide sub-contracting facilities. In particular, large companies tend to rely heavily on subcontractors, and the current trend of focusing on core activities is likely to further polarise the situation. Therefore, large companies are normally dependent on a network of suppliers, most of which are small firms. For example, in the UK 50% of sales in the manufacturing sector are generated through subcontracting (European Commission, 2003).

Deficient product quality will consequently have a negative affect on the competitive ability of the larger companies and the economy as a whole (Ghobadian and Gallear, 1996). Globally, an estimated 80% of economic growth comes from SMEs, playing a very crucial role in the economies of most emerging nations from the viewpoint of generating employment and economic growth (Jutla et al., 2002; Kula and Tatoglu, 2003). The increasing importance of SMEs in economic growth, job creation and regional and local development is also recognised by governmental committees (Bologna Charter, 2000). As governments in South East Asia try to regenerate new growth strategies, they realised the role that SMEs can play will be vital to their economies (Business Times, 2002).

In the context of this study, SMEs are defined as having a workforce of less than or equal to 200 for case study companies in Singapore, and less than or equal to 250 for case study companies in China. This definition is in accordance with the EC definition on workforce size.

3.2.2 Characteristics of SMEs

There have been numerous reports of SMEs lacking in resources, experience, skills and knowledge, often placing SMEs at a disadvantage when competing with big companies in a globalising world (Bell et al., 1992; Etemad, 1999). SMEs are different from large businesses in several ways. Most SMEs are often young in comparison to large businesses and their managers want to retain control of these SMEs, or these managers perceive the SMEs as having limited resources for a growth strategy (Chetty and Campbell-Hunt, 2003). Many SMEs rely on a few main customers, face a limited number of competitors, and stress the importance of qualitative competitive factors such as personalised service, rather than cost and price factors (Cambridge Small Business Research Centre, 1992).

On the whole, most businesses start small and many are taken over or cease trading before they have the chance to grow large. On the other hand, a company that starts small may often grow large with time, for example Microsoft Corp. SMEs typically grow by progressing through discrete stages of growth, and consequently are dependent on the ability of the entrepreneur to make structural and strategic changes to determine the growth prospects of businesses (Kazanjian, 1988; Normann, 1977). Failure to solve the key strategic "problem" of each stage will normally prevent the organisation from growing, these are also known as "barriers to growth" (Churchill and Lewis, 1983; Hambrick and Crozier, 1985; Cambridge Small Business Research Centre, 1992). Therefore, the abilities of managers to overcome these barriers to growth may determine the growth potential of the business.

SMEs are often less structured and less formal, with fewer fixed procedures, perhaps because there has not been time to develop them or due to the fact that resources are often scarce in SMEs. The generally flat structure of SMEs and fewer departmental boundaries normally result in a more flexible work environment. The evaluation, reward and reporting procedures in SMEs are also simpler in comparison to the larger companies. This could be because establishing a clear link between reward and behaviour in a small company with a flat structure may be simpler.

Managers in SMEs are usually accountable for many facets of the business and many decisions. The planning process is not formal and multi-functional planning takes place usually within the individual minds of managers. The extent of training

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and staff development in SMEs is also limited and informal, unlike large companies where there will normally be routine training schedules for both new and current members of staff. This can be due to fewer and more multi-functional human resources, the lack of qualified human resources specialists and financial constraints in SMEs. On the other hand, SMEs are expected to be more "people oriented" rather than "system oriented", and also to be flexible (Younger, 1990).

Ghobadian and Gallear (1997) also argued that being less structured and less formal, SMEs possess unique advantages in effective and open communication channels, low resistance to change, people orientation, employees employing a natural responsibility for quality, company-wide awareness, and functional integration, thus allowing SMEs to respond promptly to market changes. In both directions, face to face communication is the norm in SMEs. Smallbone et al. (1993a; 1993b) suggested that this ability to respond to market changes is an essential prerequisite for the growth of a small business. Kuhn (1982) also concluded that flexibility is an important success strategy for medium-sized companies.

Therefore, SMEs are more responsive to market needs, more adaptable to change, and more innovative in their ability to meet customers' demand. Lack of an extended hierarchy offers top management the opportunity to build strong personal relationships with employees, though these relationships may also increase the potential for interpersonal conflict. In SMEs, managers and operatives are more likely to be directly involved with the customers. However, scarcity of resources means that the (often scarce) resources are more likely to be channelled towards efforts that can bring about faster returns on investments (ROI). Fewer fixed procedures, as well as a younger business will, in turn, frequently mean that there is less opportunity to automate and introduce IT.

Closely related to this, the smaller the business, the less likely it is to have its own IT department, with resident expertise. SMEs do not have several core business processes which are the norm in large companies (Schlenker and Crocker, 2003). Most SMEs innovate only when they clearly perceive business opportunities for the organisation, or because they are under pressure from suppliers and clients. On the contrary, a survey by Grant Thornton International (2000) on SMEs in 15 member states of the EU, together with Sweden, Norway, Poland and Turkey, revealed that in

ten of the stated countries no other issues were regarded as more important than the issue of information and communication technologies.

SMEs are normally characterised by rigid leaderships as information flows mostly from top to bottom. There is very little information flowing in the opposite direction apart from reports which are required for compulsory documentation such as those for tax reporting purposes. These weaknesses in planning, employee training, finance and organisation of internal information can be explained by the fact that SMEs having fewer resources than large firms (Lee and Oakes, 1995; Ryans, 1995; Haksever, 1996). This is because the search and selection of information for SMEs though important, is extremely focused due to time and human resources constraints (Kula and Tatoglu, 2003).

Knowledge and experience are also rarely shared between the management and employees. Any decisions to be made by managers are usually influenced by the managers' belief in the company's competitive advantages or any threats and weakness of the company as well as past experiences with similar decision-making situations, although these beliefs and experiences themselves can either be advantageous or disruptive to the decision process (Collins and Porras, 1994; Jaffe and Pasternak, 1994; Porac and Rosa, 1996; Madhok, 1997; Lee et al., 2000a). Most business decisions made by SMEs are based on intuition of the management and not through research, analysis and discussion. Furthermore, SMEs are not proactive as they will generally react and improve, or change, based only on customers' demands (Schlenker and Crocker, 2003). Therefore, it is vital that managers in SMEs are guided with as detailed a methodology as possible during the planning process, in order to minimise the disruptiveness of the managerial belief system. Lee et al. (2000a) also argued the need for more formal procedures and documentation in SMEs.

Therefore, it can be seen from the above arguments that the digital economy means a lot to big organisations, as it represents a new avenue to create sustainable competitive advantage. Drihlon and Estime (1993) argued that improving competitiveness is imperative for both small and large businesses alike. Thus, with the urgency of the big organisations going digital through implementing e-business solutions, SMEs are expected to be digital-ready in order to continue as trading

partners. To the author, digital-ready is the ability and capability to conduct transactions on the Web – in essence, being e-business-ready. Once large companies start to buy online, this will often result in downward and sometimes unsustainable price pressure (Brooks, 2001). Thus SMEs must start to compete and do business internationally, or at least regionally.

3.3 SMEs and e-business

Despite the widespread acceptance of Internet use in big companies, the extent of Internet use and adaptation continues to vary widely among SMEs. While some SMEs have benefited and continue to benefit from rapid Internet growth, selling and purchasing over the Internet or experimenting with new business models, others are barely interested in the medium (Sadowski et al., 2002). Even though most companies have accepted the Internet as a way of life, many SMEs still view the Internet, primarily, and only, as an information device. This can be due to SMEs lacking appreciation of the benefits of e-business (Eduard, 2001), on which Smyth and Ibbotson (2001) also reported that only 10% in the Republic of Ireland and 7% in Northern Ireland appreciated the benefits of e-business. An OECD survey, for instance, noted that the two main reasons SMEs do not use e-commerce are that SMEs tend to be unfamiliar with the technology and its benefits, and SMEs perceive the technology to be both costly and a source of security concerns (OECD,1998). However, Drew (2003) stated that SMEs are also starting to establish themselves as significant players in the e-business economy, despite the fact that SMEs are still comparatively slower in Internet adoption when compared with the large companies. In fact, Daniel et al. (2002) presented findings that in the UK alone, 50% of SMEs have already adopted e-business in some ways.

Although the implications for non-adoption of e-business may vary, depending on the industry sector and the size of the company, the fact remains for many companies that both business and product opportunities will be lost. Another problem will be new barriers to market entry if, and when, the firm eventually decides to embrace the technology, as this will have subsequently created new types of demand and products (Fillis et al., 2004). It is no longer an option for SMEs to wait to implement e-business applications. A large percentage of their customers are online and the SMEs' competitors are also getting online (Drew, 2003). The small businesses' share

of e-commerce in the world was expected to rise from 17% in 1997 to 30% by 2003 (Goldman Sachs, 1999). Also, based on eMarketer's (2001a, 2001b) forecasts on total global e-commerce value, e-commerce will generate US$864 billion (£463 billion) for small businesses by 2004. Weintraub (2001) also suggested that the online economy will provide major opportunities for SMEs to flourish. Furthermore, surveys by Violino (1999) and Rosa (2000) showed that the main reason for companies to launch e-business initiatives was to provide better-quality customer service and to achieve higher customer satisfaction.

There is a need for SMEs to get acquainted with the benefits of e-business in order to persuade more SMEs to adopt it. These benefits can be classified into "hard" and "soft" benefits (Eduard, 2001). "Hard" benefits will be benefits which can be directly translated into dollar terms, for example allowing SMEs to trade globally and also to source for supplies globally. On the other hand, "soft" benefits are benefits that can not be easily translated into dollar terms, for example customer satisfaction and customer loyalty. Poon and Swatman (1997) stated that one of the major benefits to adopting e-business in the smaller firm is the ability to access an information infrastructure which is much larger than that owned by many large corporations. The cheapness of Internet access through the use of Internet applications also means that it is within the reach of most organisations, regardless of their size (McBride, 1997; Hormozi et al., 1998). Small businesses can gain competitive advantage through benefiting from the opportunities offered by the Internet that enables them to go global virtually overnight, and competing on the Internet simply by setting up a homepage (Sterrett and Shah, 1998; Durkin and McGowan, 2001).

While providing SMEs with new opportunities, the Internet can also be opening the door to new competitors, especially to markets that are traditionally domestic (Zheng et al., 2003). Through the Internet, companies can bypass traditional business barriers such as the physical distance between markets, and allow for improved interaction between members of a network. However, can the Internet allow SMEs to reap the benefits of information and communication technologies (ICT) in a simple and affordable way? The answer is, it depends. SMEs need to appreciate how the Internet is going to influence them both internally and externally. SMEs realise the need to go digital to survive, and many are willing to do business electronically in terms of both B2B and B2C, with a survey showing that the highest ranked Internet

applications with the largest frequency of usage are found to be principally concerned with external communication and gathering information for market and product research (Kula and Tatoglu, 2003). Quayle (2002) also suggested that SMEs appear to be aware of the basics of e-business but fail to realise that e-commerce expertise is also a prerequisite for developing the company's competitive advantage. SMEs however, are not able to value the potential or possess the know-how to manage the complexity in such a major change. As a result, Eduard (2001) suggested that now is the time when SMEs require assistance and guidance to integrate e-business into their traditional business structure.

Going electronic is not merely getting on the Web. SMEs require a social and technical knowledge to assist them in planning and managing the project of being digital-ready. SMEs require "tailored advice" (Drew, 2003). The cost of planning and implementing e-business applications will be a key concern for businesses (Management Accounting, 1999; Rodgers et al., 2002). Besides, SMEs have limited resources, and therefore cannot afford to waste these precious resources on projects which they do not know if they will be able to succeed in planning and implementing. The legacy systems in the business will also need to be looked at as current legacy systems may have to be disposed of, if SMEs want to compete in the long term (Rodgers et al., 2002). Next, the author will discuss the current available techniques in e-business planning.

3.4 Rationale behind choosing the printing industry

Gaining access to companies for the purpose of research is normally the most difficult hurdle in the research cycle. While the researcher has initially targeted and requested access to SMEs within the relatively more important industries of aerospace, motor transport and semi-conductors, all requests for an initial meeting were turned down. This can be due to the more sensitive information that these companies possess or it can be due to the lack of knowing, on personal terms, a gatekeeper. As time is a crucial element in the research project, the researcher decided to move on to other industries. The printing industry was decided on after a chance meeting with an old friend whose father is the managing director of a Singapore-based medium-sized printing company, as well as established research

links between the late Dr. Nelson Tang, the researcher's initial supervisor, and a China-based medium-sized printing company.

The prospect of ready access to two SMEs within the same industry proved to be too tempting for the researcher to refuse. However, despite ready access, initial concerns for the researcher included:

1. How important is the printing industry to the economy?
2. Is not printing just printing?
3. What has the printing industry got to do with technology, especially e-business?
4: Will it be possible to find and gain the same level of access to two other printing SMEs, even without knowing any other gatekeepers on personal terms?

The answers to the first three questions above will be discussed in more detail in section 3.5. As for the question on the possibility of finding and gaining access to two other printing SMEs, the researcher had initial doubts as it can be extremely difficult, since the gatekeepers of the ready-access companies are actually doing the researcher a favour, based of personal relationships. It turned out that it is this sort of personal relationship that the researcher fully exploited, but ethically, in gaining access to another two printing SMEs. Access to the second Singapore-based printing SME was granted through the personal connections of the researcher's sister, while access to the second China-based printing SME was agreed through arrangements by a relative of the researcher working in the mayor's office.

3.5 Overview of the printing industry

Adams et al., (1996: 44) defined printing as a "manufacturing process" that "produces multiple, identical copies of graphic images" and that printing is "the single most significant technological development in the history of the human species" (Adams et al., 1996: 2). The printing sector is one of the most important in the UK economy, being the fifth largest industry in the country and providing almost 200,000 jobs, with an annual turnover of £9 billion in addition to exports worth £2 billion (Robson Rhodes, 1996; Dotprint, 2001b). In Malaysia, the industry is estimated to be worth RM310 million (equivalent to about £45 million) in 2001 with 40.2% being exported to Singapore and 8.6% to the UK (Hamid, 2001). Over in the United States, the printing

industry's yearly sales exceeded US$140 billion (equivalent to about £75 billion) in 1994, while employing over 1 million people at the same time (Adams et al., 1996).

In Singapore, there are about 500 printing companies employing a total of 18,500 people in 2000 (Theyvendran, 2000). The printing industry in Singapore generated in the same year a value of around S$3 billion (equivalent to about £1 billion) worth of output with value-added worth S$1.5 billion (equivalent to about £0.5 billion) and exports worth S$600 million (equivalent to about £200 million) (Theyvendran, 2000; Nielsen, 2003). Investments in the printing industry in Singapore for 2000 were worth S$115 million (equivalent to about £38 million), which was 1.3% of the overall manufacturing sector's total investments (Nielsen, 2003). Singapore is commonly known as the printing and specialist information hub of Asia, helped by world-class companies in the industry having their regional headquarters in Singapore. These companies included Dun and Bradstreet, Gartner Group, Heidelberger Druckmaschinen AG and Reuters. Many international magazines and newspapers like Time Magazine and The International Herald Tribune also have their printing done in Singapore.

Although the era of e-business has not arrived in Singapore for the printing industry, in order to be prepared and equip the employees in the Singapore printing industry with the right skills and knowledge to handle the latest technology, the Singapore printing industry has applied for the assistance of the Government of Singapore to embark on a major programme to retrain employees in the Singapore printing industry (Businessworld, 2001; Cheung and Huang, 2002). This retraining programme will allow Singapore printing companies to stay ahead of competitors from the region, especially the Philippines, which are poised to take over from Hong Kong and Singapore as the printing hub in Asia, with IT-driven printing technology including digital cameras, direct-to-press digital and digital proofing (Businessworld, 2001).

In China, the largest country in the world, there are an estimated 82,189 registered printing companies in 2001 (Wu, 2001a). By the end of 2002, the number of printing companies in China had grown to 90,021 (Printpackworld, 2003). This is an increase of about 8,000 new printing companies in one year. The total value of the industry is not disclosed by the authorities, probably due to the sheer size of the industry and

the lack of proper documentation by all printing companies. According to Wu (2001a), the Chinese printing industry was revolutionalised between 1983 and 1999. By 2000, Chinese printing companies had achieved the knowledge of "laser typesetting, electronic colour separation, offset printing for books and in-line auto-binding" technology (Wu, 2001a: 2). At the same time, regional printing industrial zones are fast taking shape in China, especially in the Zhujiang River Delta area and Yangtse River Delta area, with sales income accounting for three quarters of the national printing industry. Printing companies in these two areas generally have more advanced technologies and better equipments when compared to other areas in China, although printing companies in the Bo Hai Economy Area are fast catching up (Printpackworld, 2003). Wu (2001b) believed that the next ten years will be a decade of rapid development for the printing industry in China, due to its rapid development in science and technology and economic globalisation.

Over the past 20 years, computer-based technology advancements have already made a great influence in the printing industry. The introductions of new technology has changed the basics of the industry structure, bringing about closer and more intimate relationships between printing companies and their customers. In the past decade, most printing technologies have been swiftly substituted by digital technology (Adams et al., 1996). However, the greatest changes to most of the companies in the industry have yet to come (Smallbone et al., 2000). Printing companies will definitely be influenced by the Internet and its applications (Dotprint, 2001d). In fact, in Seybold Seminars Boston 2000, a key event for the professional publishing worlds of print and Web media, attendees cited in a survey that Web technology offerings and e-commerce tools are the main areas of interest (Graphics Arts Monthly, 2000).

3.5.1 Advancement of technologies in the industry

The first typesetting machine, the Linotype, was invented in the 1880s by a German-American engineer, Ottmar Mergenthaler. In 1887, Tolbert Lanston invented the Monotype, also a typesetting machine (BBC, 2001; Dotprint, 1997d; Dotprint, 2001a). By the 1960s, photographic images had replaced type as the norm for typesetting with electronic systems slowly but successfully changing the industry (BBC, 2001; Dotprint, 2001a). More on the history of printing will be discussed in Appendix 1. In present times, digital technology is widely accepted as the way forward, with most

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printers having to play more than the role of "printers". Now, most printing companies will also have to offer skills and services including data handling, designs and warehousing. Thus, through maintaining a digital library, printing companies will be able to save time and reduce error, thus cutting overall costs of running the business (DeWitt, 2003).

American manufacturers are currently leading the printing and finishing equipment market, together with the Germans and Japanese. However, there are still dilemmas on the development of these future presses. SMEs in the printing industry, according to Smallbone et al. (2000), will have to choose from one of the following technology options in order for the business to grow: digitally controlled conventional litho presses; computer to plate (CTP) and; direct digital presses.

These new technologies, however, also mean massive investment. Besides, there will be a need, especially with CTP and direct digital presses, to have work stations connected to high powered servers with massive disk space to maintain these digital workflows. This disk space according to Smallbone et al. (2000), will have to exceed 100 gigabytes. It is also argued that with such massive data storage capacities, printing companies can also provide data archiving services, equal to storage services. With decreasing costs as digital printing technology advances, some printers have even begun to combine conventional offset presses with digital ones (Oller, 2001). On the other hand, there are still printers on the market that concentrated mainly on printing. These printers will streamline business processes by pushing some of the processes back upstream, handing customers the responsibility of proof-reading, before actual print jobs are carried out (American Printer, 2000). In turn, these printers will be able to cut turnaround time, resulting in faster and also more accurate delivery compared to other printers, which will have to prepare the drafts and then wait for approval from customers before printing a job. Therefore, as stated by Reiling, (2002), there will not be a shortage of printing technologies available.

3.5.2 Problems faced by SMEs in the industry

The printing industry is currently undergoing major changes. Most printing companies will face increasing market competition from both at home and abroad, resulting in lower profit margins (Smallbone et al., 2000; Nielsen, 2003). Acquisitions and

mergers have accelerated as with businesses in other industries. The positions of customers and suppliers are also undergoing a period of change, also through their own industries' acquisitions and mergers. Besides that, customers and suppliers are also fast engaging new technologies, especially Internet/Web technology, in trying to further boost their own businesses' competitive advantages, profitability and survivability. Therefore, printing companies must be sensitive to market movements and sentiments, catering to their services and products whilst constantly comparing them to those of their competitors (Printing World, 2001, 2002a, 2002b). In fact, one new technology that is proving to be a potentially dangerous challenger is the "electronic text". This technology can in future be a substitute to conventional printing (Klein, 2000).

Companies in the printing industry have to reshape their business strategies and rules of engagement to take into account the new needs and demands of customers and suppliers. Shepard (1997) and Barnes et al. (2003) argued that the twin trends of the globalisation of businesses and the revolution in information and communication technology will make it mandatory for businesses of all sizes to restructure. However, identifying and recognising such needs and demands are difficult as they are often and mostly implicit. Managers have to tease out these needs and demands, through their everyday interactions with customers and suppliers, as well as through their everyday tasks. Even if, and when, the manager manages to identify the needs and demands, the managers often do not have the necessary knowledge and skills to transform these needs and demands into feasible e-initiatives.

This situation is frequently further exploited by big customers and suppliers, who often coerce the smaller companies to adopt their e-business platform without taking into account the level of adaptability and expertise of the SMEs to successfully implement and maintain such e-business applications. Worse still, these different companies are often big enough to have their own platform, which meant the SMEs will be required adopt different platforms just to remain as their trading partners. Quoting a senior manager from a printing company in Singapore:

"Every big customer and supplier we have want us to adopt their e-business platforms. However, we lack the resources to effectively and efficiently manage this diverse range of platforms. The big companies are often trying out these software and e-business applications for free but we, the small companies, will have to pay the

software company a monthly royalty. We have to pay one set of royalty payment for every installed platform we have on the systems. With 10 different platforms, we have to pay 10 times the monthly royalties. To make things more frustrating, these platforms just do not work well enough, for our customers, suppliers and us. The platforms are often full of bugs and when the big companies decide to switch platforms, we have to oblige as well."

Yet despite these negative experiences, SMEs in the printing industry know that they have to be electronically-ready to be able to cope with the needs and demands of their business partners in the digital economy, or face being left behind and eventually being acquired or having to wind up. Printers are now required to efficiently and effectively employ the use of the Internet to offer a wider variety of services. This is becoming more and more crucial to the printing companies as competition for printing jobs are now on a global scale (Dotprint, 2001b). Therefore, there is a pressing need to assist SMEs in the printing industry in determining why e-business is the way forward and how these SMEs can identify internal and external needs to transform them into feasible e-business initiatives requiring urgent attention. New knowledge of technology and new technology implemented in the companies will enable these SMEs to complete more effectively. Without this knowledge and these technologies, printing companies will find it increasingly impossible to meet customer demands of higher quality and shorter turn-around times.

3.6 Chapter summary

In this chapter, there were discussions about what SMEs are and what differentiates them from big companies. Also, the author talked about the relationships between SMEs and e-business, thus establishing why SMEs should embrace e-business. Following that, the printing industry was presented as the chosen industry for the research project. The problems faced by SMEs in the industry were examined, further determining the need for a selection framework by managers of SMEs in the printing industry for e-business planning.

In the next chapter, the concept of what a framework is and what constitute a good planning framework will be presented and discussed. Frameworks that can potentially be used in e-business planning are also looked at, followed by a review on the three established techniques: BSC, VCA and QFD, which will be used as major components in the e-business selection framework.

4. Business Planning Frameworks And Their Components

4.1 Introduction

In the previous chapter, there were discussions on what SMEs are and what differentiates them from big companies. Also, the author talked about the relationships of SMEs and e-business, thus establishing why SMEs should embrace e-business. Following that, the printing industry was presented as the chosen industry for the research project. The problems faced by SMEs in the industry were also examined, further strengthening the argument for SMEs to implement e-business applications.

In this chapter, the concept of what a framework is and what constitutes a good planning framework will be presented. There will be general discussions on frameworks and also the work on frameworks carried out by Wu (1992, 1994). Current planning frameworks will be looked at and discussed regarding their potential to be developed into an e-business selection framework for SMEs. This will be followed by a review of the three established techniques, determined through reviews on potential planning frameworks, to form the proposed integrated e-business selection framework: Quality Function Deployment (QFD), Balanced Scorecard (BSC) and the Value Chain Analysis (VCA). These three established techniques will be central to the e-business selection framework being developed in this research project. The chapter will finally be completed with a chapter summary section.

4.2 Overview of planning frameworks

There are many types of framework available, including manufacturing frameworks and business strategy frameworks. The most conventional manufacturing framework consists of "process", how strategy is made, and "content", the constituents of a manufacturing strategy (Leong et al., 1980; Anderson et al., 1991). Matthews and Foo (1990) further extended this framework to "process, content, performance, consistency and implementation". Other planning frameworks are also available from the business strategy literature, for example Pettigrew's framework (1992) of "process, content and context". Wu (1992, 1994), on the other hand, described frameworks as consisting of methodologies to assist the analyst in system analysis in order to achieve a desired outcome given the limited amount of information gathered.

It has often been argued that a good planning framework has to be holistic in nature, taking into account both external and internal factors during the planning process (Skinner, 1969, 1971; Voss, 1986; Pettigrew, 1992; Wu, 1992, 1994). Frameworks should also not be too complex to use and information interaction within the framework should be minimised, that is, communication flow within the framework should be clear yet concise to avoid an overload of information. For example, Mills et al. (1995), who proposed a framework for the design of manufacturing strategy processes but also criticised the same proposed framework on the potential scale of interactions within the framework, and thus, the difficulty of pragmatic deployment. Rahim and Baksh (2003) further argued that a good framework should have an easy-to-follow, step-by-step approach, thus ensuring that the framework will be easy to implement, able to be used as a training tool and for documentation purposes.

According to Wu (1992, 1994), good frameworks should be able to guide managers towards a method or solution uniquely suitable to a particular situation in question. A good framework is to simplify the planning process, while allowing managers involved to acquire the answers through a series of methodologies. Wu (1992, 1994) listed five main stages that require answers during system analysis, which are:

1. Situation analysis
   - Where is the company now?
   This can be an identification of a problem that the company is facing or that it can be identification of internal and external customer needs. Therefore, are there needs to be met? Situation analysis includes the existing systems within the companies: the key processes, their elements and relationships. However, when the situation is either unstructured or expressed, the manager will be required to understand these situations in ways other than reading off numbers from charts and tables. Techniques including the BSC and VCA can assist the managers in this area, which will be discussed in the later sections of this chapter and also in Chapter 6. For the purpose of this research project, situation analysis will be to understand the needs of customers and key processes within the company. This information will therefore allow the managers to proceed to the next stage.

2. Objectives formulation
   - Where should the company be?

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This stage is primarily concerned with where the managers want to bring the company to. In his book, Wu (1992, 1994) stated that this included gathering the relevant information, determining if it is feasible to bring the company to the new level and what will be the most important factors that have to be considered. Through the analysis of data collected by engaging, for example, the QFD, the most important factors that require considering can be determined.

3. Synthesis and analysis of concepts
   - What are the possible routes and means for the company to achieve the desired outcome?

No matter what desired outcome a company chooses, there will almost certainly be more than one possible route to achieve that desired outcome. For example, a desired outcome of a student getting to class on time can be met by a number of possible solutions. These include taking an earlier bus, taking the train and getting his parents to drive him to school. Equally for a company considering implementing e-business, there are also many possible applications, which have been discussed earlier in section 2.3, but the underlying question that managers require an answer to is: which application is the most suitable and relevant for their company?

4. Evaluation and decisions
   - Which route should the company take to achieve the desired outcome?

At this stage, the numerous possible solutions will have already been identified and listed. Now, these solutions have to be evaluated so as to arrive at the most feasible solution. Taking the student's example above, taking an earlier bus will require him to wake up at least an hour earlier. Although the student will definitely arrive on time, the student may have to wait for at least an hour for the lecture to start, thus making this a rather less efficient solution. If the student tries to get his parents to drive him to school, the student's parents may have to take a big detour on their way to work, thus also resulting in a sub-efficient solution for the student's parents. Taking the train to school on the other hand may take the least time and be the most reliable transport option the student possesses. For a company, especially an SME considering e-business, given the limited resources, the managers have to consider the amount of resources to be invested in the right e-business applications to meet the most urgent internal and external needs.

5. Solution and implementation

- Start the journey and bear in mind progress control.

Once managers have arrived at this stage, the solution to be applied to allow the company to achieve the desired outcome has already been decided. The managers will now have to implement the changes required as per solution chosen. Implementation progress must be measured with performance measurements agreed prior to implementation.

As a final point, Wu (1992, 1994) also specifically stated that the aims of frameworks are to improve the quality of decisions, reduce costs and times, to be fit for purpose and to be able to provide a guided process. For example, van Assen et al. (2000) proposed a decentralised manufacturing planning and control framework especially for companies embracing the agile manufacturing concept, while Small and Yasin (1997) proposed a framework for the planning and implementation of advanced manufacturing systems. These frameworks aim to improve the decision-making process and are developed with the notion of dedicating them to specific purposes. By improving the quality of decisions, managers can ensure that the "right" decisions are taken in meeting the most urgent needs. A good framework will allow managers to arrive at the decisions with lower costs and in a shorter time, as good frameworks will provide a guided process through its series of steps, which are being interwoven seamlessly together. The decisions will be able to provide a fitness for purpose solution to the "problems" identified. In the next section, some of the more popular planning frameworks are identified and discussed.

4.2.1 Mintzberg model

One of the first planning frameworks is the Mintzberg model developed by Mintzberg, Raisinghani and Theoret (Mintzberg et al., 1976). This framework allows managers to take a longitudinal approach to planning, which is useful for keeping track of decisions made from the moment a need for decision-making is recognised, through to the identification of the final solution. In the Mintzberg model, the overall planning process is separated into seven steps under three stages, as shown in Figure 4.1. It is recognised that the steps need not be adhered to in a strict sequence, as practice shows in the business world, where delineation of basic steps frequently occurs, there are unforeseen circumstances and optimisation of processes. Bennett et al. (1990) demonstrated how the Mintzberg model can be applied to the design of new

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production systems for both descriptive and analytical research purposes. However, the lack of strict sequencing to allow structural planning to be carried out is a negative aspect of the framework, especially for managers in SMEs who often lack the necessary resources, experience, skills and knowledge. Also, the Mintzberg model does not provide an analysis of the needs identified and does not provide prioritisation of business processes according to criticality and implementation feasibility in meeting the needs.

Figure 4.1: The Mintzberg Model

Source: Mintzberg et al. (1976)

4.2.2 Structured analysis and design technique

Structured analysis and design technique (SADT) was developed by Ross of Softech USA to identify data flows and activities within a manufacturing or information system (Ross, 1977). The essence of SADT is to breakdown the overall system into a sequence of blocks at all levels and to identify for each block the input, output, mechanism of conversion and constraints and controls on the activities being explored as seen in Figure 4.2. Thus, the decomposition of activity from the very top level can be extended downwards to the lowest level. A manager can therefore technically test the effects of decisions made to a live SADT model. However, the main drawback for this planning framework is that it assumes that managers already know the needs and have prioritised decisions according to criticality and feasibility. Although the basic block of the SADT looks simple, it is, however, only the most basic element of a large and rather complex technique. The US Air Force later developed IDEF from SADT, which will be further discussed in the next section.

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Figure 4.2: The basic SADT block

Source: Ross (1977)

4.2.3 Integrated computer-aided manufacturing definition

Integrated computer-aided manufacturing DEFinition or Integrated DEFinition (IDEF) was developed by the US Air Force's Integrated Computer Aided Manufacture (ICAM) Programme, to describe the information and organisation structure for their complex aircraft manufacturing system. According to Bennett and Forrester (1993), IDEF is actually a collection of SADT-type graphical tools and is most commonly used as a computer-based set of tools. Wu (1992, 1994) mentioned that there are 5 basic levels of IDEF: IDEF-0, IDEF-1, IDEF-1X, IDEF-3 and IDEF-4. There is also a sixth level of IDEF. However, contrary to widespread belief, only IDEF-0 was developed as a commercial computer-based tool, while the use of IDEF is mainly restricted to the manual construction of activity flow diagrams. The basic IDEF-0 building block can be seen in Figure 4.3. The following are the uses of the different basic levels of IDEF, which may be used independently:

IDEF-0: for specifying completely the functional relationships of any manufacturing environment.
IDEF-1: for describing the relationship between data items in the environment.
IDEF-1X: simulation for investigating the system's dynamic behaviour.
IDEF-3: for process design.
IDEF-4: an object-oriented approach to manufacturing software development.
IDEF-5: an ontology description capture method

Wu (1992, 1994) stated that the main disadvantages of IDEF are that using IDEF involves many hours of learning time, is difficult to manage, the ambiguity of function specification and also, especially for IDEF-0, it is static and highly prone to making

effective communication difficult. Also, the drawings frequently used in IDEF can only be as good as the analyst's skills permit (Yeomans, 1985; Ranky, 1990; Nicholson, 1991). Kim et al. (2003) also stated that because the different IDEF notations are developed over a decade, the lack of an overarching framework to link the different IDEF notations can be a potential disadvantage to IDEF, which is true especially for SMEs with limited knowledge and resources. Kim and Jang (2002) and Goh and Zhang (2003) further discussed the difficulties in deploying IDEF-0, which are summarised by the author as shown in Table 4.1. These disadvantages of IDEF therefore make it difficult for SME managers to employ the IDEF technique during e-business planning.

Figure 4.3: IDEF-O's basic building block

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Source: Wu (1994)

4.2.4 Potential e-business planning frameworks

In section 4.2.3, it was discussed and established that IDEF is a good planning framework but too complex for SME managers to understand and deploy. It was also discussed in Chapter 2 that the more popular frameworks in e-business planning, which included Hayes's (2000) seven steps to e-business success, Kalakota and Robinson's (2000, 2001) e-business application architecture, Tetteh and Burn's (2001) SMALL framework and Intel's e-business strategy (Phan, 2002, 2003), were developed with big companies in mind, and therefore not suitable for use by SMEs, due to the differences between SMEs and bigger companies as discussed in Chapter 3. Further limitations of these frameworks currently being deployed in e-business planning can be seen in section 2.5.1.

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Based on: Kim and Jang (2002) and Goh and Zhang (2003)

On the other hand, Lee and Ko (2000) proposed a strategic framework for business strategic planning, by integrating SWOT (strengths, weaknesses, opportunities and threats) (de Witt and Meyer, 1998), BSC, QFD and "Sun Tzu's the art of business management strategies". The proposed framework is simple and potentially effective for deployment in strategy planning, as demonstrated in Ko and Lee (2000). In a similar proposed framework, Lee et al. (2000b) integrated SWOT, BSC, QFD and Malcolm Baldrige National Quality Award (MBNQA) education criteria, for strategy formulation in vocational education in Hong Kong. However, the engagement of SWOT in the framework, although helpful in guiding the managers to build the BSC, is however a potential data collection hurdle for any researchers interested in carrying out studies in companies.

Especially in SMEs, it is highly unlikely that managers will be enthusiastic about revealing the weaknesses and opportunities of the companies. The managers on the other hand, may be more willing to disclose the companies' strengths and threats. As discussed earlier in section 3.2.2, company strategies in SMEs are rarely divulged,

even to junior managers and employees. In addition, SWOT analysis is composed normally with simple catch-all guidelines, lacking the explicit underpinnings required in a strategic appraisal and, therefore, often argued as only able to generate shallow misleading results (Hill and Westbrook, 1997a, 1997b; Valentin, 2001). Thus, SWOT needs to be excluded from the selection framework, as it will need to be evaluated in SMEs to demonstrate that it is effective and efficient to use.

SME managers require assistance in identifying both the external and internal needs of the company in order to achieve competitive advantages. However, even if this is achieved, the manager's tasks do not stop there, as possible e-business applications need to be prioritised according to these needs. While many techniques like SWOT, SLEPT (political, economic, social, technical and legal) (Op. Cit.:135) and Porter's Five Forces are possible answers to identifying needs of the company, these techniques lack the focus of planning in an e-business environment (Hsu and Pant, 2000). Also, there is the urgency to distinguish a framework that can both identify and prioritise planning needs. As demonstrated by many examples, such as Akao (1972), Mazur (1993) and more recently Ko and Lee (2000), and Lee et al. (2000b), Quality Function Deployment's (QFD) strength is in its ability to prioritise needs and their solutions. Therefore, it is argued that QFD can technically be engaged to prioritise company needs and the possible e-business applications, through structured planning.

While QFD can be deployed in e-business planning, there is still a need to integrate QFD with other techniques, in order to assist QFD in identifying the needs and business processes of the company. Van Hooft and Stegwee (2001) also argued that existing models and theories can still be applied even though a new e-business perspective should be added to the strategic planning process. For this purpose, the balanced scorecard (BSC) and value chain analysis (VCA) can potentially be integrated to provide a stepping stone to build the QFD for e-business planning. Figure 4.4 shows the summary on how the techniques of BSC, VCA and QFD were chosen to be integrated and developed into a new e-business selection framework. In the following sections, the techniques of BSC, VCA and QFD will be closely examined and discussed.

Figure 4.4: Identifying the techniques to be integrated for the new e-business selection framework

Current e-business frameworks:

More suitable for big companies — Hayes (2000) seven steps to e-business success

More suitable for big companies — Kalakota and Robinson (2001) e-business application architecture

More suitable for big companies — Tetteh and Burn (2001), SMALL framework

More suitable for big companies — Phan (2002, 2003)

Manufacturing frameworks:

Too brief — Mintzberg model (1976)

Too complex — IDEF

No

SWOT needs to be excluded, alternative technique required for generating "hows"

Other frameworks:

Ko and Lee (2000) — QFD and BSC can be integrated to form a new e-business planning framework

Lee at al. (2000) — QFD and BSC can be integrated to form a new e-business planning framework

Yes

SWOT needs to be excluded, alternative technique required for generating "hows"

VCA to be included into the integrated framework to assist in the generation of business processes

End

4.3 Basics of the balanced scorecard

The balanced scorecard (BSC) was first created in 1987 at Analog Devices to help improve organisational performance and competitiveness, particularly to overcome weaknesses of the financial accounting model (Schneiderman, 2000). Kaplan and Norton (1992) first published details on the application of the BSC in the Harvard Business Review. Since then, a number of organisations including Mobil, Citicorp, AT&T, Rockwater, Apple Computer, AMD, KPMG Peat Marwick, Allstate Insurance, as well as not-for-profit and governmental organisations, have been using the BSC as a strategic planning and performance measurement tool (Kaplan and Norton, 1993, 1996a, 1996b, 2000, 2001; Chow et al., 1997). According to Silk (1998), 60% of Fortune 1000 firms have experimented with the BSC, thus signifying that it has been of considerable interest to managers (Liberatore and Miller, 1998; Thomas et al., 1999; Lipe and Salterio, 2000; Brewer and Speh, 2000).

4.3.1 Defining the BSC

The BSC is a customer-based planning and process improvement system. It is created as a strategic tool to include a variety of financial and non-financial measures from various perspectives while paying attention to the relationships between different measures, and to link performance measurements explicitly to strategy development (Kaplan, 1990; Kaplan and Norton, 1992, 1993, 1996a, 1996b, 2000; Olve et al., 1999; Sanger, 1998; Mendoza and Zrihen, 2001; Dabhilkar and Bengtsson, 2004). Thus, the BSC can also be defined simply as a performance and strategic management system (Chan, 2004). This is important as no single measurement will be able to provide a balanced view of all critical areas of the company. As the BSC is composed from a set of measures, this will provide managers with a fast but vitally, a comprehensive view of the business. Specifically, as defined in the research project, the BSC allows managers to look at the company from perspectives viewed as the most important for the success of the company, in order for tangible objectives and measures that relate to the organisation's mission, vision and strategy to be established. In his own words, Kaplan said that the BSC can bridge the "huge gap between the vision and strategy developed at the top and the things people down in the organisation, at the frontline, are doing" (DeWaal, 2003: 31).

4.3.2 Building a BSC

The first step in designing a BSC is the identification of strategic goals. Therefore, a 10-step methodology is introduced to assist in the building of a strategic management system using the BSC (Kaplan and Norton, 1996a). However, to link the companies' long-term strategy to short-term actions, organisations will have to ensure that the 10-step methodology goes through the four management processes (Kaplan and Norton, 1996a) in a spiral. There will be further discussions on building a BSC in section 6.2.1.

Figure 4.5 shows the four perspectives: customer, financial, internal business process and learning and growth that enable the BSC to provide a holistic view required by managers, compared to mere financial data (Hepworth, 1998). These four perspectives can be used to translate the organisation's vision and strategy into planning guidelines and ultimately "delighting" stakeholders, though not every

company will place equal weight on all the four perspectives (Kaplan and Norton, 2001: 90; Olson and Slater, 2002). These four perspectives are linked to each other through causal or spurious relationships, that is, a variable can impact directly or indirectly on another variable, or two variables can be impacted on by a third variable at the same time. The definitions of the four perspectives are:

- Customers: the strategy for creating value and differentiation from the perspective of the customer.
- Financial: the strategy for growth, profitability, and risk viewed from the perspective of the shareholder.
- Internal business processes: the strategic priorities for various business processes that create customer and shareholder satisfaction.
- Learning and growth: the priorities to create a climate that supports organisational change, innovation, and growth.

4.3.3 The benefits and limitations of BSC

Ritter (2003: 47) summarised the benefits of the BSC as the following:
- The BSC encourages the systematic development of vision and strategy.
- The BSC permits the formation of the business model identifying the key success factors and their inter-relation.
- The BSC reduces the risk of information overload through limiting the number of measurements to be considered.
- The BSC compels managers to look particularly at a small group of measurements which are relatively more critical to the performance of the company.
- The BSC renders it possible to appreciate the vital adjustment elements of the company and its management through a cause-and-effect analysis, in order to identify all activities that can assist the company to reach established goals, thus facilitating the allocation of resources.
- The performance measurement capability of the BSC allows managers to verify if a certain strategy has succeeded or failed.
- The BSC facilitates a top-down communication of objectives and the alignment of key business processes to achieve the strategy.
- The BSC acts as an agent for the change of paradigm.

Figure 4.5: Transforming vision and strategy

Source: Kaplan and Norton (1996)

The BSC, however, provides no mechanism for maintaining the relevance of defined measure (Hudson et al., 2001). Also, there is a lack of integration between a top-level strategic scorecard and operational-level measures, thus making execution of the newly-formed strategies problematic (Ballantyne and Brignall, 1994). This scenario matches the challenges faced by many SMEs, who need to fulfil the expectation of matching top-level objectives with operational-level processes, but are unable to identify precisely what needs to be implemented. The BSC can, on the other hand, complement other available techniques to form a strong alliance. In the case of the research project, BSC can be used to assist in the generation of needs in QFD, due

mainly to BSC's strength in providing managers with a comprehensive view of the company from top to bottom, including the customer perspectives.

4.4 The value chain analysis

4.4.1 What is value chain analysis?

The value chain has always been used to maximise opportunities to add value while minimising total cost, mostly through waste reduction (McGuffog and Wadsley, 1999). Value chain analysis (VCA), as can be seen in Figure 4.6, can also help to develop a clearer understanding of how the business operates; indicating where value is generated and how existing elements can be reconfigured or re-engineered to meet the strategic intentions. Porter (1985) developed the concept of value chain in order for manufacturing companies to deploy a framework to analyse the business activities critically for the purpose of realising competitive advantage, on the belief that every company is a collection of activities that runs through the company structure to design, produce, market, deliver and support the product. For the purpose of this research project, the VCA is defined as a technique that can assist managers in identifying the key business processes within the company, which can also be extended to the identification of external processes.

Figure 4.6: The generic value chain

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Source: Porter (1985).

4.4.2 Components of a value chain

VCA structures business operations into five primary activities and four support activities which included technology development. While it has been frequently argued that technology development has evolved from a support activity to a primary

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activity, one must not forget that technology should only be deployed if it will be able to support the overall company strategy. The five primary activities are:

1. Inbound logistics – activities associated with purchasing and receiving from suppliers and storing of raw materials.
2. Operations – activities associated with transforming inputs into the final product.
3. Inbound logistics – activities associated with physically distributing the final products to customers.
4. Marketing and sales – activities associated with providing a method for customers to purchase or inducing potential customers to become customers.
5. Service – activities on providing service to enhance or maintain the value of the product sold or to be sold.

The four support activities are:

1. Procurement – activities associated with purchasing of raw materials or inputs to be used in the value chain.
2. Selling – activities associated with the sale of products or services.
3. Technology development – activities associated with efforts to improve the product or business processes.
4. Human resource management – activities associated with recruiting, hiring, training and compensating all types of personnel.

4.4.3 Building the VCA

A value chain is, however, not merely a linear flow of physical activities. Evans and Wurster (1997) argued that the value chain should include all information flowing within the company and between the company and external parties. Depending on the organisation's size, it is useful to break down each element of the VCA into the core operational processes and assess the customer value that is added by these processes. When followed rigorously, this analysis can be used to identify the cost and revenue generated by each of the VCA processes. At the same time e-business enhancements should be considered, such as the elimination of errors through better communication and collaboration and information-sharing with process stakeholders. With regard to procurement and supply chain management, it is useful to distinguish between different process types such as the identification of new supply sources, the

ordering process, the materials planning process, and the tendering process. There will be a further discussion on building a VCA in section 6.2.2.

4.4.4 Benefits of deploying VCA in e-business planning

The generic VCA, once deployed, can assist managers in identifying key business processes in the company. In addition, a recent article by Porter (2001) on VCA in an e-business environment demonstrates a particular application that is useful for analysing the relationships between the business and its various stakeholder groups from an operational perspective, as can be seen in Figure 4.7. This facilitates the process of identifying e-business applications that can support or enable current or future relationships. By mapping the interfaces to commercial business partners, a firm can make judgments on the nature of existing and future relationships. In the process of identifying focus areas in the VCA, the main stakeholders, who should subsequently be involved in the planning process, will emerge. For the proposed integrated e-business selection framework, VCA is ideal to be used for the generation of business processes within the company that can meet the needs identified by the BSC.

4.5 Fundamentals of quality function deployment

Akao (1972, 1990) developed quality function deployment (QFD) in the late 1960s at Kobe Shipyard, Japan, as a means to motivate engineers to consider quality early in the design process, and to expand and implement the view of quality as taught by Deming and others. From there, QFD developed much further within the Japanese automotive industry. The first reported success story was the "Toyota rust study" in which Toyota reported how in the late 1970s, warranty costs due to rust were practically eliminated (Sullivan, 1986).

Yoji Akao, together with Shigeru Mizuno and other quality experts in Japan, developed the tools and techniques of QFD, and organised them into a comprehensive system to assure a high level of product quality and customer satisfaction in new products and services (Akao, 1990; Mizuno and Akao, 1994). Masao Kogure and Yoji Akao (1983) first introduced QFD to the USA in the article "Quality function deployment and CWQC in Japan" which appeared in Quality Progress in October 1983.

Figure 4.7: E-value chain application

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Source: Porter (2001).

4.5.1 Definitions of QFD

QFD is also a tool to ensure that the "correct" product is being developed. QFD ensures this by incorporating customer needs into the planning process. Also, in the words of Bouchereau and Rowlands (2000: 8), "QFD is a visual connective process that helps teams focus on the needs of customers throughout the total development cycle". In recent years, QFD has also evolved into a management tool to model the dynamics of the design process (Govers, 2001). There are a number of widely reported QFD definitions, including QFD being defined as a philosophy (Akao, 1990), a method (Akao, 1990; Mazur, 1992), a system (Slabey, 1990; Martins and Aspinwall, 2001), a set of planning and communication routines (Hauser and Clausing, 1988), a process (GOAL/QPC, 1989; Bossert, 1991), a cross-functional tool (King, 1989), a systematic planning process (Daetz et al., 1995; GOAL/QPC, 1989), a customer-oriented approach (Govers, 1996), a team-based approach (Miller and Bombino, 1992), a mechanism (Sullivan, 1986) and as the ultimate quality assurance system (Powers and Harter, 1995). More importantly in relation to the research project, QFD is also defined as a technique for identifying the voice of the customer to ensure that this voice is systematically included in the designing of products/services (Akao, 1990; Burn, 1990). A summary of these definitions from Tan and Tang (2002) can be seen as:

- A customer-oriented approach
- A cross-functional tool
- A mechanism
- A method
- A philosophy
- A process
- A set of planning and communication routines
- A system
- A systematic planning process
- A team-based approach
- A technique
- The ultimate quality assurance system

Bergman and Gustafsson (1997) attempted to sum up the definition of QFD as:

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- Customer focus – QFD starts with customer input.
- Cross-function work – QFD allows better decisions to be made since more inputs are received, that is, more information is considered.
- Communication – one of the more significant effects of QFD is improved cross-functional communication. Information is both brought in from all around the organisation and communicated out again via the cross-functional team.
- Teamwork – QFD also means teamwork and benefits from group dynamics. All decisions are made using consensus as the leading key word. This in turn facilitates the organisation to work and achieve what is actually agreed upon.
- Structured way of working – QFD helps to create a suggested list of tasks that should be carried out during the product development process.
- Prioritisation – one of the main reasons for working with QFD. Provides a focus on the available resources where it counts, in terms of improved customer satisfaction.
- Analysis of the system – QFD helps to take a system into account, compared to focusing on the separate items, and exposes the cause-and-effect relationship all the way to production.
- Documentation – The work is documented, which ensures traceability, and helps in speeding up subsequent projects. It also forms a knowledge-base preserving experience from the project.

4.5.2 So, what is QFD?

Almost all of the definitions stated earlier lean towards emphasising QFD's application in the product and manufacturing industries. The one exception is Mazur, who defined QFD for application in service industries. According to Mazur (1993), QFD consists of a system and a set of procedures to aid in the planning and development of services. QFD assures that customer expectations will be met or exceeded. From the above discussion on the definitions of QFD, it is hard to define what QFD really is, since there are many different types of applications, uses of the technique and above all, opinions on what QFD can do. Furthermore, differences in the view of QFD can be traced to different parts of the world.

The differences in culture between the East and West also led to the differences in the applications and appreciations of QFD, with the Japanese focusing on implicit and attractive quality and the American on expressed quality (Govers, 1996, 2001).

The Japanese view of QFD's main purpose is to ensure quality assurance during new product development, while the Western view focuses on QFD during product development or as a translation tool, with Slabey (1990) stating that QFD is a system for translating customer needs into suitable company requirements at each stage from research and product development to engineering and manufacturing to marketing/sales and distribution (Mizuno and Akao, 1994; Nishihara et al, 1995).

QFD may appear to be an inflexible tool that must be used in the same way each time. This is, however, not the case. Professor Akao emphasised the need to be flexible, starting his answers to many questions concerning QFD with "it depends...". Just as the GOAL, also known as the practitioner's approach, considers QFD as a composition of methodological procedures that can be applied separately, QFD can be called a technology developed by users based on common sense and effective information transfer (Govers, 1996). However, as a result of all this reasoning, the question still remains: What is QFD?

According to Hunter and Landingham (1994), all QFD definitions conveyed the power of QFD as a tool or voice of the customer that will drive everything an organisation does, from the development stage through to delivering the products and services. Hence, whatever QFD is viewed as, its purpose is to ensure that customer needs are taken into account in the design and development of new products and services, and that this consideration is made as early as possible during the design phase. In the research project, QFD is defined as a technique that can be employed to serve as a change or improvement agent, through structuring cross-functional planning and communication routine to incorporate customer requirements, when prioritising activities after the analysis of the system.

4.5.3 Why QFD?

Generally, there are four reasons for using the QFD tool for process and system improvement. These are:
- Customer requirements
- Improved communications
- Better integration of customer requirements into service requirements
- Performance measurement

Customer requirements

A tool is needed to address these diverse customer requirements and not lose sight of the external and internal customer needs. Akao (1990) stated that in many of the published cases, the use of QFD has cut the problems of those previously encountered at the beginning stages of product development by half. In addition, development time has reduced by at least one third, while also helping to ensure user satisfaction and increasing sales. However, if applied incorrectly, QFD may increase work without producing these benefits. When new products or services are developed, whether in service or in other industries, it is common to experience numerous start-up problems leading to a series of costly redesigns. These typical start-up problems have made many customers wary of being the first person to buy a new product or use a new service. Figure 4.8 illustrates the relative amount of time and resources spent using a traditional design process versus a QFD design process.

Figure 4.8: Comparison of Traditional and QFD Systems

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Source: King (1989).

According to King (1989), when using a traditional approach, little time is spent defining the customer requirements for the product and consequently, design takes less time. However, there is often a long redesign period after the new product or service is initiated. When using QFD, although substantially more time is spent up front understanding the customer requirements and desires and the relative priorities among them, the complete design process actually takes less time. By carefully meeting the customer requirements, less time is required for redesign after the product or service is initiated. Overall, there is a substantial reduction in the time and cost to achieve an acceptable product or service. In e-business planning, this will mean that although more time may be allocated to identifying and determining both internal and external needs, the overall time and therefore resources, for successful selection of e-business applications to the company will be reduced.

An effective communication tool is essential to the success of any quality initiative. Hence, a communication tool is needed to keep a quality improvement team focused and on track with customers' expectations. While QFD takes the voice of the customer or user all the way through product development to the factory floor and out into the market place, a cross-functional team formed for the purpose of implementing QFD can also help to provide key trade-offs between what customers ask for and what the company can actually produce (Govers, 1996). QFD is, therefore, not just a quality tool, but also an important performance measurement, planning and communication tool for introducing new products and upgrading existing products and, in the case of the research project, during e-business planning.

Better integration of customer requirements into service requirements
The third reason for using QFD is better integration of customer requirements into service/production requirements. QFD works with other techniques to meet customer needs. Existing procedures and processes can continue to service the day-to-day customer needs. Complementarily, QFD can be used to provide focus on customer needs for products that are not competitive.

Day (1993) illustrated the relationships between QFD and other quality and engineering techniques, such as Design for Manufacturing (DFM), Fault Tree Analysis (FTA), Design of Experiment (DOE) and Statistical Process Control (SPC). As Figure 4.9 shows, the input of the QFD process is the voice of the customer. The expected output, then, is the selection of key priority elements that are able to improve customer satisfaction. In other words, QFD translates the voice of the customer into process design. In the case of e-business planning, QFD will be able to ensure that internal and external needs are kept in focus when designing e-business plans, especially when prioritising e-business applications to be applied. The feedback loop as shown in Figure 4.9 illustrates the never-ending quality improvement process. Surveys are normally conducted to obtain feedback and evaluation from the customer.

Figure 4.9: The Relationship Between QFD and Other Quality and Engineering Tools

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Source: Day (1993).

Performance measurement

The final reason for applying QFD is performance measurement. Performance measurement is vital for an organisation that wants to succeed in the competitive market (Adam et al., 1981). Thus, a performance measurement tool is necessary to guide an organisation to assess their ability to create value for their customers. Whilst financial measures are important, they are not sufficient as financial measures can only provide a single, narrow perspective of how an organisation functions. Increasingly, more creative and better financial measures have been devised, such as the Balanced Scorecard (Kaplan and Norton, 1992) which is used to monitor the organisation's performance using four perspectives: financial, customer, internal business processes and learning and growth, and is consistent with the objective of maximisation of shareholder value. However, QFD provides a better understanding of customers' expectations by highlighting unmet customers' expectations and identifies critical processes and new processes to address these expectations.

QFD inherently incorporates and orchestrates many TQM process/techniques for improving operations, further reinforcing the argument why QFD should be implemented for companies, especially those embracing the TQM concept (Weisbrich et. al., 1992). Figure 4.10 shows how QFD is integrated into the TQM concept.

Figure 4.10: QFD Inherently Incorporates and Orchestrates Many TQM Processes/Techniques for Improving Business Operations

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Based on: Weisbrich (1992)

4.5.4 The house of quality

The house of quality (QFD) uses a matrix format to capture a number of issues vital to its planning process. This matrix is called the House of Quality (HOQ). The HOQ is the nerve centre and the engine that drives the entire QFD process. According to Hauser and Clausing (1988), the HOQ is a kind of conceptual map that provides the means for inter-functional planning and communication. Another definition given by Eureka and Ryan (1994) defined the HOQ as a product planning matrix used to depict customer requirements, company measures, target values and competitive product evaluations. An HOQ contains seven different elements as shown in Figure 4.11.

Figure 4.11: The House of Quality

Source: Evans & Lindsay (1996).

Building the HOQ

The six elements in the HOQ are:

1. Customer needs or the "whats"

   According to Hauser and Clausing (1988), the HOQ begins with the customer, whose requirements are called customer attributes or phrases that customers use to describe a product or service characteristic. Other terms for "whats" include voice of customers, customer requirements and demanded quality (Akao, 1990; Day, 1993; Eureka & Ryan, 1994; Hofmeister, 1995; Shillito, 1994).

2. Service elements or the "hows"

   The customer needs are then translated into corresponding "hows". The function of the "hows" is to translate the customer needs into terms measurable by the organisation. It is important that "hows" be objectively measurable and testable. They should not represent technical solutions for customer needs (Hofmeister, 1995). The "hows" are also called substitute characteristics, engineering attributes,

quality characteristics and technical requirements (Akao, 1990; Day, 1993; Hauser and Clausing, 1988; Shillito, 1994).

3. Correlation between the "whats" and the "hows"

   After the customer needs and service elements have been identified, the next step involves filling in the body of the HOQ. This part is called the correlation matrix. The correlation matrix indicates the extent to which the service elements affect the customer needs. Symbols are used to portray the strength of the "whats"/"hows" relationship. If no correlation exists between a particular "what"/"how" pair, its matrix space is left blank. Blank rows or columns indicate places where the translation of customer needs into service elements is deficient. This feature of the HOQ provides an opportunity for valuable cross-checking. A particular service element, which affects no customer need, may indicate that the service element list is redundant or that a customer need is missed. On the other hand, if a particular customer need is unaffected by any service element, this indicates an opportunity to expand services or products.

4. The correlation roof matrix

   This matrix describes the correlation among service elements. The description is given using symbols that represent positive or negative ratings. The correlation matrix can be used to identify which service elements support each other, or which are in conflict. When there is a positive correlation, one service element supports another. On the other hand, when there is a negative correlation, two service elements are in conflict. Positive correlation identifies service elements that are closely related. The roof matrix identifies those elements that are interdepartmental and, thus, shows where co-operation is needed or where duplication of effort should be avoided. Negative correlation represents conditions that will probably require trade-offs. Trade-offs that are not identified and resolved promote a higher likelihood of unfulfilled customer expectations.

5. Ratings and weightings

   Also contained in the HOQ are two rating scales, one for prioritising service elements and the other for prioritising customer needs. A digit between 1 and 5 is placed in the column immediately to the right of each customer need. This reflects the relative importance of the items to the customer. A priority for the customer needs is obtained by multiplying the weights assigned to each matrix symbol that

is, weak, medium or strong, with their relative importance. The priority of service elements is calculated by multiplying the relative importance of each customer need with the sum of weights assigned to each symbol that corresponds to a particular service element. The purpose for prioritising the service elements is to guide the organisation to elements that require close attention. The point is that effort should be concentrated on those critical service elements for quality improvement and customer satisfaction. The definition of "how" is inadequate when any "how" cannot be measured or is non-descriptive.

6. Competitive assessment

   The competitive assessment feature of the HOQ provides an item-by-item comparison between an organisation's products or services and those from its competitors. By assessing the competitive edge, organisations are able to examine their products or service performance. If their products or service performance are low compared to other competitors, organisations should re-evaluate their performance including their perception of customer needs. The competitive assessment can therefore assist in straightening out any inconsistencies between customers and an organisation's perception. Furthermore, it directs the organisation in establishing appropriate strategies for improvement.

In conclusion, one defining feature of the HOQ is that an HOQ can be tailored to individual applications. For example, organisations may choose to include additional elements in their HOQs, including key selling points, goals, improvement ratios, the level of difficulty and targets for service elements.

An alternative to the house of quality

Han et al. (2001) proposed a conceptual QFD planning model that includes a hierarchical framework as in Figure 4.12. There are six stages in the framework and teams are allowed to go back to any previous stages to perform "what-if" analysis. This will help to reduce the risk of wrong conclusions being reached and also helps to focus and prioritise on the most important customer expectations.

Figure 4.12: Six stages of the hierarchical framework

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Figure 4.12: Six stages of the hierarchical framework

Source: Han et al. (2001).

Beyond the basic house of quality

What occurs after construction of the basic HOQ is a series of four phases that extend the HOQ to additional matrices. According to Sullivan (1986), the four phases are:

1. Planning matrix
2. Deployment matrix
3. Process plan and quality control charts
4. Operating instructions

Named differently, Guinta (1993) uses the terms:

1. Design
2. Details (which may be referred to as parts)
3. Process
4. Production

Cohen (1995) on the other hand, as in Figure 4.13, uses the terms:

1. Product planning
2. Design deployment
3. Manufacturing planning
4. Production planning

Figure 4.13: Four Phases Quality Function Deployment Model

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Source: Cohen (1995).

Therefore, the HOQ can be demonstrated as a structured quality communication device. It is design-orientated and serves as a valuable resource for designers. Engineers may also use it as a way to summarise and convert data into information. Marketing benefits from it as it represents the voice of the customer. Upper management, strategic planners and marketing or technical intelligence can use it to pinpoint strategic opportunities. The HOQ serves as a vehicle for dialogue to strengthen vertical and horizontal communications. Issues are addressed that may never have surfaced before. The HOQ, through customer needs and competitive analysis, helps to identify the critical technical components that require change. The critical issues will then be driven through the other matrices to identify the critical parts, manufacturing operations and quality control measures to produce a product that fulfils both customer needs and producer needs within a shorter development cycle time.

4.5.5 The benefits of QFD

Generally, QFD can lead to a wide variety of benefits with the greatest gains from QFD being realised when the "voices" get deployed to the most detailed level of manufacturing operations (Govers, 1996). The results of the 1986 Japan Society for Quality Control (JSQC) survey conducted by Professor Akao and others published details on the status of QFD in Japanese companies. The survey revealed that companies using QFD reported the following benefits:

- Competitive analysis became possible
- Control points clarified
- Decreased start-up problems
- Design intent carried through to manufacturing
- Effective communications between divisions

According to Clausing and Pugh (1991), QFD can increase development efficiency of new product or process design by 50%, while also reducing start-up and engineering costs by 30%. QFD allows experts to tap the "hidden" knowledge of their colleagues since it is bringing knowledge together within the team (Govers, 1996). Such knowledge can be used as well by top management to acquire more insights and make better strategic decisions thus, in Govers' (1996) words, becoming the "real" decision makers. Another benefit of QFD is that it is problem prevention-orientated.

According to Slabey (1990), the major advantage of QFD is that it promotes preventative rather than reactive development of products, causing organisations to move upstream, working at the high leverage end of the quality lever.

The benefits of the QFD process according to King (1989), Lyons and Alexandra (1990), Bersbach and Wahl (1990), Bossert (1991), Lockamy and Khurana (1995), Martins and Aspinwall (2001), Min and Kuei (1995), and Zairi and Youssef (1995) can be summarised as follow:

1. QFD creates organisations that are customer-driven:

   - Defines product or service specifications meeting the customer needs, while paying attention to the competitors
   - Ensures consistency between customer needs and the measurable characteristics of the products or services
   - Prioritises resources and identifies items that can be acted upon

2. QFD helps organisations to reduce implementation time of the new services/products:

   - Avoids future development redundancies
   - Gets things moving quickly because planning takes place at an earlier stage and mistaken interpretations of priorities and objectives are minimised
   - Identifies future application opportunities

3. QFD helps organisations to promote teamwork within their own organisations:

   - Brings people together from various disciplines
   - Facilitates the formation of teams who are capable of meeting customer needs
   - Improvements in teamwork skills
   - Informs and convinces all those responsible in the products or services process about the relationship between the quality of each phases output and the quality of finished products or service

4. QFD encourages organisations to provide good documentation and better communication:

- Encourages documentation of marketing, design, engineering and manufacturing product knowledge in a consistent and objective manner
- Produces a living document that can always adapt to change
- Provides a framework for sensitivity analysis

In summary, the ultimate benefits of QFD are in helping organisations increase their market share and get larger profits. These benefits are possible because QFD plays a major role in creating products or services that meet or exceed customer expectations with reasonable cost and significantly shorter development times. As a result of applying QFD, products or services are intrinsically more appealing to potential customers. In e-business planning, QFD can make sure that e-business applications that are deployed first will be able to meet the most critical internal and external needs. QFD is also in line with process design quality control, the evolution of a third generation techniques and is, therefore, definitely putting an organisation and the customer in a "win-win" situation (Martins and Aspinwall, 2001). To sum up, Bouchereau and Rowlands (2000) said it best by stating that "QFD does nothing that people did not do before, but it replaces inconsistent, intuitive decision-making processes with a structured approach".

4.5.6 The limitations of QFD

As with any techniques, there are limitations with QFD. It is not an easy technique to understand and use. Also, existing working cultures tend to be mainly functionally-inclined and focused on individual contributions, rather than on a team approach to drive activities. QFD however, requires multi-functional teams to drive activities. The HOQ is generated through customer survey and manual inputs of the survey results, but records relating to QFD are rarely kept, meaning a lack of established evaluation systems suited to QFD. Information is needed to track the progress of the QFD project and to provide links between the different QFD phases.

Essentially, the "voice of the customer" in practice contains ambiguity, multiplicity of meaning and is qualitative in nature. Customers also tend to mix their primary needs with their desirable needs. The generation of "whats", the means by which the QFD

process is to ultimately satisfy, may be a very tedious task as there are few models available to assist the managers in providing a balanced view of specific customers needs with those of other stakeholders. These "whats" have to take into account customer needs as well as the organisation's broader strategic objectives and operational capabilities. There is also a need to input large amounts of data and make various decisions, such as determining the optimal trade-off between customer demands and engineering characteristics, hence determining the degree of inter-relationships between them and setting precise target values. Many of these decisions in practice have to be based on subjective evaluation (King, 1987). Govers (1996) further argues that the ability to control the production processes at a level that warrants an award of ISO certification in process orientation is a prerequisite for organisations to successfully implement QFD. Other techniques like the BSC and VCA can potentially be integrated with QFD to minimise these problems.

One of the most difficult areas of the QFD analysis, apart from actually obtaining the customer demands, is objectively correlating these demands against service quality characteristics or business processes. The strengths of the relationships are based on expert opinion. Their opinions on the strengths or directions of improvements may not always be precise. However, one way to overcome this is to obtain opinions from a number of experts and averaging these opinions. Another major drawback of QFD is the need to deal with large amounts of data on a rather personal basis. A machine learning approach, using an artificial neural network, can be used to resolve this problem (Zhang et al., 1996). Additionally, to deal with the vast amount of data, various QFD software can be used, for example, QFD/CAPTURE™ and QFD2000. The mergers of these quality techniques are envisaged to make the QFD process more robust, more quantitatively oriented and to bring together the different stages of the QFD process. It is not within the scope of this study to review how all of these quality techniques can be used to integrate with QFD.

Despite these weaknesses of QFD, QFD is nonetheless a highly effective tool in enabling the incorporation of customer needs into a planning process, prioritising these needs and feasibilities of the business processes in order to facilitate the planning process. QFD is a planning tool and organises data in a logical and systematic way. However, QFD is still a rather qualitative method, therefore it is time that companies should take advantage of any other appropriate techniques and

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incorporate these techniques within the QFD process to realise its full potential. More discussions on these will be provided in section 6.2.

4.6 Chapter summary

This chapter has covered the remaining theories that will be employed in this research project. In this chapter, it has been established that the main aim of a framework is to guide managers towards a method or solution uniquely suitable to a particular situation in question, in as simplified a manner as possible. Frameworks proposed by Lee and Ko (2000) and Lee et al. (2000b) have the potential to be developed into an e-business selection framework. However, the used of SWOT in these proposed frameworks may prove to be difficult during data collection. It was also discussed that QFD can work as a selection tool during e-business planning. The limitations of QFD may be neutralised through combining QFD with other available techniques like the BSC and VCA. Therefore, this Ph.D. project will seek to develop an e-business selection framework for SMEs during e-business planning.

In the next chapter, the author will discuss the research methodology of the Ph.D. project. The chapter will include a section on the underlying paradigms of the research project and discussions on how actual data collection was carried out, along with any reflections on methodology whilst collecting data.

5. Research Methodology

5.1 Chapter introduction

Following from the knowledge gap identified in section 2.5, a framework that can help SMEs in e-business planning will be proposed here with discussions from Chapters 2, 3 and 4 in mind. However, the researcher also has to test the framework in order to evaluate the proposed framework for feasibility and practicality. Therefore, the research methodology to evaluate the selection framework will also be discussed. In this chapter, discussions on the following points will take place to assist the researcher in deciding the research methodology of the research project:

1. The underlying paradigms, both hermeneutic and qualitative, of the research project and its influence in shaping the research questions as well as the research methodology.
2. The question of sampling, if it is more appropriate for a research methodology concentrating on looking for breadth or depth of information gathered.
3. The nature of the research problems, including:
   - Time and monetary constraints to the research project.
   - The exploratory nature of the research.
   - The "how" and "why" research questions.
   - The generalisation of the results.

The underlying paradigms will shape the research methodology of the project and the direction of data gathering. Therefore, there will first be a discussion on how the hermeneutical and qualitative paradigms influenced the shaping of the research methodology and actual data gathering stage of the project. The question of sampling will also be touched on in this chapter, as this again will have a certain degree of impact on the chosen research methodology.

Next, the author will engage in a discussion of the case study methodology, which is deployed as the data gathering strategy for the research project. The discussions will be focused on the reasons for using the case study methodology for the project, considering both the advantages and limitations of such a methodology. The author will then proceed to discuss the guidelines for data gathering, the preparation and the actual methodology engaged in the research project for data collection.

Finally, the author will come to the subject of triangulation and representativeness of the data collected, as well as any ethical concerns that arose during the research project. There will also be a section to discuss the topic of proposed timing during the data gathering stage of the project. The chapter will finally be completed with a chapter summary section.

5.2 Underlying paradigms of the research project

The influence of underlying paradigms cannot be taken lightly in the planning of a research methodology. Depending on the preference of the researcher, it will result in a direct impact on the kind of research questions formed and how the research methodology will be designed. Below is a discussion on how both the philosophical and qualitative paradigm influenced the research questions formed and the design of the research methodology.

5.2.1 The philosophical paradigm: a hermeneutical approach

Hermeneutics was the term first used by Dilthey to "denote the discipline concerned with the investigation and interpretation of human speech, behaviour, institutions as intentional" (Cashmore and Mullan, 1983: 201). In short, hermeneutics is about understanding the dynamics of society and trying to explain or interpret these dynamics. "Phenomenology is the unsurpassable presupposition of hermeneutics", therefore stating that hermeneutics is not a rival philosophy to phenomenology (Ricoeur, 1981: 101). A key argument of hermeneutics is that you cannot study everything the same way; both the natural and human worlds can be studied historically and scientifically, but will typically require different methods of study. Thus, this argument shows that hermeneutics is also a critique of positivism. Hermeneutics, suggesting the interpretative process of communication, is about the investigations of meanings, and hermeneutics research is typically characterised by the following six points (Delanty, 1997: 40):

1. There is a need for interpretation because objectification of human meaning is too complex for mere observation.
2. Facts must be separated from values.
3. Hermeneutics is value-free but ultimately implies relativism.

4. Acceptance of the unity of human nature makes interpretation possible and meaningful.
5. Language is the basic structure of society.
6. It implies an inter-subjective relationship between science and object.

Hermeneutics contains two significant schools. The first school talks about neo-Kantianism, originating from Kant's (1781) "Critique of Pure Reason" and the German historical school of Weber and Freud. The second school, philosophy of language, is more interested in the description and understanding of languages; its philosophers include Heidegeer, Wittgenstein, Hans-Georg Gadamer and Peter Winch.

Another paradigm that influenced the research methodology approach was the qualitative dimension, which will be discussed next.

5.2.2 The qualitative dimension

Qualitative methods are essentially descriptive and inferential in comparison to quantitative ones, which involve a statistical approach to analysing (Gillham, 2000). Qualitative research focuses on looking for evidence to assist the researcher in describing and understanding the subject under study, therefore fitting the requirements of a hermeneutical approach. Qualitative researchers are always asking why, exploring in great depth about the nature and origins of behaviours.

Qualitative research is about participant observation and unstructured, in-depth interviewing. Qualitative research techniques also include life history method, group discussion, case studies, fieldwork and diaries. It is viewed as being predictable based on a prior set of assumptions about the study of social reality (Bryman 1988b). The growing interest in qualitative research is mostly due to the growing disillusionment with results derived from quantitative research, the promotion of self-reflection (e.g. Kuln, 1970) and the diffusion of ideas associated with phenomenology from the 1960s.

In addition, qualitative research is regarded as phenomenological in nature and is naturalistic, inquiries from the inside and is interpretative (Magoon, 1977; Evered and Louis, 1981; Guba and Lincoln, 1982; Smith, 1983). Phenomenology depicts the view that human behaviour is a product of how people interpret their world, and thus tries

to capture this process of interpretation (Bodgan and Taylor, 1975). Its main view is that subject matter in the social sciences is fundamentally different from subject matter in the natural sciences, and that any attempt to understand such reality must be grounded in people's experience of that particular context (Bryman, 1988b).

Qualitative research is being able to understand the world from the perspective of the subject, which, on the other hand, also makes it more difficult to be analysed statistically. There are three types of research roles in qualitative research: total research, research participant and total participant (Gans, 1967). Its relative strengths lie in its ability to change research direction when the researcher discovers something unexpected but interesting to pursue, to understand the social processes better and to reveal coverts, hidden or even illegal activities (Bryman, 1988b).

Gillham (2000: 11) has provided a list of what qualitative methods enable the researcher to do:

- Carrying out investigations where the uses of other methods are not practicable or ethically justifiable.
- Investigating situations prior to formal research due to unfamiliarity of the situations.
- As an exploration of the complex issues on hand that cannot be studied otherwise.
- To understand the case from within.
- To understand the case from the subjects.
- To research into the processes leading to the phenomenon.

Miles and Huberman (1994) suggested the following in qualitative research:

- It is conducted through an intense and/or prolonged contact with a "field" or life situation.
- Researcher's role is to gain a holistic overview of the context under study.
- Researcher attempts to capture data on the perceptions of local actors "from the inside".
- The main task is to explicate the ways of managing day-to-day situations.
- There are many possible interpretations of the material.

- There is little standardised instrumentation used at the outset and most analysis is done with words.

The author will discuss in the next sub-section concerning how these paradigms influenced the research methodology formulated for the research project.

5.2.3 Implications of the paradigms for the chosen research methodology

The paradigms will definitely and directly shape the way the research methodology is to be planned and carried out. As seen from the discussions above, both the hermeneutical and qualitative paradigms were the dominant underlying paradigms of the research project. Therefore, the author had to configure the research methodology in a way that had to satisfy the criteria of both paradigms.

The research project, exploratory in nature, engaged the hermeneutics paradigm as the dominant underlying philosophy. The research project tried to seek detailed descriptions and understanding on how internal and external needs, as well as on how the ability and capability of the business processes in satisfying the identified needs, can directly affect the implementation of e-business initiatives. From this information, the researcher sought to formulate an e-business selection framework that can be implemented by SME managers, through the adaptation of the original QFD matrix model.

The qualitative paradigm on the other hand, drove the research methodology towards looking at meanings, rather than merely looking at statistical calculations. The qualitative paradigm is complementary to the hermeneutical paradigm, as can be seen from the discussions above in section 5.2.1, and further supported the hermeneutical approach of seeking detailed descriptions and understanding on both external and internal needs along with business processes, thus defining how this information can be used in a step-by-step methodology to e-business planning.

Therefore, from adopting Miles and Huberman (1994), the research methodology of the research project focused qualitatively on:

- Gathering of information through documentation and records
- Observations

- Semi-structured interviews
- Survey forms

The gathering of information through documentation and records allowed the researcher to gather sufficient understanding of the nature of the business. After this, the researcher ventured into the company for further data collection through observations and semi-structured interviews. Further discussions on gathering information through documentation and records can be seen in section 5.7.1.

Observations and semi-structured interviews carried out during data collection allowed the researcher to answer the identified research questions. Through the observations, the researcher was able to describe and understand. While it can be argued that observations give a feeling that positivism may have a certain influence on the research project, one must remember that the main objective at this stage of the research was not to merely describe. More importantly, the researcher was seeking to understand the key business processes being carried out in the company and thus could be sufficiently competent in interpreting these and enabling the researcher to fit this information into the e-business selection framework. The researcher had to interpret this information because these processes may be too complex for mere observations.

Semi-structured interviews are, on the other hand, widely recognised as a technique in seeking to further understand the complications of the dynamic world, which in this instance were the business processes. The thoughts of the managers were interpreted, and again integrated into the framework. Observations before interviews had made it easier for the researcher to establish the facts and separate them from values, be it from the subject or object. Through the interviews, the researcher identified the factors and key business processes through the language used by the interviewees. A ranking questionnaire survey was also administered. This enabled the subjects to assist in establishing the relative importance of the factors inputted into the framework.

Therefore, it can be seen that the main purpose of this research project was to collect the information required and try to fit this information into the selection framework to evaluate the framework, so as to allow the framework to be more robust for actual practical use in an SME. Moreover, the process of applying QFD in developing the

framework allowed the researcher to understand the business processes, and its impact on and from both the external and internal business needs, which is instrumental to formulating an effective framework. Further discussions on the research methodology techniques employed in the research project can be seen in section 5.7.

Next, the author will look at how the question of sampling helped to further define the research methodology of the research project.

5.3 Nature of research problems

Different research problems require different methods. Research methods for the Ph.D. project utilised the concept of "pick and mix", rather than an approach that is expected to be able to suit all. One should always mix methods to some extent to provide more perspectives on the research investigations (Bryman, 1988a, 1988b). A researcher has to decide what kind of information is required to help investigate the answers to the research questions and the way that this information can be best collected. Therefore, it is not a question of simply whether the research methodology is going to be quantitative or qualitative, but whether the techniques or combinations of techniques that can be deployed.

A number of points that can have influence over the nature of the research problem include:

1. Are there any constraints to the research, e.g. time?

   The time constraint for the research project: the project should ideally be completed within a three-year timeframe. The other main constraint was monetary budgeting. Another constraint that normally exists for research projects is the extent of access granted to the companies, which has to be defined after access has been negotiated and agreed on. Since the nature of this research project required an in-depth study within the company, the researcher when planning proposed research timing, needed to take into account information and timing provided by the company.

2. The nature of the research?

The nature of the research was exploratory, as the researcher was to develop an e-business selection framework for SMEs using existing techniques.

3. What are the key research questions we have?

The research questions were generally "how" and "why" questions, as can be seen below:

a) Why is the implementation of e-business beneficial for SMEs?
b) How can we formulate structured e-business planning for SME managers?
c) How can we create a selection framework to work as part of an e-business strategy for SMEs in the printing industry?
d) How can e-business plans be prioritised while including both internal and external factors in the planning process?
e) How can we use QFD to transform customer needs and demands into e-business plans for SMEs in the printing industry?
f) How can we integrate BSC, VCA and QFD to enhance the effectiveness and efficiency in e-business planning for SMEs in the printing industry?

These questions are asked in order to research the answers to the objectives of the research as mentioned earlier in section 1.1.

4. How can we generalise the results?

The results should be generalised to the extent of SMEs in the printing industry having similar contexts to the case study companies.

5.3.1 The question of sampling: longitudinal or cross-sectional

The question of sampling is another critical item on the checklist in the selection of research methodology. A key decision made for the research methodology was on the sampling technique to be employed, either longitudinal or cross-sectional.

While longitudinal case study research will allow the researcher to observe any sequential events that may happen over a period of time, there will also be a problem with data collection, as respondents may not exactly recall certain important events that can be crucial to the study (Voss et al., 2002).

Longitudinal studies are also more suited to establishing and examining time-dependent relationships, for example Samson and Terziovski's (1999) study to understand time-lag effects between TQM elements and performance, or Stuart and Mueller's (1994) research on the links between supplier partnerships and plant productivity. However, the focus of the research project was not to establish any time-lag effects between variables, but on how variables can be established and deployed in a structured e-business selection framework, therefore effectively looking more at contemporary issues.

In addition, due to the time constraint of the research course, doing the study in a cross-sectional way was definitely more feasible than a longitudinal approach. Besides, a full time-series data may be too time-consuming, a major negative factor in this approach. Seeking access to companies for longitudinal studies will also be more difficult than seeking access for cross-sectional studies (Voss et al., 2002).

By executing a cross-sectional research, the author tried to determine the factors facing the companies in a contemporary event, therefore allowing the selection framework to be evaluated for feasibility and practicality. Furthermore, the objectives of the research looking at contemporary issues were more suitably achieved with a cross-sectional study.

5.3.2 Sample size

The next question was that of the sample size. With the limited resources available for the research project, the sample size was a constraint. However, the fewer the case studies, the greater the opportunity for deeper and more meaningful findings (Voss et al., 2002). Literature recommending the use of case studies also rarely determines the exact number of cases required to allow findings to be declared valid and reliable.

"There are no rules" for sample size in qualitative research (Patton, 1990: 181). The decision of sample size is left to the researcher (Romano, 1989; Patton, 1990). This is further supported by successful experience from Stuart et al. (2002) with one to three sample sizes, although they fully supported Eisenhardt's (1989) basic guide of four to ten samples. Moreover, the research project was not looking at seeking an

average effect or aimed at being representative, but rather exemplary and, therefore, did not require a large number of samples.

The project was to formulate a framework that can help senior executives with e-business planning, which meant that an in-depth study was required to investigate the factors that may affect e-planning. The research project also served as a feasibility study to establish the practicality and suitability of the e-business selection framework to assist managers during e-business planning. It was not the aim of the project to produce a result that could be generalised universally. Indeed, it was only concerned with generalising the result to SMEs in a similar context. The context chosen for this particular study, as discussed above in section 5.3, is the printing industry.

Generating a random list of SMEs in the printing industry may be easy, but trying to negotiate access to the companies can be very difficult. Moreover, due to time constraints, the researcher was not able to allocate too much time in trying to gain access to a randomly selected SME. The researcher was prepared to take on board a company as long as it qualified as an SME in the printing industry. The researcher also had to take into consideration the companies' potential to contribute to the research objectives, rather than be over-immersed with randomness (Stuart et al., 2002). The SMEs selected for the research project are situated in different areas, with two companies in China and two companies in Singapore. The four case study companies are of diverse sizes. Each of the companies provides a wide variety of products to a large customer base. This allowed the researcher to generate a more comprehensive list of factors from the case study companies, as well as providing a wider perspective on the needs of the companies and their stakeholders.

5.4 Case study methodology

Case studies can be used to investigate an individual or a group, in single or multiple cases, for evidence or a range of different evidences to answer specific research questions (Gillham, 2000). Case studies can be used as a research methodology (Easton, 1994; Parkhe, 1993; Tsoukas, 1989; Yin, 1993, 1994). The case study is a research strategy which normally contains research questions beginning with "how" and "why". See Table 5.1 below for a summary of the various type of situations for the different research strategies.

Employing a case study methodology enabled the research to focus on a contemporary phenomenon, taking into account the context in which it was located, without having much control over the setting. While employing case study strategy in research methodology, the boundary between the phenomenon and context is blurred, with several techniques of data collection being deployed (Yin, 1994). Voss et al. (2002, pg. 195) stated that case studies are not restrained by any inflexible limits typical of other research methods, therefore encouraging new and creative insights, the development of new theory, and having high validity with practitioners. Hakim (1987) and Gillham (2000) also considered case study methodology as the most flexible form of research design, allowing different techniques of data collection to offer the possibility of a more elaborate study with a more global perspective. Eisenhardt (1989) further stated that case study is a research strategy focusing on understanding the dynamics present within single settings and can employ an embedded design, containing multiple levels of analysis in a single case. Case studies can therefore combine data collection methods such as archives, interviews, questionnaires and observations.

Table 5.1: Situations for different research strategies

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Source: Yin (1994).

The "how" and "why" questions are explanatory in nature, concerned with identifying and understanding the functioning of the process or processes within a phenomenon. However, "how" and "why" questions can also be deployed in exploratory studies, as was the case of this research project, since the author was trying to develop and to evaluate the selection framework. Case studies can thus be used to accomplish various aims including providing description, testing or generating theory, either explanatory or exploratory (Eisenhardt, 1989; Yin, 1994). Examples of employing case studies for the testing of theories and frameworks include the recent works of

De Toni and Nassimbeni (2001), Ainscough et al. (2003), Phan (2003) and Sarker and Lee (2003).

This Ph.D. project is anticipated to form part of a larger area of study and so it is exploratory in nature, with the bulk of questions being "how" questions seeking to understand and supported by a hermeneutics philosophical paradigm. The use of a case study can be further justified as can be seen from Table 5.1, which shows that a study with "how" and "why" questions will be more suited to case study research methodology. As stated by numerous authors, including Yin (1994), case study strategy does not require the researcher to have control over behavioural events, while focusing on contemporary events. This is precisely what the research project was about, the understanding of how e-business planning can be carried out systematically, while taking into account the company's internal and strategic needs, as well as external customers' needs.

Eisenhardt (1989) and Yin (1994) also stressed that case studies can involve only qualitative data, only quantitative data, or both. Mintzberg (1979) described the use of both types of data as synergistic, with quantitative data used to establish the relationships and qualitative data to "uncover relationships" achieved from quantitative data. Therefore, the mixture of both qualitative and quantitative data, to be collected for the research project, is ultimately supported by the fundamentals of the case study methodology. More discussions on data collection can be seen below in section 5.7.

Another good reason for using a case study methodology for this particular research project was the potential complex nature of the proposed framework. The framework will be built on QFD, the BSC and VCA, each having their preferred method of data collection, which will be further discussed in section 6.2 below. Therefore, a research methodology is required to enable the integration of these "preferred" methods of data collection.

Most authors on methodology have suggested that steps in research processes may be carried out sequentially or even in parallel. A common pattern emerges as these authors, including Eisenhardt (1989), Miles and Huberman (1994) and Yin (1994), suggested the following elements below in a case study, which can also be seen in Figure 5.1:

- Case study design
- Preparation for data collection
- Conducting case studies
- Analysing data
- Reporting

Figure 5.1: Case study method

Aston University

Illustration removed for copyright restrictions

Source: Yin (1994)

Below, we will further discuss the guidelines engaged in the preparation for data collection, followed by techniques to be employed in data collection. Before that, the limitations of the case study methodology for the research project will be discussed.

5.4.1 Limitations

Case study research strategy does have its own limitations and group of critics. The first and foremost will be the issue of bias. Case study research is being forcefully criticised for being influenced by the researcher's bias during analysis of results and findings. However, every other methodology has exactly the same problem, whether it is questionnaires or historical research. Yin (1994) clearly stated that no other research strategies are free of the risk of bias. However, the validity of the data collected can be further increased through the multiple techniques of data collection in a case study (Voss et al., 2002).

Secondly, case studies are often suggested as not having sufficient basis for generalisation. This argument however does not take into account that case study research intends to improve on theories through generalising to theoretical propositions and not to universes (Yin, 1994). Voss et al. (2002) also stated that multiple cases in the study can help to reduce the danger of overstating any results produced, as these data and results can be compared.

Thirdly, case study research will take a long time and often generate too much data, making it difficult to analyse, especially within a specific timeframe as allowed for a Ph.D. project. This argument must have resulted from confusion with ethnographies and participant-observation studies, thus requiring the research to be stationed for long periods on-site for detailed observable evidence. Yin (1994), however, stated that case studies do not depend on these techniques of data collection. The flexibility of case study is to allow multiple data collection techniques to be integrated (Hakim, 1987; Eisenhardt, 1989; Yin, 1994; Gillham, 2000; Voss et al., 2002).

5.4.2 Case study for the research project

It is important to discuss the meaning of case studies to the research project at this stage as the case study approach will be used in the project. The definition of case study research by Gubrium (1988) and Stuart et al. (2002) corresponded with the definition of case study for the research project, stating that case study research represents the intersection of theory, structures and events by attempting to fit theoretical methodology with reality. The need of the research project to contribute to knowledge lies not only with employing proven techniques in new environments, but also in testing and evaluating if the new selection framework can be deployed in the real world amidst the dynamism of reality.

The meaning of case study in essence to this research project was to identify and allow detailed understanding of the variables that influence e-business planning among SME managers. Data collection was carried out through a wide variety of techniques including documentation, observations, semi-structured interviews and questionnaires. Through the manipulation of these variables in the selection framework, the viability of the selection framework in e-business planning can be evaluated, thereby establishing the feasibility and practicality of deploying the

selection framework to assist SME managers with a structured, step-by-step approach in e-business planning.

5.5 Guidelines to data collection

The guidelines adopted for fieldwork in the research project were from the set of guidelines by Stake (1995) for doing field-observation case study. The six main steps taken during fieldwork were as follows:

1. Forming research questions
2. First visit
3. Further preparation for collection
4. Further development of conceptualisation
5. Gathering of data
6. Validating data

5.5.1 Forming initial research questions

The forming of research questions is the key to start the research methodology process (Stake, 1995; Yin, 1994; Stuart et al., 2002). Once the questions are formed, the underlying paradigms to embrace, the kind of data needed to answer the questions, and the data collection methodology to engage in order to collect the required data can be decided.

In the context of this research project, the first step to the formation of research questions was undertaking literature reviews within the interest area. From the literature reviews, the researcher established the missing gaps within the knowledge areas. Taking that into account, research questions were formed so as to allow the research to look and provide the answers to fill these missing gaps in knowledge. The key research questions were shown above in section 5.3.

At this stage, the researcher started to define the boundaries of the research project and anticipate any problems that might arise, or in the words of some researchers, to provide a focus for the research (Stake 1995; Yin, 1994; Stuart et al., 2002). Further discussions on the boundaries of research can be seen in section 5.8.1 on reliability and validity.

5.5.2 First visit

The second step to fieldwork study was the granting of preliminary access to the company. This meeting provided the researcher with a chance to further assess the potential of the companies as case study subjects for the research project. One important condition of selection was the availability of similar resources across the chosen companies, in order to further justify the issue of validity if evidences provided are similar in nature (Stuart et al., 2002).

In order to successfully obtain access to targeted companies for research purposes, it is vital to convince the gatekeepers, who can be the managing director or a senior manager, prior to the first visit. In one instance of the research project, the secretary to the gatekeeper became the "real" gatekeeper with her authority to screen calls and schedule meetings. While first contact with the companies is often done through an introductory call or mail, in the case study companies which were researched in the project, approaches to secure access were carried out in an entirely different manner. In all four cases, the researcher was introduced to the gatekeepers either through friends or relatives. It is important however, that these friends and relatives should be a close friend of the gatekeepers or hold a position with a certain authority and power to influence these gatekeepers, which can include holding office in a governmental ministry or statutory board.

There is also a stark contrast in the way the researcher was introduced to the gatekeepers in the case study companies. In Singapore, the researcher was introduced in both instances through telecommunication without face-to-face introductions, and discussions were focused instantly on the research agenda. After this, the researcher carried out the research in accordance with the timings agreed with the gatekeepers. However, in China, the researcher was introduced in both instances during dinner and it should be kept in mind that a lot of drinking and socialising were involved. The research agenda was not discussed but a new meeting was scheduled for that purpose. In Singapore, the gatekeepers in both cases assigned a manager to be the contact for the researcher throughout the period of the study. Gatekeepers in China, on the other hand, remained as the point of contact between the researcher and the company during the research period.

The first visits also allowed the researcher to experience first hand, in terms of direct costs and time expected to be expended if a particular company was to be chosen for case study purposes. Nonetheless, it was meaningless to conduct an initial visit to certain companies; for example when the researcher was in the UK, it would be meaningless to conduct a first visit to assess the potential and suitability of companies in Singapore, unless of course the researcher was going to Singapore anyway, perhaps for a conference. Therefore, the author felt that other methods of assessing companies could include discussions through emails, phone calls or through video conferencing with senior managers of targeted companies. It was helpful to the research project that discussions at this stage included an agreement for access, the extent of access, the length of access, and any costs and benefits that may arise from the research project to the companies (Stake, 1995).

For the project, a few initial visits were made to a number of companies, as well as initial assessments through discussions with senior managers using emails, phone calls and video conferencing. This enabled the discussion of the project with the potential host, as well as the definition of the assistance required from the company and its employees.

During the discussions and visits, the level of access required was stated and the managers were allowed to defer access decisions until after discussion with management or with fellow managers. Depending on the size and complexity of the business processes within the company, the access length required to the premises from a company of staff strength 250 was typically 30 working days. Materials and information access were as follows:

- Access to documentation on company mission, aims and objectives.
- Access to documentation detailing business processes and their flows.
- Access to any customer feedback and complaints that the company was willing to divulge.
- Access to managers and staff short-listed for interviews.
- Access to shop-floors and offices for observations.

The potential benefits to companies were highlighted during discussions to further entice the companies' interest to be involved in the research project. The potential benefits highlighted were as follows:

- Provision of consultation on how the company objectives can help to meet customer needs.
- To assist the company in kick-starting its e-business initiatives.
- The provision of a customised selection framework within the company's context for the company's senior managers, in addition to free training to allow any future revisions required on the framework in order to keep it up-to-date.
- To allow the transformation of customer needs into e-business plans with a structured process, while taking into account both internal and external factors.

After this round of first visits, ten companies qualified to be involved as a case study company for the research project. However, only four companies agreed to be part of the case study and to provide the level of access required by the researcher.

5.5.3 Further preparation for data collection

Preparation for data collection was finalised at this stage. This included looking at the planning of detailed research agenda for application in data collection, from recording systems to confirmation of interviewees (Stake, 1995). An additional preparation for the project was to finalise the main questions to be used during the semi-structured interview sessions. The prompting questions for each of the main questions were also finalised at this stage, although the researcher had to be flexible to determine if these prompts were suitable in any of the interview situations.

5.5.4 Further development of conceptualisation

Before actual data collection started, the researcher needed to further develop any theoretical concepts that would provide a guide to data gathering (Stake, 1995). Thus in the research project, two pilot case studies were employed to further fine-tune the feasibility and practicality of the selection framework. The results of the pilot case studies were discussed in Tan and Tang (2002), Tan et al. (2003) and in section 5.6.1 below.

5.5.5 Gathering the data

Actual data gathering commenced at this stage. Detailed discussion can be seen below in the data collection section in section 5.7.

5.5.6 Validating the data

A researcher should always ensure that data collected are satisfactorily triangulated with the key findings validated. Further detailed discussions on this stage can be seen below in section 5.8.1.

5.6 Preparation for data collection

In this stage, access timings to the companies were decided by both sides, although the researcher must bear in mind that he needed the companies' assistance more than the other way round. Therefore, the researcher must make sure that the company had the opportunity to co-arrange any timing they preferred (Wengraf, 2001). For that reason, the timings for access in the research project were only confirmed after weeks of negotiations between the researcher and the companies involved. Also, due to the high expenses incurred in travelling, as well as to be time-effective, the case studies in China and Singapore were scheduled as closely to each other as possible, allowing the researcher to complete the data gathering smoothly with minimal resources.

A researcher must always be prepared before carrying out data collection. This will help to create a professional impression and generate better responses and co-operation during fieldwork (Dunne, 1995). A researcher should therefore be proficient in the subject area that he is to collect the data on. The main questions of the semi-structured interviews need to be determined beforehand. A typical one-hour session will require between ten to fifteen questions, though not restricted to just these questions as more sub-questions which may arise during the interview can be asked. During data collection in the companies, this helped to encourage the general flow of information from the interviewees. The questions were written down once they were framed so as to allow easy referencing during the interviews. It is best to start a question "who", "what", "when", "where", "why" or "how" to encourage interviewees to talk.

The structure for each of the interviews for this project was as follows:

1. Introduction of interviewer and purpose of the interview.
2. Brief outline of the areas to be discussed.

3. Run through of the main questions, using prompting questions whenever required.

4. Seeking feedback from interviewees on the interview itself and also confirmation of data collected.

The list of key questions used in the interviews can be seen in a discussion below in section 5.7.3.

5.6.1 Pilot studies of the proposed framework

Pilot studies helped to ensure that the selection framework did not contain any glaring fundamental problems before actual data collection was to be carried out. Two sets of pilot studies were carried out for this research project.

The first set of pilot studies was done by utilising a data set from a comprehensive published case study on Marshall Industries, US (Olofson, 1999). The last thing the researcher wanted was to find the selection framework totally irrelevant and unusable during e-business planning when carrying out actual fieldwork study. Therefore, the main purpose of this study was to pilot-test the framework with readily available data before actual fieldwork, which by that time would have already required much time and money to be invested. Going through this study also allowed the researcher to acquire a deeper understanding of the selection framework as well as familiarising himself with the kind of data that was required to be collected during fieldwork, to effectively test the feasibility and practicality of the framework. The framework was also further fine-tuned during this pilot study process (Tan and Tang, 2002).

Using data gathered from the case, the first pilot was carried out on the selection framework with the assistance of nine invited candidates doing their MBA degrees in Aston Business School, who were divided into three groups of three. They were provided with the case study and asked to identify any additional "whats" that might be relevant. The candidates were then asked to rank the "whats" according to the ones which they felt are the most important with the highest points, and the lowest points to the ones which they felt are the least important needs.

The second pilot study was carried out using a data set gathered from the initial visit to the company, Guangzhou United Offset Printing Co. Ltd. (United Printing) by the

researcher. The exercise was carried out together with the assistance of a senior manager from the printing industry. The purpose of the second pilot study also served as a prelude to the researcher prior to actual data collection in the case study companies.

5.7 Data collection

Data collection of the research project was a qualitative research focusing on:

- Gathering of information through documentation and records
- Observations
- Semi-structured interviews
- Survey forms

The survey form as listed above was a quantitative survey, in order to request that respondents ranked the "what" factors according to their own perceptions of importance, and also the strengths of the inter-relationships between the "what" and "how" factors. This allowed the combination of both qualitative and quantitative methods to obtain a highly synergistic result (Mintzberg, 1979). This combination of methodologies also formed the basis of triangulation for the research (Jick, 1979; Miles and Huberman, 1994). Further discussions on the four listed techniques of data collection can be seen below.

5.7.1 Gathering of information through documentation and records

Analyses of documents and records help to examine the validity of information obtained by other methods and can also provide further information on issues that the researcher is interested in gathering (Bryman, 1989). For the research project, information from documentation was used to form the basis of understanding the background of the case study companies, the roles of the senior personnel and the workflows within the company. This information also provided further evidence to other data collected through interviews and observations. The main advantage of gathering information through documents was the fact that these documents were likely to contain little or no reactivity, especially if these documents were prepared for a different purpose other than research (Bailey, 1982). Therefore, it was unlikely for the authors of these documents to anticipate their writings being studied, thus

causing the authors to have felt unnatural, self-conscious or bothered by the study. This in turn allowed the personnel in the company to be more co-operative and supportive during fieldwork.

However, as the documents were not produced for research purposes, the documents had to be interpreted. It was therefore difficult to provide a basis for comparison, as these documents were not of a standard format. Besides, these documents did not usually provide a full report of the subject to the researcher who might or might not possess prior knowledge of the issues. Seeking access to documents can also be tedious, as the subjects may have felt insecure about such studies (Bailey, 1982). Luckily, this was not the case in any of the four case study companies. Thus, as Yin (1994) stated, researchers must not see documents and records as a pure account of facts that have happened.

In the context of this research project, the relevance of documents was based on the fact that this information was used to confirm and as an add-on to the evidence gathered from other sources. Also, data collected through documentation enabled the researcher to probe further into any information that contradicted, rather than confirmed the issues as expected. Inferences were also gathered from documents which at a later stage served as suggestions for further investigation. All these factors were important in the research project since the project was to create a framework that was to be as robust as possible, and as close as possible to the reality of the practical world. Documents read during the researcher's stay in the companies typically included journals, reports, memoranda, statements, news, letters, policy statements and guidelines. The main source of data for the VCA was also by the gathering of information through documentation and records.

5.7.2 Observation

Observation is a methodology consisting of watching what people do, listening to what they say and sometimes, asking them to clarify certain issues. The benefits of engaging in observation include looking at what people actually do, instead of what they said they are doing or what and how they should be doing it (Stake, 1995; Gillham, 2000). Through observations, the researcher was able to investigate the flow of the processes and how these processes are linked to each other in the case

study companies. Observations during data collection for the project enabled the researcher to identify questions for the semi-structured interviews.

However, there are also limitations to this approach including the possibilities of hidden processes behind the execution and that participants might be play-acting and going through the motions that they thought the researcher wanted to see, and not exactly what they would have been doing when not being observed. For example, the printing engineers could have tried to align the cartridges according to specifications in the operating manual, as opposed to aligning the cartridges just once if the engineers were actually proficient enough, or that they might have actually been required to further align the cartridges a few more times to satisfy certain criteria for printing to commence. Observation can however, be extremely time-consuming, as well as the question of observer effect on both the observed and the data collected.

The main disadvantages of observations were limited in the research project, as observation was used mainly as an initial phase and as part of a multi-method approach. Observations during fieldwork were used mainly to triangulate findings from documentation data gathering and semi-structured interviews, thus achieving "the notion of convergence" (Gillham, 2000: 49).

The researcher at this stage of the fieldwork took up the role of a complete observer with no social interaction with the subjects. This helped to minimise any potential obtrusiveness to the normal functions of the subjects, as this stage was necessary to focus on determining what the subjects did and how they carried out their roles. In short, this stage sought to clarify if the business processes were carried out as documented, and also compared to the information that was disclosed to the researcher during the semi-structured interviews.

5.7.3 Semi-structured interviews

There are many kinds of interviews, ranging from fully unstructured to fully structured, as can be seen in Table 5.2 below (Gillham, 2000). The type of interview to be administered has to be fully dependent on the needs of the research project and the preference of the researcher. In the case of the research project, it was decided that semi-structured interviews were the most appropriate. Semi-structured interviews,

consisting of open and closed questions, are also known to be able to assist in clarifying perceptions with the subjects (Stake, 1995).

Table 5.2: The verbal data dimension

Illustration removed for copyright restrictions

Source: Gillham (2000).

Semi-structured interviews are interviews designed with a number of sufficiently open-ended questions in advance, while subsequent follow-up questions are not supposed to be planned but improvised impromptu (Wengraf, 2001). Gillham (2000: 65) also stated that semi-structured interviews are highly flexible and regarded as "the most important form of interviewing in case study research". A semi-structured interview method aims to gradually reconstruct the interviewee's subjective views and also as a method to seek validation of previous interviews, as well as critical re-examination of competing alternatives. Thus, the researcher reconstructed the interviewees' view on how the company actually functions, the external and internal needs of the company and why e-business and its applications would be important to the company.

However, letting the subjects have a free rein may result in the interview straying away from its main theme. Therefore, during data collection in the companies, it was important for the researcher to compile a list of general questions with prompts well thought out in advance, to guide and keep the topics being discussed on the right track. The use of this technique also has counter-arguments from some researchers as it has a potential to create bias in the data collection process. However, as stated by Bryman (1988a, 1988b), all research will ultimately contain a certain degree of subjectivity from the researcher, on what they are looking for; and from the participants, on what they want the researcher to know.

Getting the right information required for the research from an interview session is not always an easy task (Stake, 1995). During a semi-structured interview, it is, however, highly possible that the interviewee had already set aside the time to meet up with the researcher, in respect to answering the questions the researcher may

have (Dunne, 1995). Therefore, it is most likely that the researcher will be able to gather more relevant information when compared to telephone interviews or ethnographical interviews, where interviewees can be easily distracted by other matters on their minds. Also, it is generally easier to build up rapport with the interviewees, which can help the researcher to gain trust from the interviewees. However, the researcher should also bear in mind that urgent matters can arise to distract the interviewee as happened during an interview with the operations manager of a Chinese company. The interview had to be suspended due to machine breakdown and the manager had to be present to supervise the repair work being carried out. The backup plan for such occurrences was to set aside sufficient time for contingency planning. Timing will be further discussed in section 5.12.

Another main limitation of semi-structured interviews is the high cost of travelling and time needed to travel to conduct the interviews (Dunne, 1995). This was especially true as the case study companies for the research project were in China and Singapore. This limitation was nevertheless neutralised to a certain extent, since the researcher visited the site no more than five times in a period of less than 30 working days. Also, visits to the companies were scheduled within as close to each other as possible to minimise travel between the UK where the researcher was based, China and Singapore.

In the case of the research project, a minimum of six to a maximum of fourteen candidates were chosen from each of the SMEs to be interviewed. These candidates included personnel both internal and external to the case study companies. The breakdown of the interviewees can be seen in Table 5.3. One of the candidates from senior management was either the managing director or the general manager, while middle management candidates included the finance manager, marketing manager, operations manager and human resources manager. The others each represented a function of the organisation that coincides with the four levels of analysis in the BSC. The reason for a minimum of 6 candidates was that some SMEs were not necessarily big and complex enough to have individual managers in the key functions. Conversely, these SMEs might have managers with multiple portfolios, thus it was not surprising to find a manager concurrently holding the finance and human resources portfolio during the research project.

The managing director and/or general manager assisted in providing an overview of current and future business strategies. The selection of the middle managers was in accordance with the four levels of analysis required in the BSC, which were finance, customers, internal processes and training and development. The four managers chosen were engaged in functions that coincided with these levels of analysis as part of their work roles in the company. The rest of the interviewees represented the departments of the company coinciding with the four levels of analysis in BSC.

Table 5.3: Breakdown of interviewees

Level	Positions	Candidates
One	Senior Management	1 to 2 persons
Two	Middle Management	2 to 4 persons
Three	Others	2 to 4 persons
Four	Key Customers	1 to 4 persons

The purpose of interviewing the key customers was to determine if the factors ("whats") the researcher had identified were relevant from their aspect. This was to ensure that the selection framework for e-business took into account the list of needs that were further confirmed by the key stakeholders. Key customer representatives were asked to give their rankings on the importance of the "needs", as their views might not be the same as those of the interviewed managers or staff from the SMEs.

The interviewer should possess a strong advance plan in order to push the data gathering process and it was therefore especially important to ask the right questions (Stake, 1995). The list of main questions that was used in providing a guide to the semi-structured interview process can be found in Table 5.4.

5.7.4 Use of tape recorders to record interviews

During an interview, there must always be a means for recording information efficiently and effectively (Dunne, 1995). It may be a slow activity but nonetheless, an important activity in order to obtain agreement that the story was accurately and completely presented (Leonard-Barton, 1990). Unfortunately, the writing hand is always slower than the speed of speech. Although there is a long list of methods that can be deployed to serve the function of recording information during an interview, including notepad and pen, memory and using a tape recorder, not a single method is one-hundred-percent foolproof. Gillham (2000), however, strongly recommended

the use of tape recording. The tape recording method was also used during fieldwork due to the following advantages:

- To allow the researcher to make comparisons between interviews
- To assist the researcher in observing his own evaluations brought personally into the site, which can be both distorting or cause bias (Beney and Hughes, 1970)
- To dispense with the need for the researcher to take notes, thus allowing more focus of attention on the interviews (Schwartz and Jacobs, 1979)
- As a means of making an accurate account of the interviews (Yin, 1994)

Table 5.4: List of main questions for the semi-structured interview

Questions for stage 1		Reasons for questions
1.	Can you tell me about yourself and your roles in the company?	Helping the interviewee to relax and to settle in.
2.	What can you tell me about the company?	Step 1: BSC
a	What are the company mission and aims?	Aim and missions of the company.
b	Does the company have any objectives to achieve this mission and aims you have told me? In terms of financial, customer, internal business processes, innovation and growth.	Main objectives as of each analysis level of the BSC.
c	How can the company be able to confirm that the objectives have been met?	Measurements used to measure performance.
d	How about the company's strengths and weaknesses, and any opportunities and threats the company is facing at the moment?	To triangulate and add on to information collected.
e	Do you have any other information which you can tell me about the company mission, aims, objectives and performance measurement techniques currently in use?	To round up stage 1.
Questions for stage 2		**Questions for**
1.	What can you tell me about the main business processes or procedure in the company?	Step 2: VCA
a	Can you tell me more about logistical business processes of the company? Inbound and outbound.	Logistics
b	How about the operational business processes?	Operations
c	Marketing and Sales?	Marketing and Sales
d	Services?	Services
e	Tell me more about the supporting business processes in the company.	Supporting functions
2.	Can you tell me how do you go about fulfilling your roles?	To determine how the process is being carried out.
Questions for stage 3		**Questions for**
1.	Have you heard about e-business? Can you tell me more about e-business?	Step 6: e-Business applications

| 2. | What can you tell me about e-business applications? For logistics, operations, marketing and sales, services and supporting functions of the company. | e-Business applications for each of the functions. |

However, since the tape recording technique is not foolproof, the researcher had to note the following limitations during fieldwork:

- Causing bias in interviewees' answers due to the possibility of feeling intimidate
- The interviewer may pay less attention and focus to the interview, knowing that he has a reliable source of data recording to evaluate the interviews again at a later time
- The possibility of acquiring too much information that may be useless, making sorting more difficult than it should be (Schwartz and Jacobs, 1979)
- The researcher may find it difficult to grasp the exact meanings of certain words mentioned that may have different meanings according to the context of the site under investigation, especially when respondents are using expressions and intonations to express their opinions

These limitations were controlled to a certain degree during fieldwork. The researcher started each interview by reassuring the interviewees, for example by telling them that the interviewer was there to gain knowledge and not to determine the interviewees' chances of promotion. The researcher also found it necessary to note down any other external factors that might have influenced the course of the interviews, as well as any information collected directly from the interviews. These factors included the description of the room or area the interviews were carried out in, and the timing of the interview. The amount of information was restricted in a positive sense through the use of a semi-structured interview technique, by allowing the interviewees a certain freedom in answering the questions but within the boundary set by the questions asked. The researcher also cleared up any grey areas encountered and asked the interviewees to explain each time, any expressions or intonations that were used during the interview.

5.7.5 Survey forms

Surveys can be used to quantify factors being investigated. This can be done as a quantitative sub-element within the case study methodology. The purpose of this is to

seek an "aggregation of perceptions and knowledge over multiple respondents" (Stake, 1995). It is therefore crucial that respondents were asked to rank the importance of the factors, as well as the importance of the inter-relationships between the factors generated from the other stages of fieldwork.

Surveys carried out during face-to-face interviews are often thought to be more biased than a self-administered one (Bradburn et al., 1979). Respondents may skew their answers to leave the researcher with a good impression. Thus, in the research project, respondents were issued the ranking survey forms that were returned using a big envelope left in the office. This allowed the identity of those who returned the forms to be protected. Codes were however embedded in the survey forms for coding purposes. There was always the risk that doing this might create more blanks in the forms as respondents failed to understand what was to be done. The method used to counter this potential problem was to explain in detail to the respondents what was required to be filled in, allowing them time to read the survey over to make sure they fully understood before starting to fill in the form.

Normally, respondents are asked to make judgements about, for example, "how much", "how often", "how strongly". These are often used with other unquantifiable words like "very", "sometimes" and "rather", whose meanings can vary among individuals (Bradburn et al., 1979). In the case of the research project, this element of bias was limited as the respondents were asked to rank the factors using an interval scale ranging from 1 to 10, 1 being "least important" to 10 being the "most important". Interval scales involved the allocation of individual observation to points on a scale comprising standard units of measurement. Each of the factors were to be individually ranked against the interval scale, as the researcher was also not able to provide "true" measures to these factors (Oppenheim, 1992).

The scores of each factor of "whats" was first entered into the QFD matrix, followed by scores of the relationships between each of the "whats" and the "hows". A score of 9 meant a strong relationship, 3 meant average and 1 meant weak. No entry simply represented no relationships. In the case of the second matrix, a score of 9 was determined to be of critical and should be implemented immediately, 3 as moderately critical and should ideally be implemented within the next twelve months while 1, signified that the e-business application was not important but should merely be kept under consideration and for future review. No entry represented no relationships. To obtain the scores of the inter-relationships, data were obtained through a set of

survey forms for internal respondents only, as respondents from within the company were better equipped in comparison to external respondents in evaluating the inter-relationships of the "whats" and "hows".

The main disadvantage of the interval scales survey approach was that the differences in the importance of a factor ranked 10 and one that ranked 9, or between the differences within the score of inter-relationships could not be determined. Thus, whether the difference between 10 and 9 was the same as the difference between 9 and 8 could not be established. However, during the allocation of scores to the inter-relationships, the researcher minimised this element of bias in the respondents' perceptions by taking the average points for each factor to be inputted for calculation in the selection framework. These average scores were presented to the managing director or general manager to confirm that the scores were relevant to the company. Also, the way that scores were determined in inter-relationships ratings, as in no entry, 1, 3 or 9, was to minimise any bias of the meaning within the scores.

5.8 Testing the framework

Analysis of the data to be inputted for testing was based on the following four techniques:

1. Discourse analysis: to understand the constructs of the actors through their words and documents; discourse analysis is more interested in the content compared to any other matters.
2. Summarising content analysis: interest in the frequency of words used during interviews or in documentation; content analysis believes that the higher the frequency of the words used the more important the words are and the more influence they have. Summarising content analysis will further look at excluding some of the information while bundling others.
3. Thematic coding analysis: to group the factors according to categories predetermined.
4. Feeding the data into the selection framework for calculation.

The above-mentioned analysis techniques were used in bits and parts, that is, analyses did not follow through completely on all the required steps in the analysis

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techniques. The use of discourse and summarising content analysis were to enable the researcher to identify and generate the list of factors for the case study companies' BSC and VCA, which were in turn translated to become the inputs as "whats" and "hows" for QFD eMatrix 1. Thematic coding analysis on the other hand helped to simplify the categorising of the factors according to the generic categories under the BSC and VCA, as identified for example in sections 7.2.2. and 7.2.3. The final step in the analysis of data was inputting the factors and ratings into the selection framework by applying the QFD/CAPTURE™ software, in order to produce a list of prioritised e-business plans. Findings of the case studies data will be presented in Chapter 7, while further analysis of the findings and results will be discussed in section 8.2.3.

5.9 Computer program

The computer program used for the analysis of QFD factors in the research project was the QFD/CAPTURE™ Professional Edition. QFD/CAPTURE™ Professional Edition employed the essence of QFD to translate decision criteria or critical-to-quality issues into a prioritised set of targets, choices, or improvement opportunities, thereby assisting companies to produce better products, processes, services, or strategies. QFD/CAPTURE™ Professional Edition was designed to support data management, calculations, analysis and report generation required when employing QFD.

QFD/CAPTURE™ Professional Edition was created by International TechneGroup Incorporated, founded in 1983. The main reason for the use of this software was to minimise manual calculations of the QFD matrices as well as to avoid the need of having to draw the charts manually, by allowing QFD/CAPTURE™ Professional Edition to do the prioritisation upon the entry of the factors and scores. At the commencement of the research project, QFD/CAPTURE™ Professional Edition and QFD2000 were the only available software that allowed the incorporation of QFD into their calculations and charts.

5.10 Triangulation

Different kinds of data or data from different sources will either be contradictory or in agreement (Gillham, 2000). The existence of triangulation is to instil greater

confidence in findings, as these will be derived from more than one method of investigation (Bryman, 1988b). Stake (1995) also stated that to make a good qualitative study, triangulation of data has to be part of the routine. Triangulation can also mean using more than one research instrument in the measurement of variables in a study (Webb et al., 1966). In the words of Denzin (1970), triangulation is to have multiple observers, theoretical perspectives, sources of data, and methodologies combined.

The underlying principle of triangulating results is to allow discrepancies to emerge, allowing further probing into issues with greater depth. Besides, it is also essential to test the validity and reliability of a measure. Therefore, as a form of triangulation, draft reports on the analysis can be sent to the subjects for clarifications (Stake, 1995).

The purpose of the techniques proposed in the case study research methodology was to ensure that the rule of triangulation was essentially applied. The data collected was used to triangulate each set of data to confirm the findings or, in the detection of any discrepancies, for follow-ups. While using the interview technique, it is essential to clarify the information gathered with interviewees (Dunne, 1995; Stake, 1995). This was done in three stages for the research project:

1. During the interview, through clarifying the answers provided.
2. After transcribing, to enable the interviewees to check and agree that the information collected and interpreted was what they had intended to provide.
3. As a presentation of the framework, in the context of the case study and its information gathered after the data collection.

Transcribing should ideally be done on the same day as the interview or as soon as possible, while the interview is still fresh in the mind. For the project, transcribing was carried out on the same day as the interview. That was the main reason why the next visit to the companies after the semi-structured interview stage was done only a few days after, that is to allow the researcher to transcribe the data and translate the information into the framework, in order for the respondents to carry on with the survey stage. Transcribing interviews enabled the researcher to clarify the material acquired and to decide what information was required in the writing up. The

researcher also included his own information acquired during the interviews into the transcribing process.

5.10.1 Reliability and validity

The question of validity and reliability of the research is always crucial, as inability to prove that the methodology and the process of planning, researching and analysing are all valid and reliable will throw the results attained into jeopardy. A good qualitative study must always have the data gathered validated and it is one of the ethical obligations of the researcher to minimise any misrepresentation and misunderstanding (Stake, 1995).

Reliability is concerned with the consistency of the measure; if it is measuring what it is supposed to be measuring, all the time (Bryman, 1988b). Yin (1994) further stated that reliability is to allow the study to be repeated in the same way and yielding the same results. Consistency is further divided into internal consistency and the measure's consistency over time. In qualitative research, as in the case study methodology of the research project, the researcher was looking more intensively at the reliability of data gathering and interpretation. The researcher was concerned with looking at how to separate the concepts of the subjects from the observer and the data from the interpretation. Therefore, a qualitative research like the research project would be concerned about consistency in the context of extracting the originality of the data.

On the other hand, the issue of validity is whether findings can be generalised beyond the immediate case study (Voss et al., 2002). Validity refers to the question of how the researcher can be sure that a measure really does reflect the concept which it is supposed to be referring to (Bryman, 1988b). Validity is therefore concerned with whether the measure is measuring the concepts it is supposed to be measuring. Some researchers have suggested that a way to test the validity of a measure is by using a different approach in the measurement (e.g. Campbell and Fiske, 1959). However, findings can be argued to be valid as long as there is a fit between the concepts and the measurements. In qualitative research, validity is about proving that the findings are coherent and pragmatic to the context. It must also be stressed again that it was not the aim of the project to produce a result that could be generalised universally. Generalisation of results would be to the extent of

SMEs in the printing industry having similar contexts to the case study companies. The background of the four case study companies will be presented in Chapter 7.

However, Bryman (1988b) stated that in qualitative research, one should avoid evaluating it in terms of validity and reliability, as this will impose a whole cluster of standards more relevant to the quantitative tradition. Qualitative researchers are also concerned about validating their work but have not widely agreed on any protocols that will put subjectivities into stiff tests (Stake, 1995). It is argued that in case studies, validation tests are more often due to the ethical obligations to minimise misrepresentation and misunderstanding. Furthermore, additional observations will provide the opportunity for qualitative researchers to rethink their initial interpretations.

Thus, the data collected in the case study were restricted by the boundaries created by the three techniques employed in the selection framework. Also, the natural boundaries created by the selection of SMEs in the printing industry had further provided a perimeter to the data to be collected, therefore ensuring that results were coherent and pragmatic to the context of the research project. Member checking was employed to further triangulate data gathered. This included requesting for respondents to check on any quotes taken from the interviews to ensure that the meanings interpreted were constant. In addition, the researcher was confined by ethical practices that will be further discussed below in section 5.11.

5.10.2 Representativeness Of Data Collected

In a research project, it is always a problem trying to ensure that data collected is representative of the whole (Gillham, 2000). Even when the researcher communicates with the subjects, there is always the problem of whether the researcher is speaking to the right people and if these people are only saying things they thought the researcher wanted to hear. Also, the researcher has to assess if he is only shown the documentation that the organisation wanted him to see.

The problem of representativeness of the data was limited in the project due to the high level of access granted by the company. The researcher was allowed to talk to any key personnel that he wanted to interview. The interviewees, as discussed in

section 5.7.3 above, were representatives whose job functions coincided with the four levels of analysis in the BSC.

In addition, observations were carried out in all areas of the organisation in order to combine with information collected from archival data collection; to ensure an enhanced version of the representativeness of data gathered. Also, the researcher was allowed to interview a couple of representatives from the companies' main customers. This enabled the research project to take into account the factors from the viewpoint of the customers of the case study companies.

5.11 Ethics

A researcher carrying out social research should always bear in mind the ethical practice of proper research, which includes respecting the personal rights of individuals. However, control over materials and information gathered during the case studies can be determined by the researcher's preferred solutions, and these may include companies' access to all case study materials, as well as interviewees' access to tape recordings, transcripts and interpretations (Wengraf, 2001). Therefore, before the commencement of data collection in the research project, permission and approval for access and use of data should first be sought and granted by the organisation (Gillham, 2000). For the research project, these were sought from the four case study companies before data collection. The researcher guaranteed that there would be no leakage of information to other parties and all information collected and/or produced as a direct and/or indirect result of the fieldwork would only be used for academic purposes.

As for the interviews, the interviewees were first informed that a tape recorder would be used to record the information generated during the interviewing process. During the interviews, the researcher also tried to further ensure that the interviewees fully understood the questions asked. The interviewees were also encouraged to clarify any questions that they did not fully understand, before providing their answers. It was also decided during access negotiations that the company would only be provided with the final framework customised to the context of the case study company, information collected will not be divulged to other companies. Both the companies and interviewees were not given any degree of access to the tape

recordings, though they were asked to provide any feedbacks they might have on the transcripts and interpretations.

5.12 Timing

It was proposed that all investigations should fall within a six-month period, as can been seen in Table 5.5. Literature reviews were however, carried out throughout the duration of the research project. It was expected that case study SMEs could have been confirmed by the end of two months, after the initial identification and contacting of the targeted companies. In reality, this stage took longer than expected and the whole Ph.D. project period had to be extended.

Once access was granted by the company, a timeframe of thirty working days was negotiated by the researcher to remain in the company. It was taken into consideration that the longer the researcher negotiated to remain in the company, the more difficult it would be to reach an agreement, as the company might fear interruptions to its normal daily operations and processes by the research project. Although the investigation could technically be completed within twenty working days, as can be seen from Figure 5.2 and Table 5.6, ten other workings days were set aside for each case study company as reserved. This period reserved was for any problems that might appear, that is, for contingency planning.

In spring 2003, there was an outbreak of Severe Acute Respiratory Syndrome (SARS) in Asia, resulting in hundreds of deaths and thousands being quarantined. Travelling between countries during that period became extremely difficult in a worldwide effort to curb the spread of the SARS virus. This resulted with the researcher not being able to travel freely to China and Singapore for data collection, due to the World Health Organisation's (WHO) advice on 12th March 2003 to put off "non-essential" visits to infected areas. Though data collection was essential for the researcher to compete the PhD. on time, the case study companies also discouraged data collection from taking place during the SARS crisis. Even though contingency planning did allow for delays of up to one month, it was, however, not expected that data collection had to be deferred by nearly four months. Consequently, data collection for the project was postponed till the "all-clear" was received from the WHO to travel to China and Singapore in August and July respectively. Also, the researcher's supervisor passed away just after the data collection stage and case

studies analysis had to be suspended temporarily for a period of 3 months, while a new supervisor was being assigned to guide the researcher.

Table 5.5: Timetable for investigation timing

Activity	Duration
Identifying SMEs for project	0.5 month
Contact companies and await replies	1.0 month
Setting up meetings and data collection dates	2.0 months
Data collection	3.0 months
Reserved for contingency planning	1.0 month

Figure 5.2: Timetable for each data collection period

Working days	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
Settling in																
Gather information from databanks and archives																
Observations																
Semi-Structured and completion of survey forms																
Final Presentations																
Reserved for contingency planning																

Table 5.6: Timetable for each data collection period

Activity	Duration
Settling in	2 days
Gather information from databanks and archives	12 days
Observations	10 days
Semi-Structured and completion of survey forms	12 days
Final Presentations	4 days
Reserved for contingency planning	10 days

5.13 Chapter summary

In this chapter, the influences of the underlying paradigms of hermeneutics and qualitative research on the way research questions were formed for the project was discussed. In addition to these concerns about the selection of an appropriate research methodology, the other influencing factors including the question of sampling and the nature of other research problems in the project were also discussed. Also, based on the reviews on the BSC, VCA and QFD in Chapter 4, it was established that the data collection methods of the three techniques could be potentially diverse. This will be further discussed in Chapter 6.

It was discussed in the chapter that after taking into account all the influencing factors, it was decided that case study methodology should be deployed as the main dominant research methodology in the research project. There were also discussions as to what the case study methodology was and how its flexibility had positioned it to be the best possible methodology in the context of the project. The chapter then progressed to focus its discussions on data gathering, the guidelines to preparation of data gathering, how actual data gathering was carried out and how data were triangulated.

In the final sections of the chapter, there was a discussion on QFD/CAPTURE^{TM}, the specialised software employed by the researcher, and on why QFD/CAPTURE^{TM} was the best-suited software for the research project. There was also a discussion on the concern of ethical issues and how the researcher had dealt with these issues during the research project, mainly through negotiations with the companies and keeping the interviewees informed, both before and after the interviews were carried out. More on reflections on the research project can be seen in Chapter 9. The proposed timings of data gathering were also reviewed in this chapter.

In the next chapter, the nature of data collection of the three components of the proposed e-business selection framework will be discussed. This will be followed by looking closely at the eight steps being proposed to develop the e-business selection framework for SMEs during e-business planning.

6. Developing The Selection Framework

6.1 Chapter introduction

In the last chapter, the author discussed and established the research methodology for the research project. The components of a good planning framework and the benefits of using the balanced scorecard (BSC), value chain analysis (VCA) and quality function deployment (QFD) were also discussed in Chapter 4. It was discussed as well how these techniques could be integrated to complement each other.

In this chapter, the author discusses the development of a new e-business selection framework. As the selection framework is to be an integration of three well-established techniques, the BSC, VCA and QFD, the author first talks about the preferred methodology in data generation of these three techniques. This is critical to data collection as the different approaches to data collection of the three techniques will have a direct influence on the nature of data collection techniques for evaluating the selection framework. The focus of the study is to integrate the BSC and the VCA techniques with QFD to develop an e-business selection framework.

Next, a discussion on the selection framework is provided. The author presents the eight steps to building the e-business selection framework and provides a discussion on what each of the eight steps will involve. To close the chapter, a summary section is provided.

6.2 The nature of data collection methodology in the three techniques

Each of the three techniques, namely BSC, VCA and QFD, integrated into the selection framework, has its own established methodology in data collection. This session will seek to identify and understand the key data gathering methods and discuss the methods employed for each of the techniques during actual data collection.

6.2.1 Building the balanced scorecard

A 10-step methodology was introduced to assist in the building of a strategic management system using the BSC, which can be seen in Table 6.1 (Kaplan and

Norton, 1996a). However, to link the companies' long-term strategy to short-term actions, organisations will have to ensure that the 10-step methodology goes through the four management processes in a spiral (Kaplan and Norton, 1996a). These four management processes, which can also be seen in Figure 6.1, are:

1. Translating the vision and gaining consensus
   - Coincides with steps 1, 5 and 9
2. Communicating the objectives, setting goals and linking strategies
   - Coincides with steps 2, 6 and 10
3. Setting targets, allocating resources and establishing milestones
   - Coincides with steps 3 and 7
4. Providing feedback and learning
   - Coincides with steps 4 and 8

The BSC is normally built through numerous focus group discussions with managers throughout the process. Kaplan and Norton (1993) also emphasised the use of documents, interviews and executive workshops for gathering information and building consensus for the BSC. Kaplan and Norton (1996a) suggested a two-year life cycle for the establishment and deployment of the BSC, through a series of interviews and meetings with executives. The researcher agreed, however, that a two-year span would be reasonable for the larger companies that Kaplan and Norton had been working with, but was, in the context of the research project, too long. A shorter timeline which was more appropriate for the research project was proposed, due to the flatter and more flexible organisational structures that are often typical of SMEs, which would in turn influence the way decisions and strategies are made (ICIS, 1990; Lau and Snell, 1996; Halley and Guilhon, 1997; Sadowski, 2002). Interviews with executives were proposed to be the main technique employed to establish the BSC of the four case study companies. Additional information was also gathered from documentation.

The 10-step methodology was developed with large companies in mind, while the scope of this project is to develop a selection framework for SMEs. In addition, the BSC was not the only technique integrated into the e-business selection framework, but was to be one of the three techniques that would be included to form the new e-business selection framework. Therefore, taking into consideration the above arguments, the researcher further customised a methodology for the BSC stage in the selection framework. This customised BSC involved only three steps, mainly due

to the structure of most SMEs as discussed earlier in the section and, that SMEs generally do not have many managers, which in a larger organisation would be from the many different hierarchy levels of the organisation. The identity of the managers interviewed was held anonymous for ethical reasons, as well as helping to further reassure the interviewees, as discussed earlier in section 5.11. This was to further encourage the managers to be both more open and truthful during the development of the e-business selection framework. The three-step methodology can be seen in Table 6.2 below.

Table 6.1: Establishing and deploying the BSC

Months	10-step methodology
1 to 3	**Actions:** **1.** Clarify the Vision: Forming of new executive team. A balanced scorecard is developed to translate into a strategy.
4 to 5	**2A** Communicate to Middle Managers: The top three layers of management are brought together to learn about and discuss the new strategy.
6 to 9	**2B** Develop Business Unit Scorecards: Business unit to translate its strategy into its own scorecard.
6	**3A** Eliminate Non-strategic Investments: The corporate scorecard, by clarifying strategic priorities, identifies many active programs that are not contributing to the strategy. **3B** Launch Corporate Change Programs: Identifies the need to cross-business change programs.
9 to 11	**4** Review Business Unit Scorecards: Reviews allow senior executive to shape business unit strategy.
12	**5** Refine the Vision: Updating the corporate scorecard with newly identified cross-business issues.
13 to 14	**6A** Communicate the Balanced Scorecard to the Entire Company: **6B** Establish Individual Performance Objectives:
15 to 17	**7** Update Long-Range Plan and Budget: Five-year goals are established for each measure.
18 onwards	**8** Conduct Monthly and Quarterly Reviews.
25 to 26	**9** Conduct Annual Strategy Review.
25 to 25	**10** Link Everyone's Performance to the Balanced Scorecard.

Source: Kaplan and Norton (1996a).

Figure 6.1: The BSC spiral

Illustration removed for copyright restrictions

Based on: Kaplan and Norton (1996a).

Table 6.2: Customised BSC as part of the selection framework

Illustration removed for copyright restrictions

Based on: Kaplan and Norton (1996a).

6.2.2 *Generating the value chain analysis*

Porter's (1985) VCA structures business operations into five primary activities from inbound logistics to service and four support activities. It is noted that business processes within these primary and support activities should be documented to establish the link between these processes in meeting requirements. This will enable the identification of internal customers and to improve on business processes. The human resource (HR) department's knowledge of the structure and functioning of departments can also greatly enhance the ability to identify these linkages (Hendricks and Triplett, 1989). Barker (1996) also stated that the VCA is normally completed through process tracking or process mapping, while McGuffog and Wadsley (1999) also, used process tracking in their research when establishing a case study company's VCA. Golden and Powell (1999) used a semi-structured interview methodology with managers to establish the inter-organisational systems intra- and inter-value chain and their relationships. Various data sources including observation, interview and documents can also be used to establish a VCA, therefore not limiting one to a use of a single data collection technique (Graham and Ahmed, 2000). These arguments therefore further strengthened the notion that the ideal method to generate VCAs would be through data collection from documentation and interviews with HR personnel, which were part of the data collection process of the research project.

As a framework for strategic planning, VCA are typically characterised by (Hergert and Morris, 1989: 178):

"1. An emphasis on identifying the source of sustainable competitive advantage;
2. An insistence on the importance of complex linkages and inter-relationships; and
3. The identification of generic strategies which must be pursued consciously and coherently in the different value creating activities."

Adopting Hergert and Morris's (1989) model in generating a VCA and taking into consideration the discussion above, the researcher identified and adopted the following steps to simplify the creation of a VCA as in Table 6.3 below.

Likewise, from the adopted framework mentioned in Table 6.3 on the creation of a VCA, the researcher employed the data collection methods of gathering through documentation and reinforced, as well as triangulated through both observations and

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semi-structured interviews with managers, to generate the value chain factors required to be inputted as "hows".

Table 6.3: Methodology for the creation of a VCA

Steps	Methodology
1	Defining the product to be analysed.
2	Identify the different business processes of each product.
3	Identify the components critical to these business processes.
4	Identify any other business processes either vertically or internally link or inter-related with the processes being analysed.

6.2.3 Creating the quality function deployment

According to Hauser and Clausing (1988), the QFD matrix begins with the customer, whose requirements are called customer attributes, or phrases that customers use to describe a product or service characteristic. The customer needs are then translated into corresponding "hows". The function of the "hows" is to translate the customer needs into terms measurable by the organisation. The "hows" should not represent technical solutions for customer needs, that is, "hows" must be objectively measurable and testable, allowing for accuracy in the translation of "hows" to be objectively examined (Hofmeister, 1995). In short, these "hows" must be expressed in simple terms, not as technical jargon. A summary of the main steps that were customised to the research project can be seen in Figure 6.2.

Attempting to build the QFD matrix in itself requires hours of work, as teams are required to carry out the work of collecting data, designing and interpreting it (Sullivan, 1986; Bouchereau and Rowlands, 2000). The major step towards the generation of the QFD matrix is the gathering of data, customer needs and its relative importance, through discussions with customers and customer surveys (Stocker, 1991; Griffin and Hauser, 1993; Whiting, 1993; Hunter and van Landingham, 1994). According to Lim et al. (1999), several methods can be used to establish the "whats", including structured and unstructured interviews, observations, and customers' feedback records. Govers (1996, 2001) conversely listed the following factors as critical elements to an effective QFD matrix:

- Assessment of relationships and the correlation matrix
- Customer requirements must be recognised

- For every decision taken, reference must be made to the "vital few" concept (c.f. Pareto rule)

Figure 6.2: Three stages to the set up of the QFD matrix

Aston University

Illustration removed for copyright restrictions

Based on: Han et al. (2001).

Thus, it could be seen from the discussion above that the main data gathering techniques employed for raw data collection in QFD were normally in the form of customer surveys, while task groups were normally formed to engage in interpreting the data and inputting them into the matrices. As for the purpose of the research project, the researcher was required to identify the list of needs ("whats") from stage 1, the BSC of the case study company. These needs were made up of both internal and external, and were allocated "points" to indicate their importance. Interval scales technique was used to rank the factors, with scores ranging from 0 to 10.

Lim et al. (1999) further argued that to identify the "hows" in a QFD matrix, in the case of a product, one must use a measurable element, while in the case of services, one must look at identifying the processes. The scope of this research project was to look at developing a selection framework for e-business planning, thus implying that the framework must be able to prioritise the business processes as well as e-

business applications in relation to the customer requirements. Establishing business processes, "hows", can be done with focus groups, interviews and surveys (Lim et al., 1999; Lim and Tang, 2000). For the research project, the information from the generated VCA was further developed into a list of "hows". This was possible as the "hows" were a list of internal business processes that allowed the company to meet the internal and external needs.

Key customers were also requested to provide their own rankings, the reason being that customers might have differing views from the company's executives. "Hows" were generated from the VCA, as well as from information gathered during the semi-structured interviews and from literature reviews. Additional information was also collected during semi-structured interviews, to be inputted as the scores for the inter-relationships between the "whats" and "hows". The usage of gathering information from documentation, semi-structured interviews and survey forms was discussed in more detail above in section 5.7.

6.2.4 The differences in the nature of data collection methodologies

The diverse data collection methods that were favoured by the three techniques have been discussed above. The diversity in the data collection methods of these three techniques was a serious obstacle that needed to be addressed. The underlying issue was to be able to adopt a methodology that allowed the researcher to encompass a wide variety of data collection techniques within the chosen research methodology.

In the context of generating the BSC, VCA and QFD and, employing the adopted methodologies, the researcher was required to integrate multiple data collection techniques: documentation, observations, interviews and surveys. Therefore, the project was to engage a research methodology that could enable the integration of these diverse data collection techniques mentioned. It was decided that a case study methodology could competently cover all the data collection technique requirements of the BSC, VCA and QFD.

6.3 The e-business selection framework

The researcher developed an 8-step approach to assist in the understanding and creation of the selection framework. The selection framework can be seen in Figure 6.3. The 8 steps were identified as:

Step 1 – Using BSC to develop "what" for QFD eMatrix I

Step 2 – Using VCA to develop "how" in QFD eMatrix I

Step 3 – Completing QFD eMatrix I

Step 4 – Identification of critical business processes from QFD eMatrix I

Step 5 – Inputting critical business processes to QFD eMatrix II's "what"

Step 6 – List of e-business applications to QFD eMatrix II's "how"

Step 7 – Completing QFD eMatrix II

Step 8 – Identification of critical e-business applications from QFD eMatrix II

In the first step, the employment of BSC assisted in ensuring that all-round business strategic planning was exercised within the process of the e-business planning process. Customers' needs, the "whats", would then be generated from the results of this strategic planning process. Upon the completion of step 1, or when step 1 was at least underway, the manager would be able to commence on step 2, the development of the VCA to aid in the generation of "hows", business processes, for the QFD eMatrix I. The purpose of QFD eMatrix I was to prioritise the business processes according to their ability to meet the critical needs of customers. QFD eMatrix II on the other hand, was employed for the purpose of identifying and prioritising the e-business applications in accordance with the prioritised business processes, obtained from QFD eMatrix I. Steps 1 and 2 can be carried out concurrently, and the same can be said for steps 5 and 6. Therefore, depending on the stage, activities can either be sequential or in parallel format, though some activities cannot be carried out concurrently due to resource constraints or logical sequence of the activities.

Figure 6.3: The selection framework
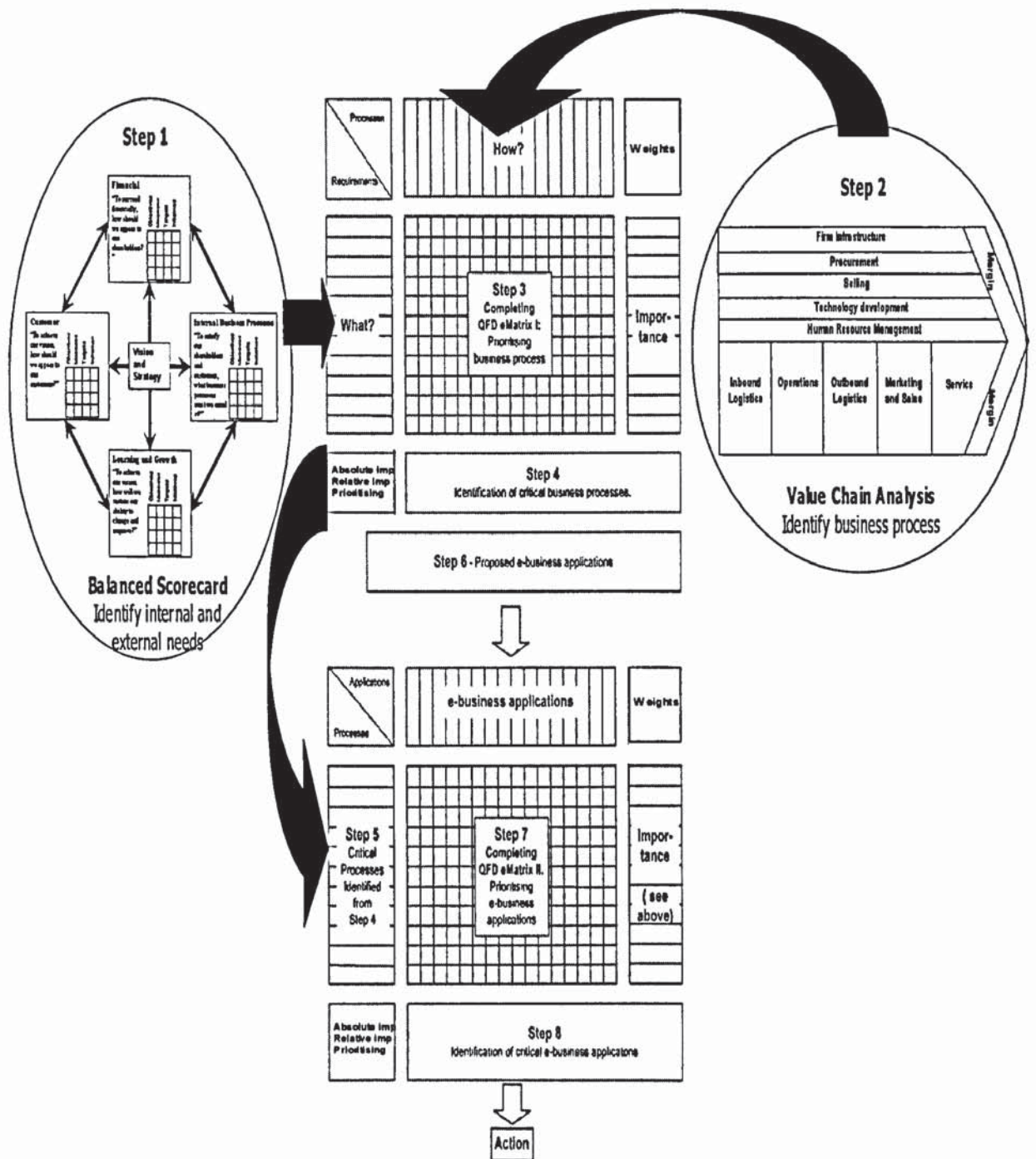
6.3.1 Using BSC to develop "what" for QFD eMatrix I

The development of the BSC is always and ideally top-down (Kaplan and Norton, 2000). Therefore, the research had to first identify the vision of the organisation. The identification of organisation vision was done through gathering information from documentation, followed by confirming the vision with senior managers. Once achieved, the researcher would be able to start in formulating the objectives from a financial perspective. Only after these financial objectives were identified, would the

organisation be able to determine, at the customer perspective level, the objectives that could help to achieve the identified financial objectives.

Kaplan and Norton (2000) listed three types of customer perspectives: operational excellence, customer intimacy or product leadership. Therefore, at the customer perspective level, the organisation must decide which of the customer perspectives the company should or was already concentrating on. Once this was agreed by managers, it would then be possible for the organisation to formulate a list of performance measurements that, upon meeting the requirements, would enable the organisation to achieve its customer perspective objectives.

The next phase was to identify a list of key business processes that could enable the organisation to achieve the objectives set from both the financial and customer perspectives. In short, these would be the business processes that the organisation would find it vital to excel in, as these processes were critical in allowing the organisation to achieve its vision. Finally, senior managers were required to identify any innovation and growth objectives for the organisation. These objectives would ultimately provide the blueprint in the creation of an infrastructure for the organisation to create long-term improvements and growth. While objectives in financial, customer and business process perspectives could be both current and for the future, there were likely to be gaps, like technology and employee skills, that acted as barriers to meeting these objectives. Therefore, objectives identified from the innovation and growth perspectives would most likely seek to narrow these gaps.

The research would now be able to develop the company's BSC. The levels of perspectives could subsequently be clearly listed from top to bottom in the order of how the BSC was formulated. This list could then be inputted as the "whats" for QFD eMatrix 1.

6.3.2 Using VCA to develop "how" in QFD eMatrix I

To most SMEs, managerial decisions have always been functionally-oriented and tended to reflect the background of the restricted number of individuals on the management team. One of the main challenges of QFD is the generation of factors as inputs for "whats" and "hows" (Sullivan, 1986; King, 1987; Tan and Tang, 2002; Tan et al., 2003). While it was discussed earlier in section 4.4.1 that the BSC could

be used to assist in the generating of "whats", the VCA is better suited to aiding the generation of "hows". The VCA process model was thus brought into the framework with the intention of identifying the basic, generic business processes that all businesses should possess (Porter, 1985). The VCA would be able to help provide an overview of the business processes, thus limiting the influences of functional-oriented managerial styles in the development of "hows".

Using the VCA would provide senior managers with a clear view of the key business processes that add value to the products and services the company provides. The VCA would further allow senior managers to analyse processes at different key stages and levels. From the identified key business processes, managers would be able to formulate a comprehensive list of "hows" to be inputted into QFD eMatrix I.

6.3.3 Completing QFD eMatrix I

The list of identified both internal and external needs were to be inputted as the "whats" in the QFD eMatrix I. Surveys and/or experts were consulted at this point to list the importance and criticality of the "whats". Usually, customers had to be consulted to determine the needs that the customers "truly desire", or to provide any additional "needs" missing from the list. Of course, managers must take note that the needs that were often most desirable might not be given explicitly by customers, and so some judgements would still be required from the researcher to ascertain any implicit customer needs. The importance ratings of these needs should range from 1 to 10. The list of identified business processes was to be inputted as the "hows" in QFD eMatrix I.

The "whats" and "hows" in QFD eMatrix I would then undergo an inter-relationship analysis, obtained from the survey and/or expert advice, to determine the business processes that were to be the most important and relevant in meeting the needs that were ranked most highly both internally and externally.

The QFD/CAPTURE™ software was used at this stage in the project to capture and analyse the inter-relationships between the "whats" and the "hows". The score of each factor of "whats" would be entered to QFD eMatrix I. This was followed by the scores and entry of the relationships between each of the "whats" and the "hows" into the software. The inter-relationship scores were defined as the following: 9 meant a

strong inter-relationship, 3 meant an average inter-relationship and 1 represented a weak inter-relationship. No entry meant there was no relationship between the "what" and "how". It is the normal practice for ratings of 1, 3, 9 and no entry to be used when rating the strengths of the inter-relationships of "whats" and "hows" in a QFD matrix. The inter-relationship of the needs and business processes would then be calculated using the correlation matrix function of the QFD/CAPTURE™ software. A list of prioritised business processes for the organisation to look into for the purpose of e-business application selection would then be displayed.

6.3.4 Identification of critical business processes from QFD eMatrix I

The product from this round of rigorous calculation was a list of key business processes that had been prioritised according to key critical areas of focus. This list highlighted the business processes that would enable the organisation to satisfy these identified higher ranked internal and external needs.

6.3.5 Inputting critical business processes to QFD eMatrix II's "what"

The next step in the framework was to integrate the list of prioritised business processes produced from QFD eMatrix I, by inputting the list as the "whats" in QFD eMatrix II, with potential e-business applications. The rationale behind this was to transform the identified critical business processes into "whats", in order for the researcher to measure the inter-relationships of these processes with available or proposed e-business applications. This allowed the identification of e-business applications that could help to streamline and enhance the effectiveness and efficiency of the business processes, in order to meet both internal and external needs.

6.3.6 List of e-business applications to QFD eMatrix II's "how"

The list of e-business applications to be inputted as "hows" in QFD eMatrix II could either be the ones already applied in the company or new applications as proposed by managers. Furthermore, e-business resources can be obtained from vendors or in-house, including researching for information online. The list of e-business applications should not limit creativity, as putting these applications through the analysis of relationships in the eMatrix would provide the managers with a clearer picture by prioritising these e-business applications in relation to the list of critical business processes.

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The list of e-business applications provided in the evaluation was as follows:

Logistics (Inbound/Outbound):

- Auto-replenishment system – a system for replenishing products as they are used.
- Computerised logistic management – computer system to automatically "plan, implement, and control the efficient, effective flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements" (Council of Supply Chain Management Professionals, 2004).
- Order tracking – computer system to track the flow and storage of goods, services, and related information from the point-of-origin to the point-of-consumption in order to meet customers' requirements

Operations:

- Graphic design – the design of print or electronic forms of visual information to communicate an expression or style.
- Online verification of design – a procedure to validate the design through the use of one computer to interact directly and simultaneously with another computer.
- Online design customisation – to tailor design through the use of one computer to interact directly and simultaneously with another computer.
- Advance machinery – state-of-the-art machines or machine systems, including high-end computerized printers.
- Advance software – state-of-the-art programs that run on computer hardware.
- Content management service (website) – work provided to capture client content, standardise the format of that content, host the content, and continually update the content to reflect the latest additions, modifications, or deletions normally on a Website.

Marketing and Sales:

- Online quotation – demands of goods and services requested to be supplied at a certain time and price through the use of one computer to interact directly and simultaneously with another computer.
- News bulletin board – an online forum for short news announcement concerning some on-going news story.

- e-Newsletter – electronic version of informative letter mailed to subscribers.
- Online ordering – commercial document used to request the supply of goods and services in return for payment and providing specifications and quantities through the use of one computer to interact directly and simultaneously with another computer.
- Online transaction – negotiation and/or the settlement of business deal through the use of one computer to interact directly and simultaneously with another computer.
- e-Auction – an electronic arrangement for the public sale where goods are sold to the highest bidder on an online portal.

Service:

- e-Catalogue – a complete list of things; usually arranged systematically in an electronic form.
- Online sourcing – to buy something from somebody through the use of one computer to interact directly and simultaneously with another computer.

Supporting:

- ERP (Enterprise Resources Planning) – a business management system that integrates all areas of the business, including inbound/outbound logistics, operations and manufacturing, marketing and sales, services and supporting functions while simultaneously linking the company to customers and vendors. Activities can include product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders.
- CRM (Customer Relationship Management) – entails all aspects of interaction a company has with its customer, whether it be sales or service related, to be better served through the introduction of reliable processes and procedures for interacting with those customers.. CRM can be a process, methodology, software, and usually Internet capabilities that bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness and market trends in an organised way.
- Online customer survey – feedback form – the use of electronic feedback form to gather information usually on customer needs, expectation and satisfaction, through the use of one computer to interact directly and simultaneously with another computer.

- e-Learning – the cognitive process of acquiring skill or knowledge over the Internet, a computer network, via CD-ROM, interactive TV, or satellite broadcast.

6.3.7 Completing QFD eMatrix II

The next step in the selection framework was the calculation of the inter-relationships of the prioritised business process, "whats", and e-business applications, "hows", in the QFD eMatrix II. This calculation was again carried out with the use of the QFD/CAPTURE™ software, in order to prioritise the ranking of the e-business applications according to the strengths of inter-relationships with the key business processes.

The scores for these inter-relationships took on a slightly different meaning to those in QFD eMatrix I. However, these scores were also obtained via survey and/or expert advice. A score of 9 was determined to be critical and should be implemented immediately, 3 as in moderately critical and should ideally be implemented within the next 12 months while 1 signified that the e-business application was not important but should be kept under consideration and for future review. "No entry" would signify that the e-business application should not be implemented with regards to improving the listed business processes.

6.3.8 Identification of critical e-business applications from QFD eMatrix II

The product from this round of eMatrix analysis would provide managers with a prioritised list of e-business applications upon which to take action. This list would be based on the e-business applications' ability and criticality in meeting the needs identified, which would be in both lists of needs from QFD eMatrix I and QFD eMatrix II. These e-business applications would be able to allow the company to start determining the key business processes required to be improved or streamlined, in order to meet both internal and external critical needs.

6.4 Chapter summary

The nature of data collection methods preferred by the three techniques – BSC, VCA and QFD – and the data collection methodology required to sufficiently meet these demands were discussed. In short, the researcher had to integrate these diverse

methods of data collection into one, which in this instance would be the case study methodology, as discussed before in Chapter 5.

In the second part of this chapter, the author provided a detailed discussion on building the proposed framework. Discussion covered the eight steps in developing the e-business selection framework and the tasks the researcher carried out for each of the eight steps. It was also stated that it was possible to allow for concurrent data collection for the different steps of the selection framework, whenever possible.

Having newly developed an e-business selection framework, it was necessary to test it in real companies in order to evaluate its validity and usefulness, as well as its feasibility and practicality for implementation. In the next chapter, the author will be presenting the evaluation results of the selection framework in four case study companies. Data collection and evaluating of the selection framework were carried out in four printing SMEs: two in China and the other two in Singapore.

7. Evaluating The Framework

7.1 Chapter introduction

In the last chapter, the author discussed the development of the e-business selection framework. In this chapter, the author presents the four case studies carried out for the purpose of evaluating the framework. As an exploratory research project, it is important to evaluate the developed selection framework to establish the feasibility and practicality of the framework. The four case studies were carried out at Atlas Paper Products Private Limited, Singapore, Fun Press Private Limited, Singapore, Guangzhou United Printing Company Limited, China and Shandong Xunda Print Company Limited, China.

Each of the case studies presented in this chapter begins with a section on the background of the case study company. Each case study is then divided into sections to coincide with the eight steps in the selection framework. For each of the case studies, the data collected to evaluate the framework is presented and explained. After the presentation of the four case studies, the chapter ends with a summary section.

7.2 Case study 1: Atlas Paper Products Private Limited, Singapore

A similar case study report was presented to the management of Atlas for fact-checking and approval for use. The management also noted that the top three most critical e-business application recommendations provided by the report were suitable and deemed able to assist Atlas in meeting their immediate needs.

7.2.1 Company background

Atlas Paper Products Private Limited was set up in 1977 with the first production starting in 1978. The vision of the company is "to be the best-rated supplier in understanding the customers and producing excellent quality products and provide superior service to satisfy the customers at all times". The aim of Atlas is "to expand its production overseas and to achieve long-term profits and survival".

The main business of the company is the manufacture and printing of corrugated boxes and cartons in accordance to customers' specification. The boxes and cartons

include both colour and black printing and come in various shapes and sizes. In the 1970s and 1980s, the main customers were from the textile industry. In the 1990s, the influx of consumer electronic manufacturers and hard-disk makers into Singapore, coupled with the relocation of most companies in the textile industry to neighbouring countries, resulted in a change of customer base for Atlas. In the past couple of years, Atlas has also started venturing into the manufacturing of display stands and is currently looking into establishing a strong position to provide specially-designed carton boxes for customers from the biotechnology industry, a sunrise industry in Singapore.

For 2002, the current market share of Atlas in Singapore was about 7%, with S$14 million (equivalent to about £5 million) turnover. The main customers of Atlas are companies, from multinational corporations (MNCs) to SMEs, in the manufacturing and packaging industries. These companies include AMD, Dupont, Fuji, Kaneka Singapore, Micron, National Semiconductor, Solectron, United Test and UPS. Atlas also has steady exports to a few customers based in Australia. Atlas is certified with ISO9002 and is currently undergoing a re-accreditation for the newly introduced ISO2000 series.

Over the years, Atlas has been constantly investing in new machinery and equipment to keep abreast with the latest developments in printing technology, and to improve its productivity and the quality of its products. Production at Atlas is now geared towards the "make-to-order" and "JIT" concept. However, the set-up of the company is to be considered as relatively low-tech with no formal training procedures for its employees.

The set-up of Atlas is informal and, being a traditional Chinese family-owned company, many of the company strategies are kept secret within top-level management with little or no documentation. All other managers and employees are normally not told or advised of the strategies, but tasks are more likely to be cascaded down from top level to the managers and employees to be achieved, in order for the company to reach their targets. There are six main departments at Atlas, with a combined staff of 114 as at the end of 2002. The six departments and the breakdown of staff strength are as in Table 7.1.

Table 7.1: Breakdown of staff strength (Atlas)

Department	No. of staff
Administrative	04
Marketing	11
Accounts/Administration/Human Resource	08
Production Operation	87
Purchasing	01
Quality Assurance	03

7.2.2 Generating the BSC of Atlas ("whats")

The first step of the selection framework was to establish the company's BSC for the purpose of generating a list of "whats" for QFD eMatrix I. A series of interviews were carried out with senior managers in order to gather information for the establishment of Atlas's BSC. The vision of Atlas was clearly stated in its quality manual and sales manual, providing a clear starting point for the establishment of a BSC for the company. The vision of Atlas is "to understand the customers and to produce excellent quality products and provide superior service to satisfy the customers at all times". The senior managers also further re-stated this vision during the interviews.

During the interviews, a number of strategies were listed by the senior managers, which would enable the company to achieve this vision. Among these strategies, the top two prioritised strategies for the year 2003 were:

1. To achieve a growth in market share (target is 1%), and/or
2. To achieve a sales growth (target is 15%).

The reason for this was due to the shrinking market base in Singapore and, therefore, even if sales growth was less than 15%, Atlas would still be able to achieve its prioritised strategy of 1% growth in market share. Atlas is presently looking at opportunities of setting up manufacturing and printing plants in neighbouring countries like Malaysia, Indonesia and China, in order to cut down costs, as well as to expand from the limited customer base in Singapore.

The financial perspectives

In order to support the growth in market share and the market growth strategies, a series of objectives were highlighted during the interviews. From the financial perspective, a number of performance measurements that would allow the company

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to keep track of its progress towards achieving the twin strategies were identified. Gathered from evidence noted from the interviews, it was possible to highlight that the following objectives from the financial perspective could be set and measured to serve this intention of performance progress tracking:

- Excellent variable costs control (limiting annual variable costs growth to 5%-10%)
- High profit growth (increment of at least 10%-20% from last year)
- High sales growth (increment of at least 10%-20% from last year)
- Increasing profit margin (increment of at least 10%-20% from last year)
- Low fixed costs growth (limiting annual variable costs growth to 5%-10%)

The customer perspectives

Atlas is seeking to concentrate on the customer intimacy preference at the customer perspectives level of the BSC. This selection could be seen to align well with documentation from quality assurance and sales manuals. This preference was further triangulated during the interviews, with senior managers emphasising the importance of understanding the customers and providing them with superior products and services. The mentality of the senior managers is almost on the "customer is always right" and "customer is king" frequency.

The interviews with senior managers also highlighted a series of measurable objectives that coincided with Kaplan and Norton's (2000) customer intimacy performance measurements. The list of performance objectives in the customer perspectives was as follows:

- Excellent results before-sales services as rated in a customer survey
- Excellent results after-sales services as rated in a customer survey
- High customer retention rate (at 100%)
- High customer satisfaction rate (at 100%)
- High rate of on-time delivery (at 100%)
- Increasing innovative solutions (with a minimal of 1 solution bi-monthly)
- Increasing number of co-operative projects with customers (with a minimal of 1 project bi-monthly)
- Low number of customer complaints (at 0%)
- Sole or preferred supplier from a survey result

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The internal business process perspectives

At the internal business process perspectives level, the researcher had to first identify the main business processes in Atlas. The identification of these business processes was assisted by deploying the VCA and its generic business processes of inbound logistics, operations, sales/marketing, outbound logistics and support services.

A typical sales cycle for a batch of colour corrugated packaging boxes would start with a confirmation of sales order from Sales and Marketing department. Once the sales order is received, purchasing department will make the necessary purchase order for materials while designers will be assigned to create and finalise the design for film production if this is a new job with no prior orders. The Production/Operations director will calculate the man-hours required for the production of the batch job and assigned a production supervisor to handle the allocation of staff on the required shift or determine when to run the batch if it can be scheduled into a normal production shift.

The start of the production schedule would be the corrugation of the cardboards into the required thickness. The corrugated cardboards are then mould and/or die-cut into the required shape and size, followed by the type-setting and printing of the colour designs onto the cardboards. The final stage of the production process was to bind/fold/glue/stitch the cardboard into the required final products, depending on the requirements of the client if the boxes should be delivered in a ready-to-use or collapsed state. The batch is then delivered and the Accounts department will follow up with payments.

Once these main business processes were identified, the researcher was able to further identify the key business processes that Atlas would have to excel to meet its vision, aims and objectives. To measure the performance of these key business processes, the following list of objectives must be included at this level of Atlas's BSC:

- Excellent results when bench-marking with key competitors (performance to be within +/-5% of key competitors)
- Excellent schedule planning
- High rate of operation efficiency

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- High rate of stock availability (at 99% at all times)
- Low hours of machine downtime (of no more than 1 hour per month)
- Low production cycle time
- Low rate of rejections (at 0%)
- Low rate of wastage (at 0%)
- Low unit cost

The innovation and growth perspectives

It was important for Atlas to plan and provide for sustained growth and ongoing innovation, in order to enable itself to meet its long-term objectives. Atlas would, through its innovation and growth perspectives of the BSC, allow the identification of current gaps especially in terms of technology and employee skills that need to be bridged.

Atlas also had to measure the performance of the objectives from the innovation and growth perspectives, to determine if the company was improving in relation to these objectives. Again, through documentation and interviews with senior managers, the following objectives were identified:

- High number of new accounts opened (at least 1 new account bi-monthly)
- High rate of development time invested to Next Generation products (5% of total man-hours)
- High rate of new product introductions (at least 1 new product every half year)
- High rate of staff satisfaction as rated in a staff survey (at 100%)
- High rate of training investment (at 5% of total man-hours)
- High rate of value-adding time (at 100% of total man-hours)

The BSC created in Atlas's context can be seen in Figure 7.1. The list of "whats" generated from the BSC for Atlas's QFD eMatrix I are listed in Table 7.2.

Figure 7.1: Balanced Scorecard (Atlas) – based on case study analysis

Vision: The best-rated supplier in the printing industry				
	To achieve a growth in market share (1%)		To achieve a market growth (15%)	

Financial Perspective	Fixed Costs Growth	Profit Growth	Sales Growth	Profit Margin	Variable costs control

Customer Perspective	Customer Satisfaction	Customer Complaints	On-time Delivery	Number of Co-operative Projects With Customers	Customer Retention
Customer Intimacy	Innovative Solutions	After-sales Services		Before-sales Services	Sole Or Preferred Supplier

Business Process Perspectives	Bench-marking with competitors	Machine Downtime	Operation Efficiency	Production Cycle Time	Schedule Planning
	Unit Cost	Rejections		Wastage	Stock Availability

Innovation and Growth Perspectives	New Product Introductions	Development Time Invested To Next Generation Products	Training Investments
	New Accounts Opened	Staff Satisfaction	Value-adding Time

Rating and inputting the "whats" of Atlas's QFD eMatrix I

Once the list of needs was prepared, finalised and determined from Atlas's BSC, surveys were carried out of senior managers, staff representatives and key customers to rate the "whats". Senior managers would be able to rate the needs in accordance with internal needs as well as their perception of external requirements. Staff representatives, on the other hand, would be providing further confirmation of the views from senior managers. Survey ratings completed by key customers would provide the research project with external views of the requirements to allow the rating to be more robust. Another key reason was that perceived internal views of external needs were often not as exact as the real views of the needs from the customers themselves. Key customers were also requested to add any other factors that they deemed important to meeting their requirements of Atlas.

The ratings were made on a scale of 1 to 10. The "whats" deemed most important were awarded the highest points of 10 and the lower scores were given to the "whats" which were felt to be of lesser importance. The "whats" with highest score, 9.0 out of 10, was "high sales growth", followed by "high percentage of on-time delivery" with a score of 8.8 and "excellent after-sales services from a survey

result" with a score of 8.6. The detailed ratings can be seen in Appendix II. It must be emphasised that this rating was the result of an average taken from the survey results obtained from Atlas senior managers, staff representatives and customer representatives. This average rating was required because of the fact that the various managers, staff representatives and (different) types of customers tend to place different levels of emphasis on various areas of the business and/or have different requirements, thus resulting in a variety of ratings.

7.2.3 Generating the key business processes of Atlas with the VCA ("hows")

Once the "whats" for QFD eMatrix I were identified, the next step was to identify the "hows" for QFD eMatrix I, which were to be developed from the VCA. Using the VCA, the researcher was able to categorise the business processes of Atlas into five main categories under the headings of "logistics", "operations", "marketing and sales", "services" and "supporting". Within each category, the key critical value-adding business processes were further identified through data gathering from documentation. This information was further triangulated through interviews with the senior managers and staff representatives of Atlas. A complete list of the key business processes is shown in Table 7.2, "QFD eMatrix I, "hows"".

7.2.4 Completing QFD eMatrix I

In this step, the list of "whats" and "hows" as generated in sections 7.2.2 and 7.2.3 were entered into the QFD eMatrix I. The senior managers of Atlas were asked to fill in the ratings determining the strengths of the inter-relationships between the "whats" and "hows". An average was then taken from among the surveys returned. The new averages of the inter-relationships ratings were then presented to seek the approval of the managing director, in order to render this average as factual. Once these ratings were keyed in to the QFD/CAPTURE^{TM} software, the software automatically prioritised the key business processes ("hows") in order of importance, according to the capability of the individual business process to meet the requirements of the "whats", which were already rated in importance. Therefore, the more relevant the business process was in meeting the requirements of the higher ranked "whats", the higher was the business process on the prioritised list.

7.2.5 Results Of QFD eMatrix I

The top three critical business processes from this first round of prioritisation can be seen in Table 7.3 with "delivery" attaining 9.0%, "customer satisfaction" getting 8.8% and "scheduling" with 7.3%. It was clear that these three business processes were critical in meeting the requirements of the top three ranked "whats" identified earlier. Figure 7.2 shows Atlas's QFD eMatrix I.

7.2.6 Establishing the "whats" in QFD eMatrix II

The "whats" inputted into the QFD eMatrix II were a direct transfer from the results of QFD eMatrix I. The important point to note was that the prioritised scores of the business processes from QFD eMatrix I were entered as the rating scores for the business processes, as the business processes are now deployed to function as the "whats" in QFD eMatrix II.

7.2.7 Establishing the list of e-business applications ("hows" in QFD eMatrix II)

For the purpose of further evaluating the selection framework, the list of potential e-business applications was generated through:

- The understanding of key processes required to undergo change for the organisation to embrace e-business
- The researcher's knowledge and interpretation of e-business applications in the printing industry
- From the case study itself, as there could be suggestions about the e-business applications the organisation was considering bringing aboard

This list of e-business applications, "hows" in QFD eMatrix II, can be seen in Table 7.2.

7.2.8 Completing QFD eMatrix II

At this step the researcher needed to establish a definition of what the strengths of the inter-relations would mean in the case of Atlas, so as to be applied in QFD eMatrix II. These definitions were conveyed to the senior managers as the managers were again asked to define the inter-relationships between the prioritised business processes and the e-business applications. A score of 9 was

determined to be critical and should be implemented immediately, 3 as in moderately critical and should ideally be implemented within the next twelve months while 1 would signify that the e-business application was not important but should be kept under consideration and for future review. "No entry" would signify that the e-business application should not be implemented at all with regards to improving the listed business processes.

7.2.9 Identification of critical e-business applications from eMatrix II

The ratings were entered into the QFD/CAPTURE^{TM} software and the relationships between the business processes and the potential e-business applications were calculated and displayed as a prioritised list. Table 7.4 shows the three most critical and feasible potential e-business applications identified by the selection framework in the context of Atlas's case study with "order tracking" attaining 12.2%, "CRM (customer relationship management)" getting 10.6% and "auto replenishments" with 8.5%. The QFD eMatrix II for Atlas can also be seen in Figure 7.3 below.

A presentation was done and a report submitted at this stage to Atlas management for final fact-checking and to seek approval to use the information for the purpose of academic research. This was to provide triangulation of results from the case study as well as to meet ethical requirements imposed upon the researcher.

Table 7.2: List of factors inputted into the eMatrices (Atlas)

QFD eMatrix I "whats"	QFD eMatrix I "hows"	QFD eMatrix II "hows"
Financial: o Variable costs control o Profit growth o Sales growth o Profit margin o Fixed costs growth **Customer:** o Before-sales services from a survey o After-sales services from survey o Customer retention o Customer satisfaction o On-time delivery o Innovative solutions o Co-operative projects	**Logistics (Inbound/Outbound):** o Inventory management o Delivery **Operations:** o Scheduling o Design o Corrugating o Moulding o Die-cutting o Type-setting o Printing o Binding/ folding/ gluing/ stitching o Packaging for delivery	**Logistics (Inbound/Outbound):** o Auto-replenishment system o Computerised logistic management o Order tracking **Operations:** o Graphic design o Online verification of design o Online design customisation o Advance machinery o Content management service (website)

○ Customer complaints ○ Sole or preferred supplier from a survey **Business Process:** ○ Bench-marking with key competitors ○ Schedule planning ○ Operation efficiency ○ Stock availability ○ Machine downtime ○ Production cycle time ○ Rejections ○ Wastage ○ Unit cost **Innovation and Growth:** ○ New account opened ○ Development time invested to Next Generation products ○ New product introductions ○ Staff satisfaction from a survey ○ Training investment ○ Value-adding time	**Marketing and Sales:** ○ Advertising ○ Appointments ○ Quotation ○ Accounting ○ Sample products **Service:** ○ Before-sales services ○ After-sales services ○ Customer complaints ○ Customer satisfactions **Supporting:** ○ Purchasing ○ Finance checks on potential customers ○ Payment collections ○ Training and education ○ Employee performance measurement – bonus ○ Company performance measurement – bonus	**Marketing and Sales:** ○ Online quotation ○ News bulletin board ○ e-Newsletter ○ Online ordering ○ Online transaction ○ e-Auction **Service:** ○ e-Catalogue ○ Online sourcing **Supporting:** ○ ERP (Enterprise Resources Planning) ○ CRM (Customer Relationship Management) ○ Online customer survey – feedback form ○ e-Learning

Table 7.3: Atlas Top 3 Business Processes (Results from QFD eMatrix I)

Score	364.3	353.3	295.3
Percentage	9.0%	8.8%	7.3%
Business Processes	Delivery	Customer Satisfaction	Scheduling

Table 7.4: Atlas Top 3 Critical e-Business Applications (Results from QFD eMatrix II)

Score	260.5	225.3	179.8
Percentage	12.2%	10.6%	8.5%
e-Business Applications	Order Tracking	CRM (Customer Relationship Management)	Auto Replenishments

Figure 7.2: Atlas's QFD eMatrix I

Figure 7.3: Atlas's QFD eMatrix II

Legend (Standard 9-3-1): Strong ● 9.0, Moderate O 3.0, Weak ▽ 1.0
Max = 12.2, Min = 0.9 (HOWs); Max = 9.0, Min = 0.2 (Importance)

HOWs (columns): 1 Logistics (Inbound/Outbound); 2 Auto-replenishment system; 3 Computerised logistic management; 4 Order tracking; 5 Operations; 6 –; 7 Graphic design; 8 Online verification of design; 9 Online design customisation; 10 Advance machinery; 11 Content management service (website); 12 Marketing and Sales; 13 –; 14 Online quotation; 15 News bulletin board; 16 e-Newsletter; 17 Online ordering; 18 Online transaction; 19 e-Auction; 20 Service; 21 –; 22 e-Catalogue; 23 Online sourcing; 24 Supporting; 25 –; 26 ERP (Enterprices Resources Planning); 27 CRM (Customer Relationship Management); 28 Online customer survey - feedback form; 29 e-Learning

#	WHAT (Importance of the WHATs)	Importance	Relationships (col: symbol)	Overall Importance	Percent Importance
1	Logistics (Inbound/Outbound):				
2	Inventory Management	209.5	2:O 3:O 4:● 11:▽ 17:▽ 18:▽ 22:▽ 27:▽ 28:O 29:▽	209.5	5.2
3	Delivery	384.3	2:O 3:O 4:O 17:▽ 18:▽ 19:▽ 28:O	384.3	9.0
4					
5	Operations:				
6	Scheduling	295.3	2:▽ 3:▽ 4:O 11:▽ 17:▽	295.3	7.3
7	Design	127.9	7:O 8:O 9:O 10:O 11:O 22:O	127.9	3.2
8	Corrugating	229.2	2:▽ 3:▽ 4:O 9:O 14:▽ 23:▽	229.2	5.7
9	Moulding	105.3	2:▽ 3:▽ 4:O 7:O 8:O 9:O 10:O 11:O 22:▽ 23:▽	105.3	2.6
10	Die-cutting	111.0	2:▽ 3:▽ 4:O 7:O 8:▽ 9:▽ 10:O 23:▽	111.0	2.8
11	Type-setting	119.8	2:▽ 3:▽ 4:O 7:▽ 8:▽ 9:▽ 10:O 23:▽	119.8	3.0
12	Printing	167.2	2:▽ 3:▽ 4:O 7:O 8:O 9:O 10:O 11:O 22:▽ 23:▽ 28:▽	167.2	4.2
13	Binding/ folding/ gluing/ stitching	121.1	2:▽ 3:▽ 4:O 7:▽ 10:O 23:▽	121.1	3.0
14	Packaging for delivery	84.5	2:O 3:O 4:O 7:▽ 8:▽ 9:▽ 22:▽ 23:▽ 28:▽	84.5	2.1
15		6.9		6.9	0.2
16	Marketing and Sales:				
17	Advertising	14.2	7:▽ 8:▽ 9:▽ 10:▽ 11:O 14:▽ 15:O 16:O 17:▽ 22:● 23:▽	14.2	0.4
18	Appointments	154.7	27:●	154.7	3.8
19	Quotation	158.5	2:▽ 3:▽ 10:▽ 14:O 17:▽ 18:▽	158.5	3.9
20	Accounting	25.4	14:O 17:O 18:O	25.4	0.8
21	Sample products	72.4	7:O 8:O 9:O 10:O 11:O 22:O 23:O 28:O	72.4	1.8
22					
23	Service:				
24	Before-sales services	140.1	7:O 8:O 9:O 10:O 11:O 14:O 15:▽ 16:▽ 18:▽ 19:▽ 22:▽ 23:▽ 28:O	140.1	3.5
25	After-sales services	240.8	2:▽ 3:▽ 4:▽ 7:O 8:O 9:O 10:O 11:O 14:O 28:O	240.8	6.1
26	Customer complaints	279.9	2:O 3:O 4:O 7:▽ 8:▽ 9:▽ 11:▽ 22:▽ 23:▽ 27:● 28:O	279.9	7.0
27	Customer satisfactions	353.3	2:O 3:O 4:O 7:O 8:O 9:O 10:O 11:O 14:O 15:▽ 16:▽ 17:O 18:O 19:▽ 22:O 23:O 27:● 28:O	353.3	8.8
28					
29	Supporting:				
30	Purchasing	174.8	2:● 3:O 4:O 14:O 17:O 18:O 19:▽ 22:▽ 23:O 28:▽	174.8	4.3
31	Finance checks on potential customers	20.5	27:▽ 28:▽	20.5	0.5
32	Payment collections	98.0	3:▽ 7:O 8:O 9:O 10:O 11:O 14:O 17:O 18:O 28:O	98.0	2.4
33	Training and education	109.8	4:O 26:O 27:O 28:O 29:O	109.8	2.7
34	Employee performance measurement - bonus	112.4	2:▽ 3:▽ 4:O 14:O 15:▽ 16:▽ 17:▽ 18:▽ 19:▽ 22:▽ 23:▽ 26:▽ 27:O 28:O 29:O	112.4	2.8
35	Company performance measurement - bonus	125.0	2:▽ 3:▽ 4:O 14:O 15:▽ 16:▽ 17:▽ 18:▽ 19:▽ 22:▽ 23:▽ 26:▽ 27:O 28:O 29:O	125.0	3.1

Importance of the HOWs (Max = 12.2, Min = 0.9):

Col	2	3	4	7	8	9	10	11	14	15	16	17	18	19	22	23	27	28	29
Importance	179.6	153.8	260.5	121.2	112.7	112.7	152.5	110.6	107.1	19.2	19.2	85.9	76.0	31.5	79.2	84.7	225.3	150.7	25.9
Percent Importance	8.5	7.2	12.2	5.7	5.3	5.3	7.2	5.2	5.0	0.9	0.9	4.0	3.6	1.5	3.7	4.0	10.6	7.1	1.2

7.3 Case study 2: Fun Press Private Limited, Singapore

A similar case study report was presented to the management of Fun Press for fact-checking and approval for use. The management also noted that the top three most critical e-business application recommendations provided by the report were suitable and able to assist Fun Press in meeting their immediate needs.

7.3.1 Company background

Three friends came together after graduation from the Nanyang Technological University of Singapore to set up Fun Press Private Limited in 2001. The aim of the company is "to become the market leader in personalised printing by providing excellent quality products with the shortest turnover time together with superior service to satisfy the customers as a one-stop printing solution provider". Fun Press is the holding company for Twigmedia, set up in 2001, and Touch and Print Hougang, through the acquisition of a retail shop of the "Touch and Print" franchise in early 2003.

Fun Press provides a wide variety of products for both retail and corporate printing needs, with each accounting for 50% of the business's turnover. Their products include large format printings including banners, wall displays and stage backdrop productions from Twigmedia and the printing of T-shirts, CD designs, mugs, plates, mouse pads, plaques, candles, calendars, button badges and 3D mats through Touch and Print.

The set-up of the company can be considered as relatively high-tech, although with no formal training procedures for its employees. Compared with key competitors, Fun Press is the technology leader in terms of software engaged in the production cycle. Fun Press's main selling point is being the company in the industry with the fastest production turnover time for sales orders, in as fast as half an hour at some instances to a maximum of four days for more complicated productions. According to a survey done by the managing director of Fun Press and disclosed during the interview, Fun Press is currently ranked fourth in this niche market, in terms of sales turnover.

Fun Press has a very informal organisational structure with no documentation apart from simple balance sheets. The organisational structure of Fun Press is very flat

with a two-layer arrangement. There are four functional sections at Fun Press, with a combined staff of 8 as of June 2003. All the functional areas are of a one-tier structure with personnel taking up the position of managers except for production operation, where a designer and two production workers make up the second-tier in the functional area. The four functional areas and the breakdown of staff strength are as in Table 7.5.

Table 7.5: Breakdown of staff strength (Fun Press)

Functional Area	No. of staff
Accounts/Administration/Human Resource	01
Marketing	02
Production Operation	04
Purchasing	01

7.3.2 Generating the BSC of Fun Press ("whats")

The first step of the selection framework was to establish the company's BSC for the purpose of generating a list of "whats" for QFD eMatrix I. A series of interviews were carried out with senior managers in order to gather information for the establishment of Fun Press's BSC. The vision of Fun Press was clearly stated during the interviews as "to become the market leader in personalised printing by providing excellent quality products with the shortest turnover time together with superior service to satisfy the customers as a one-stop printing solution provider", providing a straight-forward starting point to the establishment of a BSC for Fun Press.

During the interviews, only one strategy was listed by the senior managers in assisting the company to achieve this vision:

1. To achieve a market growth (by 100% of current sales figure).

As Fun Press was still a very young company, sales figures were currently growing at a rather high rate, at an estimated monthly value of 10% to 20%. Ideally, Fun Press was also looking at market share expansion. However, due to loan repayments in its portfolio and limited cash, Fun Press management expressed difficulty with investing on new outlets at the current moment.

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<u>The financial perspectives</u>

In order to support the market growth strategy, a series of objectives were highlighted during the interviews. From the financial perspectives, a number of performance measurement techniques that would allow the company to keep track of its progress towards achieving the main strategy were identified. Gathered from evidence noted from the interviews, it was possible to highlight that the following objectives from the financial perspectives could be set and measured to serve this intention of performance progress tracking:

- High profit growth (at 40%)
- High sales growth (at 100%)
- Increasing volume profit (at 20%)
- Low fixed costs growth (at 5%-10%)
- Low unit costs (limit to 50% of selling price)

<u>The customer perspectives</u>

Fun Press is seeking to concentrate on the customer intimacy preference at the customer perspectives level of the BSC. The managers divulged this selection during their interview sessions. This preference was further triangulated during the observations on their business operations with sales personnel taking time and effort to fully understand the customers' requirements before suggesting any solutions that Fun Press was able to provide. Managers also underlined the importance to understand the customers in order to provide the customers with superior products and services. The management of Fun Press stressed that they should strive to exceed what customers were asking for, always and every time.

The interviews with senior managers provided the researcher with a list of measurable objectives that coincided with Kaplan and Norton's (2000) customer intimacy performance measurements. The list of performance objectives engaged in Fun Press's customer perspectives in the BSC is as follows:

- Excellent brand image
- Excellent brand recognition
- High customer retention rate (at 100%)
- High customer satisfaction rate (at 100%)
- High rate of on-time delivery (at 100%)

- Increasing number of co-operative projects (at least 1 project per month)

The internal business process perspectives

At the internal business process perspectives level, the researcher initially identified the main business processes in Fun Press through observations. This information was further refined and triangulated through additional information gathered from the interviews with senior managers. The business processes were categorised through engaging the VCA and its generic business processes of inbound logistics, operations, sales/marketing, outbound logistics and support services.

Before the confirmation of a sales order, inventory levels of material required for the batch job will be determined to provide the client with an accurate delivery date. Once confirmed, purchase orders will be made to either produce the final good or to replenish the stock levels. The production/operations cycle of the batch job will commence with designing through the use of computer software, which may also include scanning, sizing and colouring the design for confirmation by the client. The batch job are then printed and quality-checked before being packaged for delivery. Some jobs may also require the product to be mounted on stands or wooden boards, for example banners or display boards, thus requiring cutting/sawing, and/or binding/folding/gluing/stitching activities. Depending on prior arrangements, the client may pick up the products from Fun Press or that the products will be delivered by one of the managers. The products are payable upon collection or delivery.

When these main business processes were identified, the researcher was able to further identify the key business processes that Fun Press would have to excel at to meet its vision, aims and objectives. To measure the performance of these key business processes, the following list of objectives must be included at this level of Fun Press's BSC:

- Excellent results when bench-marking with key competitors (performance to be within +/-5% of key competitors)
- Excellent schedule planning
- High rate of operation efficiency

- High rate of stock availability (at 99.9%)
- Low production cycle time
- Low rate of wastage (at 0%)
- Low rate of rejections (at 0%)
- Sustained product quality (at 100%)

The innovation and growth perspectives

It was important for Fun Press to plan and provide for sustained growth and ongoing innovation, in order to enable itself to meet its long-term objectives. Fun Press would have to, through the innovation and growth perspectives of its BSC, allow the identification of current gaps, especially in terms of technology and employee skills, that would need to be bridged.

Fun Press would also have to measure the performance of the objectives from the innovation and growth perspectives to determine if the company was improving in relation to the objectives set for the company. Again, with information gathered through interviews with senior managers, the following objectives were identified:

- High number of outlets opened (with 1 new outlet yearly)
- High rate in speed of innovation (with 1 new product every month)
- High rate of training investment (at 10% of total man-hours)
- Technology leadership

The BSC created in Fun Press's context can be seen in Figure 7.4. The list of "whats" generated from the BSC for Fun Press's QFD eMatrix I are listed in Table 7.6. At this stage, the senior managers were asked to look at the list of "whats" to determine if this was consistent with the information they had provided during the interview and if there were any other factors to be added.

Figure 7.4: Balanced Scorecard (Fun Press) – based on case study analysis

Vision: Market leader in one-stop printing solution provider in personalised printing

To achieve a market growth (100% of current sales figure)

| Financial Perspective | Fixed Costs Growth | Profit Growth | Sales Growth | Volume Profit | Unit Cost |

Customer Perspective — Customer Intimacy: Customer Satisfaction, Brand Image, On-time Delivery, Number of Co-operative Projects With Customers, Customer Retention, Brand Recognition

Business Process Perspectives: Production Cycle Time, Operation Efficiency, Sustained Product Quality, Bench-marking with competitors, Schedule Planning, Rejections, Wastage, Stock Availability

Innovation and Growth Perspectives: Speed of innovation, Technology leadership, Outlets Opened, Training Investments

Rating and inputting the "whats" of Fun Press's QFD eMatrix I

Once the list of needs was prepared and determined from Fun Press's BSC, surveys were carried out of senior managers, staff representatives and key customers to rate the "whats". Senior managers would be able to rate the needs in accordance with the company's internal needs as well as on their perceptions of external requirements. Staff representatives, on the other hand, provided further confirmation of the views from senior managers. Survey ratings completed by key customers would provide the research project with external views of the requirements to allow the rating to be more robust. Another key reason was that the perceived internal views of external needs were often not as exact as the real views of the needs from the customers themselves. Key customers were also requested to add any other factors that they deemed important for meeting their requirements of Fun Press.

The ratings were made on a scale of 1 to 10. The "whats" deemed most important were awarded the highest points of 10, and the lower scores were given to the "whats" that were felt to be of lesser importance. It was acknowledged that in relation to Fun Press, the "whats" with the highest score, 9.8 out of 10, was "high profit growth", followed by "sustained product quality" with a score of 9.4 and "high percentage of on-time delivery" and "number of outlets opened" with a score of 9.0.

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The detailed ratings can be seen in Appendix III. It must be emphasised that this rating was the result of an average taken from the survey results obtained from Fun Press senior managers, staff representatives and customer representatives.

This average rating was required as the various managers, staff representatives and different types of customers tend to place different levels of emphasis on various areas of the business and/or have different requirements, thus resulting in a variety of ratings.

7.3.3 Generating the key business processes of Fun Press with the VCA ("hows")

Once the "whats" for QFD eMatrix I were identified, the next step was the identification of "hows" for QFD eMatrix I, which was to be developed from the VCA. Using the VCA, the researcher was able to categorise the business processes of Fun Press into five main categories under the headings of "logistics", "operations", "marketing and sales", "services" and "supporting". Within each category, the key critical value-adding business processes were further identified through interviews with the senior managers and staff representatives of Fun Press. This information was further triangulated through observations on the day-to-day business processes carried out by personnel in the company. A complete list of the key business processes is shown in Table 7.6, "QFD eMatrix I, "hows"".

7.3.4 Completing QFD eMatrix I

In this step, the list of "whats" and "hows" as generated in sections 7.3.2 and 7.3.3, were entered into the QFD eMatrix I. The senior managers of Fun Press were asked to fill in the ratings in determining the strengths of the inter-relationships between the "whats" and "hows". An average was then taken from among the surveys returned. This new average of the inter-relationships rating was then presented to seek the approval of the general manager, in order to render this average as factual. Once these ratings were keyed in to the QFD/CAPTURE™ software, the software automatically prioritised the key business processes ("hows") in order of importance, according to the capability of the individual business process to meet the requirements of the "whats", which were already rated in importance. Therefore, the more relevant the business process was in meeting the requirements of the higher ranked "whats", the higher the business process would be on the prioritised list.

7.3.5 Results Of QFD eMatrix I

The top three critical business processes from this first round of prioritisation can be seen in Table 7.7 with "quality check" attaining 8.7%, "customer satisfaction" getting 7.7% and "printing" with 6.6%. It was clear that these three business processes were critical in meeting the requirements of the top four ranked "whats" identified earlier. Fun Press's QFD eMatrix I is shown in Figure 7.5.

7.3.6 Establishing the "whats" in QFD eMatrix II

The "whats" inputted into the QFD eMatrix II were a direct transfer from the results of QFD eMatrix I. The important point to note was that the prioritised scores of the business processes from QFD eMatrix I were entered as the rating scores for the business processes, as the business processes are now serving the function of "whats" in QFD eMatrix II.

7.3.7 Establishing the list of e-business applications ("hows" in QFD eMatrix II)

For the purpose of further evaluating the selection framework, the list of potential e-business applications was generated through:

- The understanding of key processes required to undergo change for the organisation to embrace e-business
- The researcher's knowledge and interpretation of e-business applications in the printing industry
- From the case study itself, as there could be suggestions as to the e-business applications the company was considering bringing aboard

This list of e-business applications, "hows" in QFD eMatrix II, can be seen in Table 7.6.

7.3.8 Completing QFD eMatrix II

At this step the researcher needed to establish a definition of what the strengths of the inter-relations would mean in the case of Fun Press, so as to be applied in QFD eMatrix II. These definitions were conveyed to the senior managers as the managers were again asked to define the inter-relationships between the prioritised business processes and the e-business applications. A score of 9 was determined to be critical

and should be implemented immediately, 3 as in moderately critical and should ideally be implemented within the next twelve months while 1 would signify that the e-business application was not important but should be kept under consideration and for future review. "No entry" would signify that the e-business application should not be implemented at all with regards to improving the listed business processes.

7.3.9 Identification Of Critical e-Business Applications From eMatrix II

The ratings were entered into the QFD/CAPTURE[TM] software and the relationships between the business processes and the potential e-business applications were calculated and displayed as a prioritised list. Table 7.8 shows the three most critical and feasible potential e-business applications identified by the selection framework in the context of Fun Press's case study with "online customer survey – feedback form" attaining 10.8%, "e-catalogue" getting 10.7%, and "CRM (customer relationship management)" with 10.2%. The QFD eMatrix II for Fun Press can also be seen in Figure 7.6 below.

A presentation was done and a report submitted at this stage to Fun Press management for final fact-checking and to seek approval in order to use the information for the purpose of academic research. This was to provide triangulation of results from the case study as well as to meet ethical requirements imposed upon the researcher.

Table 7.6: List of factors inputted into the eMatrices (Fun Press)

QFD eMatrix I "whats"	QFD eMatrix I "hows"	QFD eMatrix II "hows"
Financial: o Fixed costs growth o Profit growth o Sales growth o Unit costs o Volume profit **Customer:** o Brand image o Brand recognition o Customer retention o Customer satisfaction o Number of co-operative projects o On-time delivery	**Logistics (Inbound/Outbound):** o Inventory management o Delivery **Operations:** o Design o Sizing o Colour o Scanning o Printing o Cutting/ Sawing o Binding/ folding/ gluing/ stitching o Quality check o Packaging for delivery	**Logistics (Inbound/Outbound):** o Auto-replenishment system o Computerised logistic management o Order tracking

Business Process:	Marketing and Sales:	Operations:
o Bench-marking with key competitors o Operation efficiency o Production cycle time o Rejections o Schedule planning o Stock availability o Sustain product quality o Wastage **Innovation and Growth:** o Outlets opened o Speed of innovation o Technology leadership o Training investment	o Advertising o Appointments o Quotation o Accounting o Sample products **Service:** o Before-sales services o After-sales services o Customer complaints o Customer satisfactions **Supporting:** o Purchasing o Payment collections o Training and education o Employee performance measurement – bonus	o Graphic design o Online verification of design o Online design customisation o Advance machinery o Advance software o Content management service (website) **Marketing and Sales:** o Online quotation o News bulletin board o e-Newsletter o Online ordering o Online transaction o e-Auction **Service:** o e-Catalogue o Online sourcing **Supporting:** o ERP (Enterprise Resources Planning) o CRM (Customer Relationship Management) o Online customer survey – feedback form o e-Learning

Table 7.7: Fun Press Top 3 Business Processes (Results from QFD eMatrix I)

Score	476.5	422.7	362.4
Percentage	8.7%	7.7%	6.6%
Business Processes	Quality Check	Customer Satisfaction	Printing

Table 7.8: Fun Press Top 3 Critical e-Business Applications (Results from QFD eMatrix II)

Score	101.9	101.3	95.9
Percentage	10.8%	10.7%	10.2%
e-Business Applications	Online Customer Survey – Feedback Form	e-Catalogue	CRM (Customer Relationship Management)

Figure 7.5: Fun Press's QFD eMatrix I

Legend:
- Strong ● 9.0
- Moderate ○ 3.0
- Weak ▽ 1.0
- Standard 9-3-1

WHATs — Importance and Overall/Percent Importance

#	WHAT	Importance of the WHATs	Overall Importance (Max = 54)	Percent Importance (Min = 37)
2	Financial: Fixed costs growth	8.4	8.4	4.8
3	Profit growth	9.8	9.8	5.4
4	Sales growth	6.8	8.8	4.8
5	Unit costs	8.4	8.4	4.6
6	Volume profit	8		
9	Customer: Brand image	7.7	7.7	4.2
10	Brand recognition	8.0	8.0	4.4
11	Customer retention	8.4	8.4	4.6
12	Customer satisfaction	8.7	8.7	4.8
13	Number of co-operative projects	7.4	7.4	4.1
14	On-time delivery	9.0	9.0	5.0
17	Business Process: Bench-marking with key competitors	7.7	7.7	4.2
18	Operation efficiency	8.5	8.5	4.7
19	Production cycle time	9.8	9.8	4.8
20	Rejections	7.5	7.5	4.1
21	Schedule planning	6.8	6.8	3.7
22	Stock availability	7.7	7.7	4.2
23	Sustained product quality	9.4	9.4	5.2
24	Wastage	7.5	7.5	4.1
27	Innovation and Growth: Outlets opened	9.0	9.0	5.0
28	Speed of innovation	7.8	7.8	4.3
29	Technology leadership	8.0	8.0	4.4
30	Training investments	8.5	8.5	4.7

HOWs — Importance (Max = 87, Min = 14)

HOW #	HOW	Importance of the HOWs	Percent Importance of the HOWs
2	Logistics (Inbound/Outbound): Inventory Management	258.4	4.7
3	Delivery	192.0	3.5
6	Operations: Design	356.2	6.5
7	Sizing	231.2	4.2
8	Colour	300.3	5.5
9	Scanning	168.6	3.1
10	Printing	362.4	6.6
11	Cutting/ Sawing	132.0	2.4
12	Binding/ folding/ gluing/ stitching	125.7	2.3
13	Quality check	476.5	8.7
14	Packaging for delivery	211.7	3.8
17	Marketing and Sales: Advertising	187.0	3.4
18	Appointments	198.0	3.6
19	Quotation	162.7	3.0
20	Accounting	79.8	1.4
23	Service: Before-sales services	288.9	5.2
24	After-sales services	282.3	5.1
25	Customer complaints	270.5	4.9
26	Customer satisfactions	422.7	7.7
29	Supporting: Purchasing	180.7	3.3
30	Payment collections	120.4	2.2
31	Training and education	356.7	6.5
32	Employee performance measurement - commission	144.2	2.6

Figure 7.6: Fun Press's QFD eMatrix II

WHATs	#	Importance of the WHATs	Overall Importance	Percent Importance
Direction of improvement	1			
Logistics (inbound/Outbound):	1			
Inventory Management	2	258.4	258.4	4.7
Delivery	3	192.0	192.0	3.5
	4			
Operations:	5			
Design	6	258.2	258.2	4.6
Sizing	7	231.2	231.2	4.2
Colour	8	300.3	300.3	5.5
Scanning	9	168.6	168.6	3.1
Printing	10	362.4	362.4	6.6
Cutting/ Sawing	11	132.0	132.0	2.4
Binding/ folding/ gluing/ stitching	12	126.7	126.7	2.3
Quality check	13	470.5	470.5	8.0
Packaging for delivery	14	211.7	211.7	3.8
	15			
Marketing and Sales:	16			
Advertising	17	187.0	187.0	3.4
Appointments	18	198.0	198.0	3.6
Quotation	19	162.7	162.7	3.0
Accounting	20	79.8	79.8	1.4
	21			
Service:	22			
Before-sales services	23	288.0	288.0	5.2
After-sales services	24	282.3	282.3	5.1
Customer complaints	25	270.5	270.5	4.9
Customer satisfactions	26	422.7	422.7	7.7
	27			
Supporting:	28			
Purchasing	29	180.7	180.7	3.3
Payment collections	30	120.4	120.4	2.2
Training and education	31	358.7	358.7	6.5
Employee performance measurement - commission	32	144.2	144.2	2.6

Max = 8.5
Percent Importance
Min = 1.4

HOWs (columns):
1 Logistics (Inbound/Outbound):; 2 Auto-replenishment system; 3 Computerised logistic management; 4 Order tracking; 5 Operations:; 6 Graphic design; 7 Online verification of design; 8 Online design customisation; 9 Advance machinery; 10 Advance software; 11 Content management service (website); 12 Marketing and Sales:; 13 Online quotation; 14 News bulletin board; 15 e-Newsletter; 16 Online ordering; 17 Online transaction; 18 e-Auction; 19 Service:; 20 e-Catalogue; 21 Online sourcing; 22 Supporting:; 23 ERP (Enterprises Resources Planning); 24 CRM (Customer Relationship Management); 25 Online customer survey - feedback form; 26 e-Learning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Importance of the HOWs		11.5	41.1	67.5			60.8	40.2	27.3	11.3	23.2	58.5			35.2	47.3	87.4	43.5	30.2	6.6			101.3	6.7			11.5	95.9	101.9	37.5
Percent Importance of the HOWs		1.2	4.4	7.2			8.4	4.3	2.9	1.2	2.5	6.0			3.7	5.0	9.3	4.6	3.2	0.7			10.7	0.7			1.2	10.2	10.8	4.0

Max = 10.8
Percent Importance of the HOWs
Min = 0.7

Standard 9-3-1

Strong ● 9.0
Moderate ○ 3.0
Weak ▽ 1.0

7.4 Case study 3: Guangzhou United Printing Company Limited, China

A similar case study report was presented to the management of United for fact-checking and approval for use. The management also noted that the top three most critical e-business application recommendations provided by the report were suitable and able to assist United in meeting their immediate needs.

7.4.1 Company background

Guangzhou United Printing Company Limited was established in 1992 as a Sino-foreign co-operative joint venture, with a vision "to be a one-stop solution medium-sized printer providing friendly, reliable and cost effective printing and design services".

In the past eleven years, United had grown from an initial set up capital of RMB10 thousand (equivalent to about £630) with nine staff, to the current capital base level of RMB10 million (equivalent to about £630,000) with around two hundred staff. Sales figures had also grown steadily from a monthly figure of RMB1 million (equivalent to about £63,000) in 1992 to the current level of RMB12 million (equivalent to about £756,000) in 2003. In a market with 5,000 other printers in Guangzhou alone, United's success is mainly built around the niche market of being a "product beautician". That is, the production of products packaging.

The company deals with the printing needs of domestic and foreign customers, both public enterprises and private companies. United produces a wide variety of products including colour trademarks, picture brochures, manuals, packing bags, paper boxes, wall calendars and envelopes. United also provides services in printing design, copy and plate-making, paper compression moulding, paper mounting and cartons.

The company is relatively low-tech and labour intensive in its operations. There is also a lack of formal training procedures and policies for both new and current employees. Over the years, United has been constantly investing in new machinery and equipment, albeit second-hand machinery, to keep abreast with latest technology developments and to improve its productivity, as well as the quality of its products. United started production in 1992 with only one small 1967 Roland, second-hand two-colour printer, but this has now grown to the current impressive list of machinery including one large two-colour printer, two large four-colour printers, six moulding machines and four cutting machines. The main investor in United Printing,

HK Luensun Printing Co. Ltd, on the other hand, is famous for its state-of-the-art equipment and technology.

The set-up of United is informal, and being a traditional Chinese family-owned company, much of the company strategies are kept within its top-level management with little or no documentation. In order for the company to achieve the targets, objectives to help achieve these strategies were handed down as tasks from top level management to the managers and employees. There are four main departments at United and the breakdown of staff strength is as in Table 7.9.

Table 7.9: Breakdown of staff strength (United)

Department	No. of staff
Accounts/Administration/Human Resource	18
Marketing/ Sales	09
Production	160
Design	04

7.4.2 Generating the BSC of United ("Whats")

The first step of the selection framework was to establish the company's BSC for the purpose of generating a list of "whats" for QFD eMatrix I. A series of interviews were carried out with senior managers in order to gather information for the establishment of United's BSC. Firstly, the vision of United was stated as seeking to be "a one-stop solution medium-sized printer providing friendly, reliable and cost effective printing and design services".

During the interviews, three main strategies for 2003 were listed by the senior managers that would enable the company to move closer to its vision. The strategies were prioritised as:

1. To pay government taxes on time.
2. To pay all wages on time.
3. To increase shareholders' dividends (target is by 10%-20%).

The reasons behind the formulation and prioritisation of the three strategies were clearly explained by the senior managers. It was stated that in order to achieve the company vision, United must pay up government taxes on time, for failing to do so will be detrimental to United's reputation, as well as not being able to carry out daily

normal operations due to undue influence and action by the authority. As a very traditional family-owned company, United firmly believes that the loyalty of the employees comes before the amount of dividends received by shareholders. Therefore, United places a higher importance on paying employee wages on time, thus spurring its employees to work for the betterment of United and to provide friendly and reliable services to its customers.

The financial perspectives

In order to support the three strategies listed above, a series of objectives were highlighted during the interviews. From the financial perspectives, a number of performance measurements would enable the company to keep track of its progress towards achieving these strategies. Gathered from evidence noted from the interviews, it was possible to highlight that the following objectives from the financial perspectives could be set and measured to serve this intention of performance progress tracking. The list of measurable objectives from the financial perspectives was as follows:

- Excellent variable costs control (limiting variable costs growth to 5%-10%)
- High profit growth (by 20%-30%)
- High sales growth (by 20%-30%)
- Increasing profit margin (by 10%-20%)
- Low fixed costs growth (limiting fixed costs growth to 5%-10%)

The customer perspectives

United seeks to concentrate on the customer intimacy preference at the customer perspectives level of the BSC. This preference was highlighted during the interviews with senior managers emphasising the importance of understanding the customers and providing them with superior products and services. Besides providing reliable and quality printing services, managers at United believed that customer loyalty is based hugely on the affability of their relations. In China, the strengths of this friendliness play a huge role in customer satisfaction and retention.

The interviews with senior managers also highlighted a series of measurable objectives that coincided with Kaplan and Norton's (2000) customer intimacy

performance measurements. The list of performance objectives in the customer perspectives for United was as follows:

- Excellent after-sales services from a survey
- Excellent before-sales services from a survey
- Excellent brand image
- High customer retention rate (at 100%)
- High customer satisfaction rate (at 100%)
- High rate of on-time delivery (at 100%)
- Low number of customer complaints (at 0%)
- Sole or preferred supplier from a survey

The internal business process perspectives

At the internal business process perspectives level, the researcher first had to identify the main business processes in United. The identification of these business processes was assisted through engaging the VCA and its generic business processes of inbound logistics, operations, sales/marketing, outbound logistics and support services. .

With the receipt of a sales order, purchase orders will be made for material purchase and work schedules will be worked out for both man-hours and machinery loading times. For the production of moon cake packaging boxes, the involvement of the Design department will be dependent if a new design is required by the client. In which case, the designers engage the use of specialised design software together with scanning, sizing and colouring the design. Once the design is approve by the customer, the next stage would be film production for the purpose of printing.

The production cycle of the job starts with the cutting of the paper, follow by the type-setting activities of the printer. Once printing is completed, further cutting may be required or moulding of the printed paper will take place. The final stage of the production cycle is a very labour-intensive activity including may include binding, folding, gluing and the stitching of the paper, before being packaged for delivery. Upon the delivery of the product, Accounts will despatch a notice for payment.

Once these main business processes were identified, the researcher was able to further identify the key business processes that United would have to excel to meet its vision, aims and objectives. To measure the performance of these key business processes, the following list of objectives must be included at this level of United's BSC:

- Excellent results when bench-marking with key competitors (performance to be within 5% of key competitors)
- Excellent schedule planning
- High rate of operation efficiency
- High rate of stock availability (at 95%)
- Low hours of machine downtime (at 1% of total man-hours)
- Low production cycle time
- Low rate of rejections (at 0%)
- Low rate of wastage (at 0%)
- Low unit cost

The innovation and growth perspectives

It is important for United to plan and provide for sustained growth and ongoing innovation, in order to enable itself to meet its long-term objectives. United would, through its innovation and growth perspectives of the BSC, allow the identification of current gaps especially in terms of technology and employee skills that needed to be bridged.

United would also have to measure the performance of the objectives from the innovation and growth perspectives to determine if the company was improving in relation to the objectives. Again, through documentation and interviews with senior managers, the following objectives were identified:

- High number of new accounts opened (a minimum of 1 new account bi-monthly)
- High rate of staff satisfaction as rated in a staff survey (at 100%)
- High rate of training investment (at about 1%-2% of total man-hours)
- High rate of value-adding time (at 99% of total man-hours)

The BSC created in United's context can be seen in Figure 7.7. The list of "whats" generated from the BSC for United's QFD eMatrix I are listed in Table 7.10.

Figure 7.7: Balanced Scorecard (United) – based on case study analysis
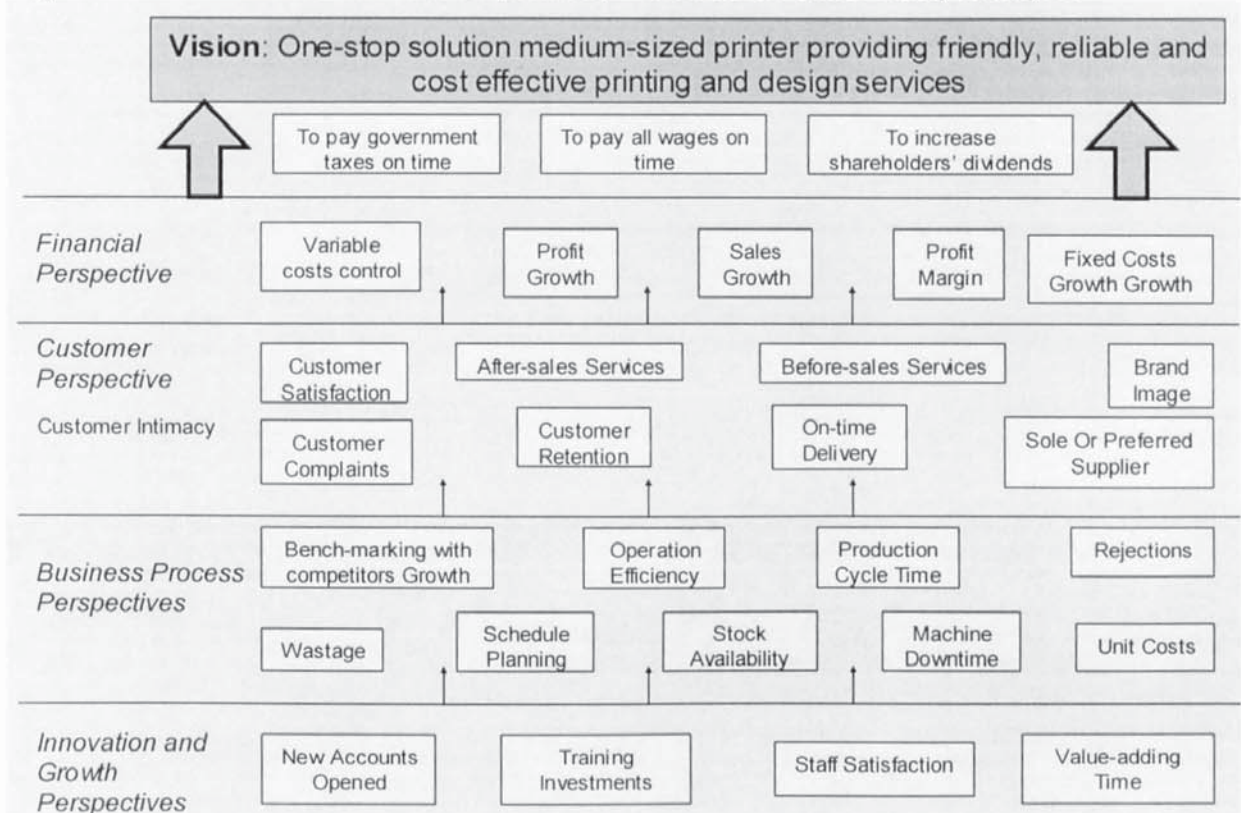
Rating and inputting the "whats" of United's QFD eMatrix I

Once the list of needs was prepared, finalised and determined from United's BSC, surveys were carried out of senior managers, staff representatives and key customers to rate the "whats". Senior managers would be able to rate the needs in accordance to internal needs as well as their perceptions on external requirements. Staff representatives on the other hand would be providing further confirmation of the views from senior managers. Survey ratings completed by key customers would provide the research project with external views of the requirements to allow the rating to be more robust. Another key reason was that the perceived internal views of external needs were often not as exact as the real views of the needs from the customers themselves. Key customers were also requested to add any other factors that they deemed important for meeting their requirements of United.

The ratings were done on a scale of 1 to 10. The "whats" deemed most important were awarded the highest points of 10, and the lower scores were given to the "whats" which were felt to be of lesser importance. The "whats" with the highest score was "high customer retention rate', '"high customer satisfaction rate" and "high operation efficiency rate", all sharing a rating of 9.6 out of 10. The detailed ratings can be seen in Appendix IV.

It must be emphasised that this rating was the result of an average taken from the survey results obtained from senior managers, staff representatives and customer representatives. This average rating was required because the various managers, staff representatives and different types of customers would place different levels of emphasis on various areas of the business and/or have different requirements, thus resulting in a variety of ratings.

7.4.3 Generating the key business processes of United with the VCA ("hows")

Once the "whats" for QFD eMatrix I were identified, the next step was to identify the "hows" for QFD eMatrix I, which needed to be developed from the VCA. Using the VCA, the researcher was able to categorise the business processes of United into five main categories under the headings of "logistics", "operations", "marketing and sales", "services" and "supporting". Within each category, the key critical value-adding business processes were further identified, through data gathering from documentation. This information was further triangulated through interviews with the senior managers and staff representatives of United. A complete list of the key business processes is shown in Table 7.10, QFD eMatrix I, "hows"".

7.4.4 Completing QFD eMatrix I

In this step, the lists of "whats" and "hows" as generated in sections 7.4.2 and 7.4.3 were entered into the QFD eMatrix I. The senior managers of United were asked to fill in the ratings in determining the strengths of the inter-relationships between the "whats" and "hows". An average was then taken from among the surveys returned. The new averages of the inter-relationships ratings were then presented to seek the approval of the general manager, in order to render this average as factual. Once these ratings were keyed in to the QFD/CAPTURE^{TM} software, the software automatically prioritised the key business processes ("hows") in order of importance, according to the capability of the individual business process to meet the requirements of the "whats", which were already rated in importance. Therefore, the more relevant the business process was in meeting the requirements of the higher ranked "whats", the higher was the business process on the prioritised list.

7.4.5 Results of QFD eMatrix I

The top three critical business processes from this first round of prioritisation can be seen in Table 7.11 as "printing" with 6.8%, "quotation" with 6.2% and

"scheduling" with 5.9%. It was clear that these three business processes were critical in meeting the requirements of the top three ranked "whats" identified earlier. Figure 7.8 shows United's QFD eMatrix I.

7.4.6 Establishing the "whats" in QFD eMatrix II

The "whats" inputted into the QFD eMatrix II were a direct transfer from the results of QFD eMatrix I. The important point to note was that the prioritised scores of the business processes from QFD eMatrix I were entered as the rating scores for the business processes as the business processes are now serving the function of "whats" in QFD eMatrix II.

7.4.7 Establishing the list of e-business applications ("hows" in QFD eMatrix II)

For the purpose of further evaluating the selection framework, the list of potential e-business applications was generated through:

- The understanding of key processes required to undergo change for the organisation to embrace e-business
- The researcher's knowledge and interpretation of e-business applications in the printing industry
- From the case study itself, as there could be suggestions as to the e-business applications the organisation was considering bringing aboard

This list of e-business applications, "hows" in QFD eMatrix II, can be seen in Table 7.10.

7.4.8 Completing QFD eMatrix II

At this step the researcher needed to establish a definition of what the ratings of strengths would mean in the case of United, so as to be applied in QFD eMatrix II. These definitions were conveyed to the senior managers as the managers were again asked to define the inter-relationships between the prioritised business processes and the e-business applications. A score of 9 was determined to be critical and should be implemented immediately, 3 as in moderately critical and should ideally be implemented within the next twelve months while 1 would signify that the e-business application is not important but should be kept under consideration and for

future review. "No entry" would signify that the e-business application should not be implemented at all with regards to improving the listed business processes.

7.4.9 Identification of critical e-business applications from eMatrix II

The ratings were entered into the QFD/CAPTURE™ software and the relationships between the business processes and the potential e-business applications were calculated and displayed as a prioritised list. Table 7.12 shows the three most critical and feasible potential e-business applications identified by the selection framework in the context of United's case study as "e-learning" with 8.7%, "content management service (website)" with 8.6% and "online quotation" with 8.1%. The QFD eMatrix II for United can also be seen in Figure 7.9 below.

A presentation was done and a report submitted at this stage to United management for final fact-checking and to seek approval for using the information for the purpose of academic research. This was to provide triangulation of results from the case study as well as to meet ethical requirements imposed upon the researcher.

Table 7.10: List of factors inputted into the eMatrices (United)

QFD eMatrix I "whats"	QFD eMatrix I "hows"	QFD eMatrix II "hows"
Financial: o Fixed costs growth o Profit growth o Profit margin o Sales growth o Variable costs control **Customer:** o After-sales services from a survey o Before-sales services from a survey o Brand image o Customer complaints o Customer retention o Customer satisfaction o On-time delivery o Sole or preferred supplier from a survey	**Logistics (Inbound/Outbound):** o Inventory management o Delivery **Operations:** o Scheduling o Design o Film production o Type-setting o Printing o Die-cutting o Moulding o Binding/ folding/ gluing/ stitching o Packaging for delivery **Marketing and Sales:** o Appointments o Quotation o Accounting o Sample products	**Logistics (Inbound/Outbound):** o Auto-replenishment system o Computerised logistic management o Order tracking **Operations:** o Graphic design o Online verification of design o Online design customisation o Advance machinery o Content management service (website)

Business Process:	**Service:**	**Marketing and Sales:**
o Bench-marking with key competitors o Machine downtime o Operation efficiency o Production cycle time o Rejections o Schedule planning o Stock availability o Unit cost o Wastage **Innovation and Growth:** o New account opened o Staff satisfaction from a survey o Training investment o Value-adding time	o Before-sales services o After-sales services o Customer complaints o Customer satisfactions **Supporting:** o Purchasing o Payment collections o Training and education o Employee performance measurement – bonus o Company performance measurement – bonus	o Online quotation o News bulletin board o e-Newsletter o Online ordering o Online transaction o e-Auction **Service:** o e-Catalogue o Online sourcing **Supporting:** o ERP (Enterprise Resources Planning) o CRM (Customer Relationship Management) o Online customer survey – feedback form o e-Learning

Table 7.11: United Top 3 Business Processes (Results from QFD eMatrix I)

Score	549.8	499.8	480.4
Percentage	6.8%	6.2%	5.9%
Business Processes	Printing	Quotation	Scheduling

Table 7.12: United Top 3 Critical e-Business Applications (Results from QFD eMatrix II)

Score	359.9	355.7	377.8
Percentage	8.7%	8.6%	8.1%
e-Business Applications	e-Learning	Content management service (website)	Online quotation

Figure 7.8: United QFD eMatrix I

HOWs (columns):

1. Logistics (Inbound/Outbound):
2. Inventory Management
3. Delivery
4. Operations
5. Scheduling
6. Design
7. Film production
8. Type-setting
9. Printing
10. Die-cutting
11. Moulding
12. Binding/ folding/ gluing/ stitching
13. Packaging for delivery
14. (Marketing and Sales group)
15. Marketing and Sales
16. Appointments
17. Quotation
18. Accounting
19. Sample products
20. Service:
21. Before-sales services
22. After-sales services
23. Customer complaints
24. Customer satisfactions
25. Supporting:
26. Purchasing
27. Payment collections
28. Training and education
29. Employee performance measurement - bonus
30. Company performance measurement - bonus

Right-hand columns: B = Overall Importance, 9 = Percent Importance (Max = 44, Percent Importance Min = 0.0)

WHATs (rows) — Overall Importance / Percent Importance:

#	WHAT	Overall Importance (B)	Percent Importance (9)
1	Direction of Improvement		
1	Financial		
2	Fixed costs growth	6.8	3.1
3	Profit growth	9.4	4.3
4	Profit margin	9.5	4.3
5	Sales growth	9.5	4.3
6	Variable costs control	6.4	2.9
7			
8	Customer:		
9	After-sales services - in a survey	8.9	4.1
10	Before-sales services - in a survey	8.9	4.1
11	Brand image	8.0	3.0
12	Customer complaints	6.7	3.1
13	Customer retention	9.6	4.4
14	Customer satisfaction	9.6	4.4
15	On-time delivery	9.1	4.2
16	Sole or preferred supplier - in a survey	7.7	3.5
17		0.0	0.0
18	Business Process:		
19	Bench-marking with key competitors	6.8	3.0
20	Machine downtime	7.8	3.6
21	Operation efficiency	9.6	4.4
22	Production cycle time	8.5	3.9
23	Rejections	8.1	3.7
24	Schedule planning	8.3	3.8
25	Stock availability	8.7	4.0
26	Unit cost	8.8	4.0
27	Wastage	8.2	3.7
28		0.0	0.0
29	Innovation and Growth:		
30	New account opened	9.0	4.1
31	Staff satisfaction - in a survey	8.5	3.9
32	Training investments	7.4	3.4
33	Value-adding time	9.5	3.9

Importance of the HOWs / Percent Importance of the HOWs (Max = 6.6, Min = 1.8):

Column	Importance of the HOWs	Percent Importance of the HOWs
2	374.3	4.6
3	393.0	4.9
6	480.4	5.9
7	374.3	4.6
8	236.0	2.9
9	192.5	2.4
10	549.8	6.6
11	383.5	4.7
12	347.9	4.3
13	357.2	4.4
14	357.2	4.4
17	456.2	5.6
18	499.8	6.2
19	387.0	4.8
20	164.0	2.0
23	391.7	4.8
24	429.3	5.3
25	255.1	3.2
26	351.3	4.3
29	419.0	5.2
30	227.6	2.8
31	148.3	1.8
32	186.9	2.3
33	132.2	1.6

Legend (Standard 9-3-1):
Strong ● 9.0
Moderate ○ 3.0
Weak ▽ 1.0

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Figure 7.9: United QFD eMatrix II

Legend (Standard 9-3-1):
- Strong ◆ 9.0
- Moderate ○ 3.0
- Weak ▽ 1.0

Max = 8.7, Min = 1.7 (Percent Importance of the HOWs)
Max = 6.8, Min = 0.0 (Percent Importance of WHATs)

HOW columns (1–29):
1. Logistics (Inbound/Outbound):
2. Auto-replenishment system
3. Computerised logistic management
4. Order tracking
5. Operations:
6. Graphic design
7. Online verification of design
8. Online design customisation
9. Advance machinery
10. Content management service (website)
11. Marketing and Sales
12. —
13. Online quotation
14. News bulletin board
15. e-Newsletter
16. Online ordering
17. Online transaction
18. e-Auction
19. Service
20. —
21. e-Catalogue
22. Online sourcing
23. Supporting
24. —
25. ERP (Enterprise Resources Planning)
26. CRM (Customer Relationship Management)
27. Online customer survey - feedback form
28. e-Learning

WHATs	Importance of the WHATs	Overall Importance	Percent Importance
Direction of Improvement			
Logistics (Inbound/Outbound):			
Inventory Management	374.3	374.3	4.8
Delivery	393.0	393.0	4.9
Operations:			
Scheduling	480.4	480.4	5.8
Design	374.3	374.3	4.8
Film production	236.0	236.0	2.9
Type-setting	192.5	192.5	2.4
Printing	540.8	540.8	6.8
Die-cutting	383.5	383.5	4.7
Moulding	347.0	347.0	4.3
Binding/ folding/ gluing/ stitching	357.2	357.2	4.4
Packaging for delivery	357.2	357.2	4.4
		0.0	0.0
Marketing and Sales:			
Appointments	468.2	468.2	5.8
Quotation	499.8	499.8	6.2
Accounting	387.0	387.0	4.8
Sample products	184.0	184.0	2.0
		0.0	0.0
Service			
Before-sales services	391.7	391.7	4.8
After-sales services	420.3	420.3	5.2
Customer complaints	255.1	255.1	3.2
Customer satisfactions	351.3	351.3	4.3
		0.0	0.0
Supporting:			
Purchasing	419.0	419.0	5.2
Payment collections	227.8	227.8	2.8
Training and education	148.3	148.3	1.8
Employee performance measurement - bonus	185.9	185.9	2.3
Company performance measurement - bonus	132.2	132.2	1.6

Importance of the HOWs (columns 1–29):
132.6, 129.9, 259.8, , , 150.2, 161.4, 147.2, 295.3, 355.7, , , 337.8, 71.8, 165.0, 204.9, 219.5, 226.0, , , 251.2, 282.2, , , 101.2, 104.3, 208.1, 359.9

Percent Importance of the HOWs (columns 1–29):
3.2, 3.1, 6.3, , , 3.6, 3.9, 3.6, 7.1, 8.6, , , 8.1, 1.7, 4.0, 4.9, 5.3, 5.5, , , 6.1, 6.3, , , 2.4, 2.5, 5.0, 8.7

7.5 Case study 4: Shandong Xunda Print Company Limited, China

A similar case study report was presented to the management of Xunda for fact-checking and approval for use. The management also noted that the top three most critical e-business applications recommendations provided by the report were suitable and able to assist Xunda in meeting their immediate needs.

7.5.1 Company background

Shandong Xunda Print Company Limited was established with a vision to "be a top ten printer in Shandong province with high quality products to achieve customer satisfaction".

Xunda was initially registered with the company name Lu Xin Development Centre Printing Company Limited in 1996 with seven partners. By 1999, three of the shareholders decided to sell off their shares of the company at a profit, to the remaining four shareholders. In 2001, Lu Xin Development Centre Printing Company Limited was renamed Shandong Xunda Print Company Limited with only two of its original board members on board.

Xunda deals mainly with the printing needs of domestic customers, from both the public and private sectors, with a wide variety of products including paper bags, small brochures, brand labels, posters, information booklets and graduation theses. Xunda also provides services in printing design.

In the seven years from 1996 to 2003 Xunda had grown from a company with RMB1.3 million (equivalent to £82,000) worth of fixed assets and seven staff to the current RMB1.7 million (equivalent to £107,000) fixed assets and forty staff. The relatively low growth in fixed assets was due to the depreciation of fixed assets and the shareholder buyouts. Thus, most of the profits were channelled towards the buying out of shares rather than being reinvested back into the company. Sales had grown from RMB700 thousand (equivalent to £44,000) in the first year to the current RMB3 million (equivalent to £189,000). However, profitability had gone from 25% of sales figures to 10%, due to rising costs of production and lower sale prices of its products.

In spite of this, Xunda's list of machinery and equipment had grown from just a single one-colour printer and one cutting machine in 1996 to the current one two-colour printer, four single colour printers, six stapling machines, one binding machine, one book press, two cutting machines and seven personal computers. The future of Xunda looks even brighter as the management is currently looking at injecting RMB2 million (equivalent to £126,000) into Xunda. The bulk of this will go towards financing the purchase of a four-colour printer, which will in turn bring about a targeted RMB6 million (equivalent to £378,000) sales increment in a year, a 100% growth.

Xunda is relatively low-tech and labour intensive in its operations. There is also a lack of formal training procedures and policies for both new and current employees. Being a traditional Chinese SME, the set-up of Xunda is very informal with little or no documentation. Objectives and tasks that allow Xunda to achieve these strategies are cascaded from top level to the managers and employees, in order for the company to achieve the targets. There are four main departments at Xunda and the breakdown of staff strength is shown Table 7.13.

Table 7.13: Breakdown of staff strength (Xunda)

Department	No. of staff
Accounts/Administration/Human Resource	02
Marketing/ Sales	03
Production	27
Design	08

7.5.2 Generating the BSC of Xunda ("whats")

The first step of the selection framework was to establish the company's BSC for the purpose of generating a list of "whats" for QFD eMatrix I. A series of interviews were carried out with senior managers in order to gather information for the establishment of Xunda's BSC. The vision of Xunda was stated as seeking to "be a top ten printer in Shandong province with high quality products to achieve customer satisfaction".

During the interviews, a number of strategies were listed by the senior managers, which would enable the company to achieve this vision. Among these strategies were the top two prioritised strategies for the year 2003, which were:

1. To increase turnover (by 200%).
2. To increase profit (by RMB1 million which is equivalent to £63,000).

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It was clear through the interviews with the senior managers that the managers believed that by increasing sales figures, it would directly increase the amount of profit Xunda generates. They had set a high target of a 200% sales increment for 2004, from RMB3 million (equivalent to £189,000) to RMB6 million (equivalent to £378,000). They believed this would be possible with the acquisition of a new, though second-hand, four-colour printer that would speed up production as well as increase the quality of products. Thereby, senior managers also targeted an increase of RMB1 million profits for Xunda, which was interpreted as an increase of over 300%, to a total profit of RMB1.3 million (equivalent to £82,000) for 2004.

The financial perspectives

In order to support the strategy listed above, a series of objectives were highlighted during the interviews. From the financial perspectives, a number of performance measurements would allow the company to keep track of its progress towards achieving these strategies. Gathered from evidence noted from the interviews, it was possible to highlight that the following objectives from the financial perspectives could be set and measured to serve this intention of performance progress tracking:

- High profit growth (by 300%)
- High sales growth (by 300%)
- Increasing product profitability (by 20%-30%)
- Increasing profit margin (by 20%-30%)

The customer perspectives

Xunda was seeking to concentrate on the product leadership preference at the customer perspectives level of the BSC. This preference was highlighted during the interviews with senior managers emphasising the importance to lead the market through outstanding branding and superior products and services. Besides providing reliable and quality printing services, managers at Xunda also believed that product leadership would also have to depend on the affability of their relationships with customers. In China, the strengths of this friendliness play a huge role in customer satisfaction and retention.

The interviews with senior managers also highlighted a series of measurable objectives that coincided with Kaplan and Norton's (2000) product leadership

performance objectives. The list of performance measurements in the customer perspectives for Xunda was as follows:

- Excellent brand image
- Excellent brand recognition
- High customer retention rate (at 100%)
- High customer satisfaction rate (at 100%)
- High rate of on-time delivery (at 100%)
- Low number of customer complaints (at 0%)

The internal business process perspectives

At the internal business process perspectives level, the researcher had to first identify the main business processes in Xunda. The identification of these business processes was assisted through using the VCA and its generic business processes of inbound logistics, operations, sales/marketing, outbound logistics and support services.

After a sales order has been confirmed, purchase orders are drawn up for materials required for the production of the products and the job is entered into the production schedule. Xunda handles simple designs while customers will normally design and forward more complicated designs to Xunda for print. Film production is also outsourced. The production cycle for the job will start with the type-setting of the printer, followed by the actual print job. Die-cutting may be required to depending on the job, before being packaged for delivery. Payment notes are then despatched by Accounts.

Once these main business processes were identified, the researcher was able to further identify the key business processes that Xunda would have to excel at to meet its vision, aims and objectives. To measure the performance of these key business processes, the following list of objectives must be included at this level of Xunda's BSC:

- Excellent schedule planning
- High level of sustained product quality (at 100%)
- High rate of stock availability (at 90%)

- Low production cycle time
- Low rate of rejections (at 0%)
- Low unit cost (at 40% of selling price)

The innovation and growth perspectives

It is important for Xunda to plan and provide for sustained growth and ongoing innovation, in order to enable itself to meet its long-term objectives. Xunda would, through its innovation and growth perspectives of the BSC, allow the identification of current gaps, especially in terms of technology and employee skills, that are needed to be bridged.

Xunda would also have to measure the performance of the objectives from the innovation and growth perspectives, to determine if the company is improving in relation to these objectives. Again, through documentation and interviews with senior managers, the following objectives were identified:

- High rate of staff satisfaction from a survey (at 90%)
- High rate of value-adding time (at 99% of total man-hours)
- Technology leadership

The BSC created in Xunda's context can be seen in Figure 7.10. The list of "whats" generated from the BSC for Xunda's QFD eMatrix I are listed in Table 7.14.

Rating and inputting the "whats" of Xunda's QFD eMatrix I

Once the list of needs was prepared, finalised and determined from Xunda's BSC, surveys were carried out of senior managers, staff representatives and key customers to rate the "whats". Senior managers were be able to rate the needs in accordance with internal needs as well as on their perceptions of external requirements. Staff representatives on the other hand would be providing further confirmation of the views from senior managers. Survey ratings completed by key customers would provide the research project with external views of the requirements to allow the rating to be more robust. Another key reason was that the perceived internal views of external needs were often not as exact as the real views of the needs from the customers themselves. Key customers were also requested to add

any other factors that they deemed important for meeting their requirements of Xunda.

The ratings were done on a scale of 1 to 10. The "whats" deemed most important were awarded the highest points of 10, and the lower scores were given to those which were felt to be of lesser importance. The "whats" with highest score, 9.0 out of 10, was "high sales growth", followed by "customer complaints" and "value-adding time", both with scores of 9.5. The detailed ratings can be seen in Appendix V. It must be emphasised that this rating was the result of an average taken from the survey results obtained from Xunda senior managers, staff representatives and customer representatives. This average rating was required because of the fact that various managers, staff representatives and different types of customers tend to place different levels of emphasis on various areas of the business and/or have different requirements, thus resulting in a variety of ratings.

7.5.3 Generating the key business processes of Xunda with the VCA ("hows")

Once the "whats" for QFD eMatrix I were identified, the next step was to be the identification of "hows" for QFD eMatrix I, which would have to be developed from the VCA. Using the VCA, the researcher was able to categorise the business processes of Xunda into five main categories under the headings of "logistics", "operations", "marketing and sales", "services" and "supporting". Within each category, the key critical value-adding business processes were further identified through data gathering from documentation. This information was further triangulated through interviews with the senior managers and staff representatives of Xunda. A complete list of the key business processes is shown in Table 7.14, "QFD eMatrix I, "hows"".

7.5.4 Completing QFD eMatrix I

In this step, the list of "whats" and "hows" as generated in sections 7.5.2 and 7.5.3 were entered into the QFD eMatrix I. The senior managers of Xunda were asked to fill in the ratings in determining the strengths of the inter-relationships between the "whats" and "hows". An average was then taken from among the surveys returned. The new averages of the inter-relationships ratings were then presented to seek the approval of the managing director, in order to render this average as factual. Once these ratings were keyed in to the QFD/CAPTURETM software, the software automatically prioritised the key business processes ("hows") in order of importance,

according to the capability of the individual business process to meet the requirements of the "whats" that were already rated in importance. Therefore, the more relevant the business process was in meeting the requirements of the higher ranked "whats", the higher was the business process on the prioritised list.

Figure 7.10: Balanced Scorecard (Xunda) – based on case study analysis
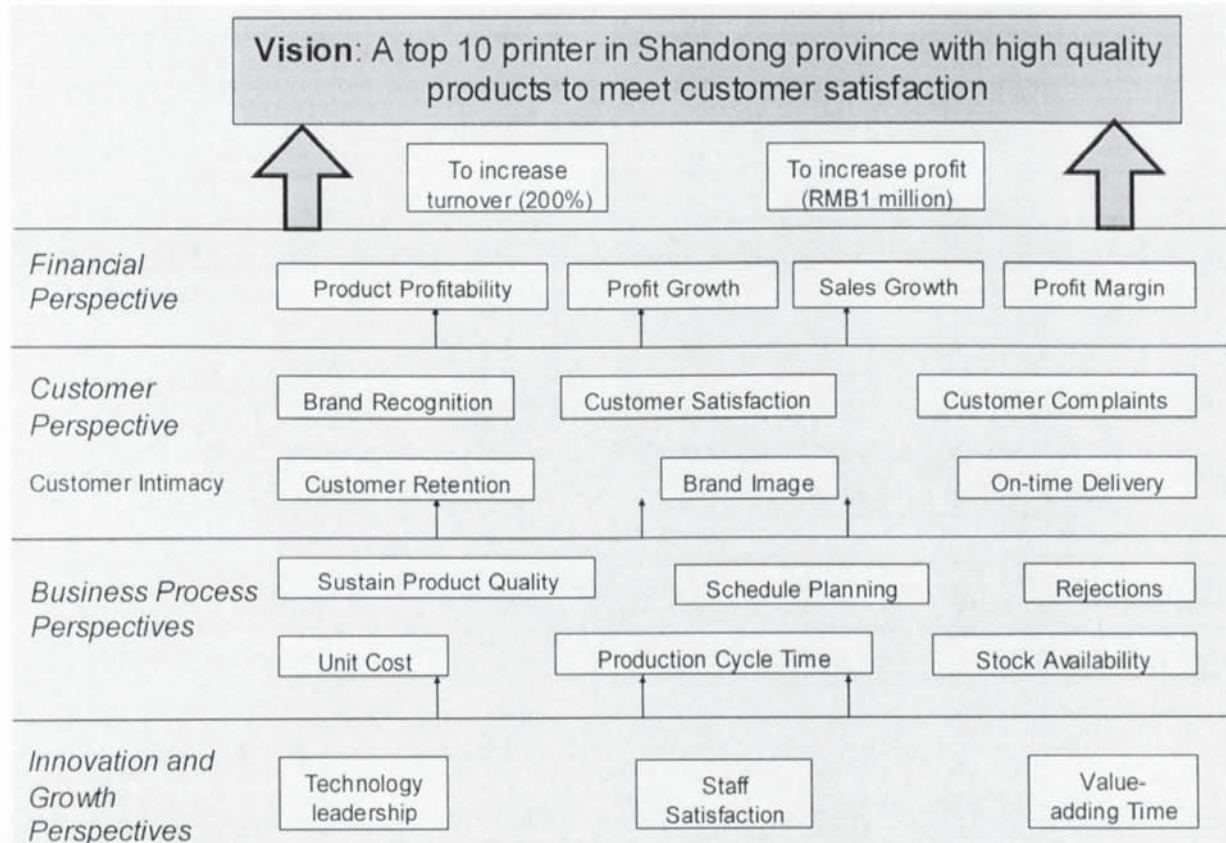
7.5.5 Results of QFD eMatrix I

The top three critical business processes from this first round of prioritisation can be seen in Table 7.15 to be "printing" with 9.1%, "customer satisfaction" with 8.7% and "delivery" with 8.3%. It was clear that these three business processes were critical in meeting the requirements of the top three ranked "whats" identified earlier. Figure 7.11 shows Xunda's QFD eMatrix I.

7.5.6 Establishing the "whats" in QFD eMatrix II

The "whats" inputted into the QFD eMatrix II were a direct transfer from the results of QFD eMatrix I. The important point to note was that the prioritised scores of the business processes from QFD eMatrix I were entered as the rating scores for the business processes, as the business processes were now serving the function of "whats" in QFD eMatrix II.

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7.5.7 Establishing the list of e-business applications ("hows" in QFD eMatrix II)

For the purpose of further evaluating the selection framework, the list of potential e-business applications was generated through:

- The understanding of key processes required to undergo change for the organisation to embrace e-business
- The researcher's knowledge and interpretation of e-business applications in the printing industry
- From the case study itself, as there could be suggestions as to the e-business applications the organisation was considering bringing aboard

This list of e-business applications, "hows" in QFD eMatrix II, can be seen in Table 7.14.

7.5.8 Completing QFD eMatrix II

At this step the researcher needed to establish a definition of what the ratings of strengths would mean in the case of Xunda, so as to be applied in QFD eMatrix II. These definitions were conveyed to the senior managers as the managers were again asked to define the inter-relationships between the prioritised business processes and the e-business applications. A score of 9 was determined to be critical and should be implemented immediately, 3 as in moderately critical and should ideally be implemented within the next twelve months while 1 would signify that the e-business application is not important but should be kept under considerations and for future reviews. "No entry" would signify that the e-business application should not be implemented at all with regards to improving the listed business processes.

7.5.9 Identification of critical e-business applications from eMatrix II

The ratings were entered into the QFD/CAPTURE™ software and the relationships between the business processes and the potential e-business applications were calculated and displayed as a prioritised list. Table 7.16 shows the three most critical and feasible potential e-business applications identified by the selection framework in the context of Xunda's case study as "order tracking" with 8.8%, "online customer survey" with 8.6% and "computerised logistic management" with 8.2%. The QFD eMatrix II for Xunda can also be seen in Figure 7.12 below.

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A presentation was done and a report submitted at this stage to Xunda management for final fact-checking and to seek approval in order to use the information for the purpose of academic research. This was to provide triangulation of results from the case study as well as to meet ethical requirements imposed upon the researcher.

Table 7.14: List of factors inputted into the eMatrices (Xunda)

QFD eMatrix I "whats"	QFD eMatrix I "hows"	QFD eMatrix II "hows"
Financial: o Profit profitability o Profit growth o Profit margin o Sales growth **Customer:** o Brand image o Brand recognition o Customer complaints o Customer retention o Customer satisfaction o On-time delivery **Business Process:** o Production cycle time o Rejections o Schedule planning o Stock availability o Sustain product quality o Unit cost **Innovation and Growth:** o Staff satisfaction from a survey o Technology leadership o Value-adding time	**Logistics (Inbound/Outbound):** o Inventory management o Delivery **Operations:** o Scheduling o Design o Type-setting o Printing o Die-cutting o Packaging for delivery **Marketing and Sales:** o Appointments o Quotation o Accounting o Sample products **Service:** o Before-sales services o After-sales services o Customer complaints o Customer satisfactions **Supporting:** o Purchasing o Payment collections o Employee performance measurement – bonus o Company performance measurement – bonus	**Logistics (Inbound/Outbound):** o Auto-replenishment system o Computerised logistic management o Order tracking **Operations:** o Graphic design o Online verification of design o Online design customisation o Advance machinery o Content management service (website) **Marketing and Sales:** o Online quotation o News bulletin board o e-Newsletter o Online ordering o Online transaction o e-Auction **Service:** o e-Catalogue o Online sourcing **Supporting:** o ERP (Enterprise Resources Planning) o CRM (Customer Relationship Management) o Online customer survey – feedback form o e-Learning

Table 7.15: Xunda Top 3 Business Processes (Results from QFD eMatrix I)

Score	352.7	335.6	321.0
Percentage	9.1%	8.7%	8.3%
Business Processes	Printing	Customer Satisfaction	Delivery

Table 7.16: Xunda Top 3 Critical e-Business Applications (Results from QFD eMatrix II)

Score	99.2	98.0	92.8
Percentage	8.8%	8.6%	8.2%
e-Business Applications	Order Tracking	Online Customer Survey	Computerised Logistic Management

Figure 7.11: Xunda QFD eMatrix I

Legend (Standard 9-3-1):
- Strong ◆ 9.0
- Moderate ○ 3.0
- Weak ▽ 1.0

HOWs (columns 1–29):

No.	HOW	Importance of the HOWs	Percent Importance of the HOWs
1	Logistics (inbound/outbound):		
2	Inventory Management	86.0	2.2
3	Delivery	321.0	8.3
4	Operations:		
5	Scheduling		
6	Design	182.9	4.7
7	Type-setting	287.6	7.5
8	Printing	167.1	4.3
9	Die-cutting	352.7	9.1
10	Packaging for delivery	247.0	6.4
11	Marketing and Sales	222.6	5.8
12	Appointments		
13	Quotation		
14	Accounting	132.8	3.4
15	Sample products	190.8	4.8
16	Service:	166.6	4.4
17	Before-sales services	183.4	4.8
18	After-sales services		
19	Customer complaints		
20	Customer satisfactions	174.5	4.5
21	Supporting:	225.8	5.9
22	Purchasing	179.7	4.7
23	Payment collections	335.6	8.7
24	Employee performance measurement - bonus		
25	Company performance measurement - bonus		
26	Purchasing	107.9	2.8
27	Payment collections	163.1	4.2
28	Employee performance measurement - bonus	63.4	1.6
29	Company performance measurement - bonus	63.4	1.6

Max = 9.1, Min = 1.0 (Percent Importance of the HOWs)

WHATs:

No.	WHAT	Importance of the WHATs	Overall Importance	Percent Importance
1	Direction of Improvement			
1	Financial:			
2	Product profitability	8.3	8.3	5.0
3	Profit growth	7.7	7.7	4.6
4	Profit margin	8.5	8.5	5.1
5	Sales growth	10.0	10.0	6.0
6				
7	Customer:			
8	Brand image	8.6	8.6	5.2
9	Brand recognition	8.0	8.0	4.8
10	Customer complaints	9.5	9.5	5.7
11	Customer retention	8.8	8.8	5.3
12	Customer satisfaction	9.3	9.3	5.6
13	On-time delivery	9.3	9.3	5.6
14			0.0	0.0
15	Business Process:			
16	Production cycle time	9.3	9.3	5.6
17	Rejections	6.7	6.7	4.0
18	Schedule planning	8.5	8.5	5.1
19	Stock availability	9.0	9.0	5.4
20	Sustain product quality	9.3	9.3	5.6
21	Unit cost	8.3	8.3	5.0
22			0.0	0.0
23	Innovation and Growth.			
24	Staff satisfaction - in a survey	8.5	8.5	5.1
25	Technology leadership	9.0	9.0	5.4
26	Value-adding time	9.5	9.5	5.7

Max = 6.0, Min = 0.0 (Percent Importance)

Relationship matrix (HOW column numbers; ◆ = Strong, ○ = Moderate, ▽ = Weak):

- Product profitability: ▽2 ●3 ○6 ●7 ○8 ●9 ●10 ○11 ▽14 ○15 ○16 ○17 ▽20 ○21 ○22 ○23 ▽26 ○27 ▽28 ▽29
- Profit growth: ▽2 ●3 ○6 ○7 ○8 ●9 ●10 ○11 ○15 ○16 ▽20 ○21 ▽22 ○23 ○27 ▽28 ▽29
- Profit margin: ▽2 ●3 ○6 ○7 ○8 ●9 ○10 ○11 ○15 ○16 ○21 ○22 ○23 ▽26 ○27 ▽28 ▽29
- Sales growth: ▽2 ○3 ○6 ●7 ○8 ●9 ○10 ●11 ▽14 ○15 ○16 ○17 ○20 ○21 ○22 ○23 ▽26 ▽27 ▽28 ▽29
- Brand image: ○14 ▽15 ▽16 ○17 ○20 ▽21 ▽22 ○23
- Brand recognition: ○14 ▽15 ○16 ○17 ○20 ▽21 ▽22 ○23
- Customer complaints: ○17 ○20 ▽21 ○22 ○23 ○26 ▽27
- Customer retention: ▽3 ▽6 ○7 ▽8 ○9 ○10 ▽11 ○14 ○15 ○16 ○17 ○20 ○21 ○22 ○23 ○26 ○27
- Customer satisfaction: ○3 ○9 ○10 ○11 ▽14 ●15 ○16 ●17 ○20 ○21 ○22 ●23
- On-time delivery: ○2 ●3 ▽6 ○7 ○8 ○9 ○10 ○11 ○14 ▽16 ○21 ○22 ●23 ▽26 ▽27
- (row 14): ○6 ○7 ○8 ○9
- Production cycle time: ○3 ●6 ●7 ○8 ●9 ●10 ○11 ▽14 ▽15 ○16 ○17 ○20 ○21 ○22 ○23 ○26 ▽27
- Rejections: ○20 ○21 ○22 ○23
- Schedule planning: ○6 ○7 ▽8 ▽9 ▽10 ○11 ○14 ○15 ○16 ▽17 ▽20 ▽21 ▽22 ○23 ▽26 ○27 ▽28 ▽29
- Stock availability: ○2 ●3 ▽6 ○7 ○8 ○9 ○11 ○14 ○21 ▽22 ○23 ○26
- Sustain product quality: ○6 ○7 ○8 ○9 ○10 ○11 ○20 ○21 ▽22 ○23
- Unit cost: ○2 ○3 ○10 ○16 ○20 ▽21 ○22 ○26 ○27 ▽28 ▽29
- Staff satisfaction - in a survey: ▽6 ▽7 ▽8 ▽9 ▽10 ▽11 ○28 ○29
- Technology leadership: ○6 ▽7 ▽8 ▽9 ○14 ○15 ○16 ○20 ○21 ○26 ○27
- Value-adding time: ○2 ○3 ○6 ○7 ○8 ○9 ○23 ○27 ○28 ○29

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Figure 7.12: Xunda QFD eMatrix II

HOWs (columns):

No.	HOW
1	Logistics (Inbound/Outbound):
2	Auto-replenishment system
3	Computerised logistic management
4	Order tracking
5	—
6	Operations:
7	Graphic design
8	Online verification of design
9	Online design customisation
10	Advance machinery
11	Content management service (website)
12	—
13	Marketing and Sales:
14	Online quotation
15	News bulletin board
16	e-Newsletter
17	Online ordering
18	Online transaction
19	e-Auction
20	—
21	Service:
22	e-Catalogue
23	Online sourcing
24	—
25	Supporting:
26	ERP (Enterprises Resources Planning)
27	CRM (Customer Relationship Management)
28	Online customer survey - feedback form
29	e-Learning

Relationship matrix (symbols: ◆ Strong = 9.0, O Moderate = 3.0, ▽ Weak = 1.0)

#	WHAT	Imp. of WHATs	2	3	4	7	8	9	10	11	14	15	16	17	18	19	22	23	26	27	28	29	Overall Importance	Percent Importance
1	Logistics (Inbound/Outbound):																							
2	Inventory Management	88.0	▽	O	O	▽	▽	▽	▽	▽							O	O			O	▽	88.0	2.2
3	Delivery	321.0		O	▽	▽				▽							▽	▽					321.0	8.3
4																							0.0	0.0
5	Operations:																						0.0	0.0
6	Scheduling	182.9		▽	▽	▽	▽	O	O	▽							▽	▽	▽	▽	▽	▽	182.9	4.7
7	Design	287.6	▽	▽	▽	▽	O	O	O	▽				▽	▽	▽	▽	▽	▽	▽	▽	▽	287.6	7.5
8	Type-setting	187.1	▽	▽	▽	▽	▽	O	O	▽				▽	▽	▽	▽	▽			▽	▽	187.1	4.3
9	Printing	352.7	▽	▽	▽	▽	▽	▽	▽	O				▽	▽	▽	▽	▽				▽	352.7	9.1
10	Die-cutting	247.0																					247.0	6.4
11	Packaging for delivery	222.0																					222.0	5.8
12																							0.0	0.0
13	Marketing and Sales:																						0.0	0.0
14	Appointments	132.8		O		▽	▽	▽	▽	O	▽	▽	▽			O	O	▽	▽		▽	▽	132.8	3.4
15	Quotation	190.8		▽							▽	▽		▽	▽	O	▽	O					190.8	4.9
16	Accounting	168.6		▽		▽							▽	▽	▽	▽	▽						168.6	4.4
17	Sample products	183.4					▽																183.4	4.8
18																							0.0	0.0
19	Service:																						0.0	0.0
20	Before-sales services	174.8		▽	▽		▽			▽	▽	▽		▽	▽	▽	▽				▽	▽	174.8	4.5
21	After-sales services	225.8	▽	▽	O					▽							▽				O	▽	225.8	5.9
22	Customer complaints	179.7					▽														O		179.7	4.7
23	Customer satisfactions	335.8		▽	O	▽	▽	▽	▽	▽				▽	▽	▽	▽	▽			O	▽	335.8	8.7
24																							0.0	0.0
25	Supporting:																						0.0	0.0
26	Purchasing	107.9	▽	▽							▽		▽	▽	▽							▽	107.9	2.8
27	Payment collections	183.1		▽										▽							O		183.1	4.2
28	Employee performance measurement - bonus	63.4																	O	O		▽	63.4	1.8
29	Company performance measurement - bonus	63.4							▽		▽								O	O		O	63.4	1.8

Importance of the HOWs

Col	2	3	4	7	8	9	10	11	14	15	16	17	18	19	22	23	26	27	28	29
Importance of the HOWs	31.8	92.8	99.2	52.8	64.3	77.8	73.1	85.6	12.3	11.1	10.6	54.0	49.7	53.4	79.4	67.7	25.5	22.1	98.0	72.5
Percent Importance of the HOWs	2.6	8.2	8.8	4.7	5.7	6.9	6.5	7.8	1.1	1.0	0.9	4.8	4.4	4.7	7.0	6.0	2.3	1.9	8.6	6.4

Max = 8.8
Percent Importance of the HOWs
Min = 0.0

Max = 9.1
Percent Importance
Min = 0.0

Standard 9-3-1

Strong ◆ 9.0
Moderate O 3.0
Weak ▽ 1.0

7.6 Chapter summary

In this chapter, the author has presented the four case studies carried out for the purpose of evaluating the framework. Each of the case study reports began with a write-up on the company background. The data and results were then presented in the headings according to the eight steps of the selection framework. It was noted that in each of the case studies, results from the application of the selection framework were presented to the management of each company. This was to ensure that the results were suitable to meet both the internal and external needs of each case study company.

This chapter has established that the developed e-business selection framework is feasible to be employed in SMEs in the printing industry and that the results obtained are accurate in meeting both the internally and externally prioritised needs of the company. In the next chapter, the author will further discuss the results of the four case studies and the implications of these results in a wider context.

8. Analysis and Discussion

8.1 Chapter introduction

In the previous chapter, the findings and the analysis within each of the case studies for the evaluating of the e-business selection framework were presented. In this chapter, a wider perspective of analysis will be presented and discussed, that is, analysing the four case studies as a whole. This chapter will seek to discuss the cross-case analysis similarities and differences as well as establishing the deeper notions of these findings. There will also be a discussion on the evaluation of the selection frameworks in other industries.

8.2 Analysis and discussion

In this section, a wider context will be engaged for the purpose of analysing and discussing the test results. This section presents the main contributions of the research to the areas of the BSC for a printing SME, VCA for a printing SME, the uses of QFD, e-business and e-business planning for SMEs.

8.2.1 Analysis of the data

Analyses of the data to be inputted for testing are based on the following techniques which were discussed earlier in section 5.8:

- Discourse analysis
- Summarising content analysis
- Thematic coding analysis
- Feeding the data into the selection framework for calculation

8.2.2 Analysing the test results

The test results are also further analysed in accordance with the eight proposed steps in the e-business selection framework:

Step 1 – Using BSC to develop "what" for QFD eMatrix I

Step 2 – Using VCA to develop "how" in QFD eMatrix I

Step 3 – Completing QFD eMatrix I

Step 4 – Identification of critical business processes from QFD eMatrix I

Step 5 – Inputting critical business processes to QFD eMatrix II's "what"

Step 6 – List of e-business applications to QFD eMatrix II's "how"

Step 7 – Completing QFD eMatrix II

Step 8 – Identification of critical e-business applications from QFD eMatrix II

Step 1: Using BSC to develop "what" for QFD eMatrix I

Step one of the selection framework was the development of "whats" for QFD eMatrix I. In this step, there were five areas which required the generation of data. These five areas, corresponding with the BSC were:

1. Company strategies
2. Financial perspectives
3. Customer perspectives
4. Internal business process perspectives
5. Innovation and growth perspectives

Company strategies

The respective company strategies were drawn from the respective company's vision and interviews with managers. Looking at the visions of the companies, it can be concluded that they were all trying to establish themselves as providers of superior services, besides the normal physical quality of goods. As research by Cambridge Small Business Research Centre (1992) has revealed, SMEs normally stress the importance of qualitative competitive factors such as personalised service, which clearly was evident in the visions of the four case study companies. In Atlas and Fun Press, market growth was stated as a main strategy, while Atlas also backed-up that strategy with a growth in market share. For the Shandong-based Xunda, they were seeking to increase turnover and profit, which might more likely be a result of a market growth or an increased market share. These were all "expected" strategies as most businesses would normally seek to expand and increase profit. However, the Guangzhou-based United had entirely different strategies: paying government taxes and wages on time, placed before increasing shareholders' dividends. Upon looking closely at what the managers at United revealed, only paying taxes and wages on time would allow the company to function normally. This can be attributed to what Chetty and Campbell-Hunt (2003) reported on SME managers wanting to retain control of their businesses.

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Financial perspectives

Among the financial objectives, all four SMEs stated that they were seeking to increase sales and profit growth. All but Xunda were also seeking to control the increment in fixed costs and variable costs. This could be partly due to the economy of the region where these SMEs are. Atlas and Fun Press are in Singapore, which is a newly developed country with relatively higher standards of living in comparison to China. Within China itself, the province of Guangzhou is also far more developed than the province of Shandong. Therefore, it can be argued that Xunda is operating in a local economy where prices of goods are increasing, but not to the extent that requires cost controls to be set as an objective. One surprising objective though, is that Fun Press was seeking an increase in volume profit, as Fun Press amongst the four SMEs studied was the smallest but most technologically-advanced. It was therefore puzzling at first instance that while Atlas, United and Xunda were seeking to increase profit margin, Fun Press did not state the increase of profit margin as an objective, but instead, set an objective seeking for an increase in volume profit. This can however be explained by the fact that most of the managers' salaries at the time of the research were made up by commissions through number of sales generated. Therefore, an increment in profit margin might not be reflected directly as a higher pay packet for the managers, but a higher number of sales made by an individual would result in a larger pay cheque. This would be an unavoidable situation where reward and behaviour are especially clear and straightforward in an SME. Coupled with the fact that managers in SMEs are usually accountable for many facets of the business and many decisions, the effect can be detrimental to the overall well-being of the company.

Customer perspectives

It can be seen from the data generated that all four SMEs placed heavy emphasis on their customer relationships. These were in line with the customer intimacy preference the managers interviewed stated for the customer perspective level of the BSC. This was true apart from Xunda, whose managers selected a product leadership preference in the customer perspective level. Even so, it can still be seen from the analysis of the data that Xunda still places heavy emphasis on its customer relationships. Moreover for SMEs, managers and executives are more likely to be directly involved with the customers. Therefore, these data and findings can be supported, even in the case of Xunda.

Brand image was another area which only managers at Atlas did not mention during the interviews, but was emphasised as an objective by all other companies which hoped that in the event superior brand image was achieved, it would promote the growth of sales and hopefully result in higher profit. Atlas, however, did not emphasise brand image, but nonetheless mentioned the importance of being the sole or preferred supplier of its customer, an objective also mentioned by managers at United. This can be explained by the fact that these medium-sized printing companies acknowledge that SMEs are usually reliant on a few main customers. The small-sized printing companies, however, might be relying on a more diverse customer base instead, as there will always be a lower limit on how much these small-sized printing companies can produce and sell. On the same frequency, the medium SMEs also seek to provide excellent before- and after-sales services, further stating implicitly the importance of retaining current customers. It was also interesting to note that both Singapore-based SMEs are looking at increasing the number of co-operative projects, which can be due to the smaller customer base in a much smaller market and economy in comparison to China. The importance of on-time delivery were mentioned by all managers in the four SMEs, thus meaning that there are always competitors willing to sell to their current customers and perhaps also reflecting the ease of the customers in looking for alternatives.

Internal business process perspectives
Looking at the internal business objectives listed, it can be gathered that the four SMEs were concerned primarily with the quality of their products and resource wastage. Although most, if not all businesses, aim to cut down waste while making sure that their services and products are of sustainable quality, it is crucial for SMEs to achieve this, due to the relatively scarce resources available in SMEs. This is further agreed by Kula and Tatoglu (2003) who cited that there are often limited time and human resources in SMEs. Apart from Xunda, the other three SMEs listed benchmarking their processes with competitors as an objective to determine their standing. This could be due to the level of competitiveness of the local economy the SMEs were competing in.

Innovation and growth perspectives
The interesting factor to point out in the innovation and growth objectives was that the two smaller printing companies, Fun Press and Xunda, were looking at improving their technology leadership. This can be explained by the fact that at the time of data collection, Fun Press was already the technology leader in Singapore on the software

used in its production, while Xunda was looking at achieving a product leadership preference on the customer perspective. To add to that, Fun Press also indicated that they would like to improve their speed of innovation. Improving technology leadership can therefore ensure that Fun Press maintains its technology leadership in Singapore while Xunda on the other hand, would be allowed to work towards achieving a product leadership in its market. Atlas, being in the same market economy as Fun Press although catering to different customer segments, listed looking at development time invested and number of new products to be introduced, in this level of perspectives, therefore, it can again be seen that the Singapore printing market is very competitive and printing companies will be required to improve their products and services to keep abreast of competition.

As discussed earlier, Xunda competes in a relatively less competitive business environment compared to the other three. Thus, it was understandable why Xunda was the only SME of the four not to have included training investment. Atlas and Fun Press, being situated in Singapore, have to train their staff to improve their abilities and to maintain the companies' competitiveness in the market. United on the other hand, included training investment, as the managers place staff welfare high on their list of priorities, supported by the fact that United managers listed paying wages on time as a key strategy to help them to achieve their company vision. Xunda though, being in a less competitive market, could always look at employing new staff to ensure that the right level of knowledge and skills were acquired. This is despite Xunda, along with Atlas and United, listing staff satisfaction as an objective in the innovation and growth perspectives, as these three companies employ quite a number of employees in order to ensure the smooth running of the company. Fun Press, with most of its managers doubling up as sales and production executives, is expectedly not as concerned with staff satisfaction.

Fun Press, often able to provide short product turnover time, was not concerned with value-adding time, while the other three SMEs, which were highly likely to have orders running for days at the shortest and weeks for some projects, indicated a need to improve value-adding time. This is especially so for example if a technician or engineer, after setting the machine to work according to specification, was idle for days or weeks while waiting for the job to complete. Of course, the technician or engineer needs to perform routine checks on the status of the machine, and perhaps

to reload the machines' ink cartridges or paper tray. Therefore, it can be seen why these three SMEs listed down improved value-adding time as an objective.

Overall discussion on the BSCs generated

The following tables will seek to summarise which objectives in higher level perspectives are being supported by perspectives at the lower level of the BSC. Table 8.1 shows the coding of the objectives identified in the four case studies. The objectives listed in Table 8.1 are also determined in the context of the case studies to be the generic list of objectives in the four perspectives of the BSC that can be used as a guide for future research in similar companies. Table 8.2 shows the objectives in the higher level perspectives which are supported by each of the objectives in the lower perspectives of customer, internal business processes and innovation and growth perspectives.

Step 2: Using VCA to develop "how" in QFD eMatrix I

Through collating the results in step two of the four case studies, a list of generic tasks in a typical business cycle of a printing SME can be concluded. This list can be used for reference in the generation of "hows" for QFD ematrix I in similar research. The tasks in the business cycle are shown in Table 8.3.

Step 3: Completing QFD eMatrix I

It has to be emphasised that the inter-relationship scores were defined as 9 meaning a strong inter-relationship, 3 meaning an average inter-relationship and 1 representing a weak inter-relationship. "No entry" meant there was no relationship between the "what" and "how". As the scale given was of "no entry", 1, 3 and 9, there was no mid-way point for the participants to choose. This definition forced the participants to think hard about the differences between the degrees of strength of the inter-relationship and justify the scores they earned.

Table 8.1: Coding the objectives

Objectives In The Financial Perspectives	Code
Fixed Costs Growth	F1
Product Profitability	F2
Profit Growth	F3
Profit Margin	F4
Sales Growth	F5
Unit Costs	F6
Variable Costs Control	F7
Volume Profit	F8

Objectives In The Customer Perspectives	Code
After-sales Services	C1
Before-sales Services	C2
Brand Image	C3
Brand Recognition	C4
Customer Complaints	C5
Customer Retention	C6
Customer Satisfaction	C7
Innovative Solutions	C8
Number Of Co-operative Projects	C9
On-time Delivery	C10
Sole Or Preferred Supplier	C11

Objectives In The Internal Business Process Perspectives	Code
Bench-marking With Competitors	IP1
Machine Downtime	IP2
Operation Efficiency	IP3
Production Cycle Time	IP4
Rejections	IP5
Schedule Planning	IP6
Stock Availability	IP7
Sustained Product Quality	IP8
Unit Costs	IP9
Wastage	IP10

Objectives In The Innovation And Growth Perspectives	Code
Development Time Invested	IG1
New Accounts Opened	IG2
New Product Introductions	IG3
Outlets Opened	IG4
Speed Of Innovation	IG5
Staff Satisfaction	IG6
Technology Leadership	IG7
Training Investment	IG8
Value-adding Time	IG9

Table 8.2: Relationships between the objectives

Objectives In The Innovation And Growth Perspectives	Objectives in Higher Level Perspectives Supported
IG1	C9, C10
IG2	F5, C3, C9, C10, IP1
IG3	C9, C10
IG4	F5, C3, C4, C9
IG5	C3, C4, C9
IG6	All objectives in higher level perspectives
IG7	F2, F3, F4, F5, F8, C3, C4, C6, C7, C9, IP1, IP3, IP4, IP5, IP6, IP8, IP9, IP10
IG8	C1, C2, C3, C5, C7, IP1, IP2, IP3, IP4, IP5, IP6, IP8, IP9, IP10
IG9	IP1, IP2, IP3, IP5, IP6, IP8, IP9, IP10
Objectives In The Internal Business Process Perspectives	**Objectives in Higher Level Perspectives Supported**
IP1	C6, C11
IP2	F1, F2, F3, F4, F6, F7, F8, C10
IP3	F1, F2, F3, F4, F6, F7, F8, C3, C10
IP4	F1, F2, F3, F4, F6, F7, F8, C10,
IP5	F1, F2, F3, F4, F5, F6, F7, F8, C1, C3, C5, C6, C7, C11
IP6	F1, F2, F3, F4, F6, F7, F8, C5, C6, C7, C10
IP7	C2, C3, C5, C6, C7, C10, C11
IP8	C1, C3, C5, C6, C7, C11
IP9	F2, F3, F4, F6, F7, F8
IP10	F1, F2, F3, F4, F6, F7, F8
Objectives In The Customer Perspectives	**Objectives in Higher Level Perspectives Supported**
C1	F5
C2	F5
C3	F5
C4	F5
C5	F1, F2, F3, F4, F5, F6, F7, F8
C6	F1, F3, F5, F6, F7, F8
C7	F2, F3, F4, F5, F6, F7, F8
C8	F2, F3, F4, F5
C9	F2, F3, F4, F5, F6, F7
C10	F1, F3, F4, F6
C11	F1, F5, F8

Table 8.3: List of generic tasks in a typical business cycle of a printing SME

Value Chain Categories	Tasks
Logistics (Inbound/Outbound):	Inventory management
	Delivery
Operations:	Scheduling
	Design
*Actual tasks carried out depend on products.	Sizing
	Colour
	Scanning
	Film production
	Corrugating
	Moulding
	Die-cutting
	Type-setting
	Printing
	Cutting/ sawing
	Binding/ folding/ gluing/ stitching
	Quality check
	Packaging for delivery
Marketing and Sales:	Advertising
	Appointments
	Quotations
	Accounting
	Sample products
Service:	Before-sales services
	After-sales services
	Customer complaints
	Customer satisfaction
Supporting:	Purchasing
	Finance checks on potential customers
	Payment collections
	Training and education
	Employee performance measurement
	Company performance measurement

Step 4: Identification of critical business processes from QFD eMatrix I

This list was the product of QFD eMatrix I. It showed a prioritised list of business processes due to its ability and criticality in meeting the higher ranked needs. All the top three business processes identified in each of the case studies can be seen to be concerned with internal processes as well as being customer-oriented. Printing and customer satisfaction were both in the top three critical business processes in three of the four cases. Delivery and scheduling were in the top three for two of the four cases. Quotation and quality check made up the rest of the top three, appearing in one top-three list each. This could be due to the fact that all four companies were

looking to establish themselves as cost-effective printers providing superior quality products and services to satisfy customers.

The quality of printing would have a direct impact on the quality of products produced for their customers while customer satisfaction, perhaps by means of surveys, would be the main method of feedback the companies could gather to determine if they were satisfying their customers. Efficient delivery and scheduling processes would enable goods and services to be despatched on time to customers. This would directly satisfy customers while also minimising costs to the printers themselves through optimised use of resources including machinery, man-hours and storage areas. Quotation and quality check could also help to satisfy the customers, perhaps through providing customers with better credit terms or lower prices, and ensuring goods and services provided are of high sustainable quality.

Step 5: Inputting critical business processes to QFD eMatrix II's "what"

This is the stage where the "whats" in eMatrix I were transformed to be the "hows" of eMatrix II. There was no need to survey for the ratings of these "whats" of eMatrix II as the scores of these business processes can be attained from eMatrix II, which already showed the importance of the business processes in the case study SME with regards to meeting the higher rated external and internal needs.

Step 6: List of e-business applications to QFD eMatrix II's "how"

This list of e-business applications was a generic list that was exactly the same in all four cases, apart from Fun Press having included e-auction in the marketing and sales category. This could be because Fun Press was already the technology leader with regards to software used in the production process and the managers felt the company possessed the necessary capabilities to engage in e-auctions. e-Auction was also initially included in the list of the other three cases. However, after the inter-relationships ratings were done for eMatrix II, managers in Atlas, United and Xunda left ratings for e-auctions blank which was subsequently left out of the results presented. The possible reason for managers leaving e-auction out of eMatrix II could be due to one or more of the following three explanations:

1. Managers do not consider e-auctions as being able to create more sales.

2. Managers do not consider their company as having the capability and resources to handle and engage in e-auctions.

3. e-Auction jobs can be and are mostly very customised, which will make it very difficult to attain production economy of scales. This will result in higher costs to the companies or higher prices to their customers. Either result will be detrimental to relationships with customers and to the bottom line.

Step 7: Completing QFD eMatrix II

The scores for these inter-relationships took on a slightly different meaning to those in QFD eMatrix I. A score of 9 was determined to be critical and should be implemented immediately, 3 was moderately critical and should ideally be implemented within the next 12 months while 1 would signify that the e-business application is not important but should be kept under consideration and future review. "No entry" would signify that the e-business application should not be implemented with regards to improving the listed business processes. This definition forced the participants to think hard about the differences between the degrees in strengths of the inter-relationship and justify the scores they earned. The definitions for these scores were found to be extremely useful in explaining the significance of the scores to the managers. Managers who were asked to do the ratings also commented that these definitions were clearer for the purpose of eMatrix II than if the same definitions were used as in eMatrix I.

Step 8: Identification of critical e-business applications from QFD eMatrix II

The product from this round of eMatrix analysis was the result of e-business applications' ability and criticality in meeting the needs identified, which would be in both lists of needs from QFD eMatrix I and QFD eMatrix II. The rationale behind this was that these e-business applications would be able to meet the needs of the business processes, which in turn have to satisfy the internal and external needs. These e-business applications would therefore allow the company to start determining which key business processes need to be improved, in order to assist the company in meeting both internal and external critical needs. This is true to the extent that in order to implement an e-business application, the company may be required to upgrade or perhaps streamline part of their business processes that have been directly influenced by the applications, which are the business processes with ratings of 9 which correspond to the e-business application. The other business

processes that will be indirectly influenced also have to be considered. That is the same for business processes with inter-relationship ratings of 3 with the chosen e-business applications, but perhaps not so importantly for those either rated as 1 or rated as "no entry".

It can be seen from the results of the four case studies that the e-business applications in the top three for each of the cases were mostly customer-focused. Customer relationship management, online customer survey and order tracking each appeared twice, while auto replenishments, computerised logistic management, content management service, e-catalogue, e-learning and online quotation made up the rest of the e-business applications in the four top-three tables. The results can be concluded to be directly corresponding with the results of eMatrix I. However, it can also be seen that the printing process, listed three times in the four top-three tables for eMatrix I, only has content management service as a direct corresponding application in United's top-three table for eMatrix II. It was expected that there would be more e-business applications directly influencing the printing process to be prioritised. The main reasons for these applications not making it into the top-three lists could be due to costs and perceived capabilities of the company's resources to implement these applications, which included advanced machinery and graphic design. Advanced machinery would require large capital investment and also trainings for staff to upgrade their skills in order to operate the advanced machinery. Graphic design would also require capital investment in equipment and software and training for staff to upgrade their skills, though in smaller amounts compared to capital investment for advanced machinery. In both instances, the company might have to recruit new employees to man these machines or to handle the graphic design business processes if current employees are not up to par with the standard skills required.

On the whole, during presentations of final results to the management of the four case study companies, it was agreed that the use of the e-business selection framework did allow them to see the clearer picture of e-business planning. In addition, the final prioritised lists of e-business applications for management consideration were agreed to reflect directly on the degree of criticality of the applications of the companies in meeting external and internal needs. Also, management of the four companies felt that the relatively easier applications, though not necessarily less important, were also listed higher on the final list. This assertion

indicated that the selection framework did take into consideration the ability of the company's business processes in meeting the needs of the e-business applications. A summary of the results can be seen in Table 8.4. More discussion on the managerial implications of this research can be seen in section 8.3.

Table 8.4: Summary of results from the 4 case studies

Country	Singapore	Singapore	China	China
Factor/ Company	Atlas	Fun Press	United	Xunda
Environment	Very highly competitive	Very highly competitive	Highly competitive	Rather competitive
Business set up model after	Hong Kong and also fully developed economies	Clicks-and-mortar	Hong Kong and local economies	Costal cities in China
Vision	Quality products and superior services	Quality products and superior services	Quality products and superior services	Quality products and superior services
Strategies	Growth strategy: • Market growth • Growth in market share Market growth	Growth strategy: • Market growth	Retain control strategy: • Pay taxes on time • Pay wages on time Growth in market share Market growth • Increase shareholder-rs dividends	Profit increase strategy: • Increase turnover • Increase profit
Financial Objectives	Increase in sales growth	Increase in sales growth	Increase in sales growth	Increase in sales growth
	Increase in profit growth	Increase in profit growth	Increase in profit growth	Increase in profit growth
	Control increment in fixed costs	Control increment in fixed costs	Control increment in fixed costs	
	Control increment in variable costs	Control increment in variable costs	Control increment in variable costs	
	Increase in profit margin		Increase in profit margin	Increase in profit margin
		Increase in volume profit		

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Customer Objectives	Customer intimacy preference	Customer intimacy preference	Customer intimacy preference	Product leadership preference
	On-time delivery	On-time delivery	On-time delivery	On-time delivery
	Increase in number of co-operative projects	Increase in number of co-operative projects		
	Excellent before sales service		Excellent before sales service	
	Excellent after sales service		Excellent after sales service	
	Sole or preferred supplier		Sole or preferred supplier	
		Excellent brand image	Excellent brand image	Excellent brand image
Internal Business Objectives	Excellent product quality	Excellent product quality	Excellent product quality	Excellent product quality
	Excellent wastes control	Excellent wastes control	Excellent wastes control	Excellent wastes control
	Benchmarking with key competitors	Benchmarking with key competitors	Benchmarking with key competitors	
Innovation and Growth Objectives	High training investment	High training investment	High training investment	
	Excellent staff satisfaction		Excellent staff satisfaction	Excellent staff satisfaction
	High value-added time		High value-added time	High value-added time
	High level of development time invested			
	High number of new products			
		Technology leadership		Technology leadership
Top 3 critical business processes from QFD eMatrix I	1. Delivery 2. Customer satisfaction 3. Scheduling	1. Quality check 2. Customer satisfaction 3. Printing	1. Printing 2. Quotation 3. Scheduling	1. Printing 2. Customer satisfaction 3. Delivery

Top 3 e-business applications from QFD eMatrix II	1. Order tracking 2. CRM 3. Auto replenish-ment	1. Online customer survey 2. e-Catalogue 3. CRM	1. e-Learning 2. Content manage-ment service 3. Online quotation	1. Order tracking 2. Online customer survey 3. Computer-ised logistic manage-ment

8.2.3 Implications of the test results

Central to e-business developments in smaller firms was the understanding that not all such firms were immediately willing to embrace the technology. However, it could be seen from the research that it was not because SMEs were not willing, but that they did in fact lack the knowledge in planning for such major projects. In other words, SMEs are often overwhelmed by what is on offer and do not know which solution is the best for them in terms of feasibility and criticality of the applications.

Through evaluation of the selection framework in the four cases it was found that the strengths of the BSC allowed the generation of "whats" for the eMatrices of the QFD to be simplified and structured. An interesting conclusion was that coupled with the measurement functions typical of any BSC, QFD can be made more robust by incorporating the "voice of customers" generated from the BSC. This can eliminate the need for customer surveys, which are mostly vague in their findings, since these "voices" can now be constructed by using the BSC framework. The QFD can, vice versa, provide an integration between top-level objectives and operational-level activities, a major deficiency in the typical BSC approach, by making it possible for managers to prioritise needs while taking into account the business processes, ultimately providing a blueprint for e-business planning. QFD can also facilitate planning at the lowest level of implementation through the deployment of multi-level eMatrices as deemed necessary by the company and/or for the specific planning.

Through engaging the balanced scorecard technique, both a top-down and a bottom-up approach to planning can be achieved, while the balanced scorecard can also serve as an able tool to collect data of both internal and external needs, the "whats" for eMatrix I. The value chain analysis, on the other hand, can provide an analysis of the business processes of the company, thereby providing the foundations for the generation of "hows". Through inputting the data collected through the deployment of

the balanced scorecard and the value chain analysis into the quality function deployment matrices, the managers were able to prioritise the business processes according to the ability of the process to meet both internal and external needs. Once this is achieved, the e-business applications can subsequently be entered into the house of quality (HOQ) to be prioritised in accordance with the prioritised business processes.

The results and analysis of the evaluation data therefore concluded that the newly developed e-business selection framework is able to guide managers in SMEs during e-business planning. The selection framework is able to structure planning and consider both external and internal needs during e-business planning, which were not achievable by other individual planning techniques and/or frameworks. Simplicity is the key to a good planning framework. Keeping it simple will allow most managers to pick up on the uses of the framework with minimal training or in actual fact, no training at all for some of the managers. Being able to allow managers to do a step-by-step evaluation of the needs and applications on offer, the e-business selection framework is designed with SMEs in mind, and for SMEs.

During the interviews at Xunda in Shandong, it was disclosed that Xunda positions their vision and objectives similar to the printing companies from the more prosperous coastal cities of China, including Guangzhou, which managers at Xunda clearly stated are at least a decade in front of them in terms of management, technology and market. While United did not reveal where they adopted their strategies and objectives from, it can be surmised that United did model part of its set up on its Hong Kong parent company. However, United also had to integrate local needs into its set-up, due primarily to the difference in the governmental and economic structure of China and Hong Kong. Atlas Singapore surprisingly also mentioned Hong Kong set-ups as a reference for their business model, while also taking into account business set-ups from the more affluent fully developed economies like Japan, the US and the UK. Fun Press Singapore, however, tended to focus on being small but nimble, aiming for niche markets and trying to create a clicks-and-mortar model.

The research project has also provided insights into Chinese business set-ups. Despite the very flat organisation structure in comparison to big companies, one or a small group of dominant shareholders normally exists in these companies, serving on

the managing board or as senior managers. Company strategies are normally made within this small circle of dominant shareholders or managers and rarely divulged outside the circle, including to junior managers in the company. Instead, tasks are handed down from top management or senior managers to junior managers in order for company strategies to be achieved. Further discussion on the managerial implications can be seen in section 9.3.

8.3 Evaluating the selection framework in other industries

The selection framework is currently being taught as part of an e-business module in the postgraduate programme at Aston Business School. As part of their assessment, postgraduate students taking the e-business module have to implement the selection framework in a company of their attachment or where they are working at. Two cases of implementing the selection framework by MBA students will be presented and discussed here. The first case study company, MT, is a supplier of engineering parts to both government agencies and manufacturing companies in the aerospace industry. The second case study company VirtualCom is a dotcom start-up specialising in community groups and dating services. The names of the companies used here are fictitious due to the sensitive nature of the industries the companies are operating in.

8.3.1 Testing the framework in MT

MT has three main divisions: MTaero, MTfit and MTinsu. MTaero manufactures shock and anti-vibration mounts, selling to both commercial manufacturers and government agencies in the aerospace industry. Being part of a big group of companies, MTaero shares its support functions with others in the same business grouping, including the accounts and human resources departments. MTaero, however, has full authority over its own manufacturing and sales functions.

The management at MT recognises the importance of IT in developing sustainable competitive advantage over its competitors. To date, they have successfully implemented a three-year upgrading manifesto for an in-house IT system to overlook certain functions within the company. These functions include order entry and processing, accounts for customers and purchasing, stock control and production planning. As a result, these functions showed improvements in terms of time

management efficiency and cost control. MTaero itself has been able to develop other support IT applications to support the main system at MT headquarters. Main investment motivations, however, depended heavily on the potential ability of these new investments to either assist in improving sales figures or in the improvement of resources management.

In order to understand the industry, the student undertook a PESTL analysis to identify the macro factors and a Porter's (1980, 1985) five forces analysis to identify the micro factors that were the key environmental strategic drivers influencing the industry. Together with the vision of MT, "to be the number one manufacturer and service provider in the industry", two main strategies were identified for MT:

1. To achieve a growth in market share by 10%.
2. To reduce cost by 10%.

The BSC is built next for MT. The objectives identified for each level of the BSC can be seen in Table 8.5. At the same time, the VCA of MT was constructed for input into QFD eMatrix I. The list of MT VCA factors can be seen in Table 8.6. From the analysis of the factors and ratings of the "whats" and "hows" of eMatrix I, the top three business processes identified as critical in meeting the needs of the important "whats" are: 1. Manufacturing of products with a score of 328, 2. Dealing with enquiries/ quotations with a score of 259 and, 3. Working with agents and distributors with a score of 250. This was not surprising as the manufacturing of products is the basis for competitive advantage for MT, in an industry for highly-precise products. For dealing with enquiries/quotations and working with agents and distributors, this can be explained by the fact that MT will need to sell its products to earn a profit. The nature of the industry is such that sales are normally concluded through middlemen, agents and distributors, although MT does respond to enquiries and quotations.

At this stage, a list of possible e-business applications was drawn up under the headings of "improved dedicated website", "customer relationship management", "content management system", "extranet" and "knowledge management". The full list of possible e-business applications for MT can be seen in Table 8.7. The results from QFD eMatrix II showed that e-business applications from "improved and dedicated website" and "CRM" are preferred, with the provision of a "simple mount/product selector guide/program" coming in at first place with a score of 317 and "product

datasheets" in second place with a score of 284. The five processes from CRM were ranked joint third with a score of 264. The following explanations were provided to reinforce the validity of the results:

1. Current website of MT is lacking in detailed and specific information relating to its products and services. This can be rectified with a simple mount/product selection guide/program.

2. At the moment, most enquiries for both general and specific product information come directly to MT. This requested information can take days to reach customers or potential customers by fax or post, as MT does not have a lot of information in digital form. Therefore, providing datasheets online will allow this process to be streamlined, allowing resources to be channelled to other parts of the company. Also, having technical information readily available online will encourage design engineers to incorporate products from MT into their designs.

3. CRM will be able to help MT in monitoring the more popular products and increase the level of co-ordination within the company with agents and distributors through a single central database. This will minimise incidents where potential customers are approached by both MT and an agent or distributor. Behaviour of customers can also be more easily monitored and predicted with CRM.

Table 8.5: MT BSC objectives

Level	Objectives	Ratings
Financial	High level of costs reduction	3
	High sales growth	5
	High level of product profitability	3
Customer	High rate of on-time delivery	5
	High customer retention rate	5
	High customer satisfaction rate	5
Internal Business Process	Low production cycle time	3
	High level of process reliability	3
	High level of product quality	5
	Excellent production planning	3
Innovation and Growth	High number of new account opened	3
	High rate of new product introductions	3
	High rate of staff satisfaction – in a survey	3
	High rate of training investment	3

Table 8.6: MT VCA factors

Inbound Logistics	Product and material storage
	Quality Control of materials and batch records
Operations	Production scheduling
	Work-in-progress quality monitoring
	Process development and improvement
	Manufacturing of products
Outbound Logistics	Order receipt and entry
	Packing for despatch
	Arranging transportations
Sales and Marketing	Dealing with enquiries/ quotations
	Working with agents and distributors
	Promotions – website, advertising, exhibitions
Service	Technical services - testing and analysis
	Maintaining customer records

Table 8.7: Possible e-business applications for MT

Improved Dedicated Website	Product datasheets and information available for download
	'Simple' mount/ product selection guide/ program
	Comprehensive company information
Customer Relationship Management	Customer enquiry tracking
	Customer ordering tracking
	Customer information available to MT/ agents/ distributors
	Customer information can be updated by MT/ agents/ distributors
	Central storage of information
Content Management System	Easy maintenance of web page content
	Consistent presentation of information
	Consistent information with agent/ distributor website
Extranet	Secure/ limited access for agents/ distributors/ customers
Knowledge Management	Transactional support – customer service/ 'help desk'
	Analytical support – holding data/ data mining
	Asset management – document and content management
	Process support
	Developmental support – training, learning, staff skills
	Support of innovation and creation – teamwork and collaboration

Therefore, from the above discussion, it can be determined that the selection framework can be deployed in engineering companies other than those in the printing industry. In the next section, the case of VirtualCom will be discussed to further illustrate that the flexibility of the selection framework means it can be applied in the service industry.

8.3.2 Testing the framework in VirtualCom

VirtualCom is a dotcom start-up company based in Eastern Europe, generating most of its revenues from online customers. The company specialises in online community technologies and seeks to maximise users' perceived beneficiary experiences through an online dating portal and a community e-magazine. Both websites are considered as leading community web providers in the country, with about 150,000 members, given the low number of people going online in the country, estimated to be less than one million.

VirtualCom had until recently not charged the users of its online services any subscription fees, due mainly to the very limited size of the country's Internet market. Management of VirtualCom believed that charging of subscription fees earlier would have caused up to 90% of the users to discontinue using VirtualCom's services, and thereby would have destroyed most of the value in VirtualCom. Currently, there are opportunities in the market identified by the management, which VirtualCom hopes to exploit. Therefore, the following three strategies were identified:

1. Repositioning to the online community.
2. Expansion to the chosen foreign market.
3. Gradual introduction of subscription fees.

From the strategies, the BSC was constructed for VirtualCom. The objectives identified for each level of VirtualCom's BSC can be seen in Table 8.8. At the same time, a VCA was also generated for VirtualCom. As VirtualCom is not a manufacturing company, it was more appropriate in this case to use the commerce value chain analysis by Treese and Stewart (1998) as opposed to the generic value chain analysis by Porter (1985). The factors identified for VirtualCom's value chain can be seen in Table 8.9. From the analyses of the "whats" and "hows" and their inter-relationships, the top three critical business processes identified as meeting the

needs were: 1. "Order processing", and "Payment processing", ranked joint first with scores of 766; 2. "Usage analysis" with a score of 759 and, 3. "Affiliate program" with a score of 630. These results were not surprising for a dotcom as most online companies will be highly dependent on the efficiency of order processing and payment processing to generate their income. While usage analysis would enable the online company to further understand the needs and behaviour of its users, affiliate programs would further enhance the experience and perceived benefits by its users and members.

At this stage, a list of possible e-business applications was drawn up for VirtualCom, which can be seen in Table 8.10. The results from the QFD eMatrix showed that the e-business applications under the heading of "Retain" came in first with a score of 7,404, while the three e-business applications under "Act" came in joint second with a score of 6,894. The affiliate system, under the "Attract" heading came in third with a score of 5,670. The validity of these results can be further reinforced with the following explanations:

1. VirtualCom requires a tool for site usage analysis in order to determine the users' behaviour. This will help to contribute to the design of the services to increase customer loyalty as well as increasing the rate of conversion for first-time visitors into customers. Thus, the web log analysis system will enable VirtualCom to provide accurate first-hand data in the understanding of the visitors and customers.
2. The order processing system and payment processing system applications under the "Act" heading will be able to streamline order and payment processes in VirtualCom. The database management system on the other hand will provide the necessary database upgrade to meet the new demands on the database management system, due to the introduction of different statuses and privileges for free and paying members.
3. The affiliation system will provide VirtualCom with a cost-effective method to attract new customers as compared to banner or keyword advertising. This is because in an affiliation system, only affiliates that provide actual new members will be entitled to payments from VirtualCom.

Thus, the discussion in this section has shown that the e-business selection framework can also be applied to companies within the service industry.

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Table 8.8: VirtualCom BSC objectives

Level	Objectives	Ratings
Financial	High level of costs reduction	4
	High revenue growth	5
	High level of product profitability	5
Customer	High customer retention rate	4
	High customer satisfaction rate	3
Internal Business Process	Low transaction cycle time	4
	Low order processing cycle time	4
	High level of quality information	5
Innovation and Growth	High number of new account opened	4
	High rate of new service introductions	3
	High rate of training investment	3

Table 8.9: VirtualCom VCA factors

Attract	Market research
	Banner advertising
	Search engine positioning
	Affiliate program
	Product innovation
Interact	Stimulate trial of the service
	Profile database management
	Visitor support
Act	Member generation
	Member identification and authentication
	Order processing
	Payment processing
React	Invoice generation
	Receipt generation
	Inquiry processing
Retain	Usage analysis
	Loyalty programme
Support	Financial accounts and analysis
	Training
	Knowledge management

Table 8.10: Possible e-business applications for VirtualCom

Attract	Affiliate system
Interact	CRM system
	e-Newsletter
	e-Bulletin board
	Online customer survey
Act	Database management system
	Order processing system
	Payment processing system
Retain	Web log analysis system

8.4 Chapter summary

In this chapter, the test data and results were further analysed and discussed in a wider context in comparison to Chapter 7. The data collected were analysed using a mixture of techniques including discourse, summarising content and thematic coding analyses. Once analysed using these three techniques, the data were inputted into the selection framework for calculation in order to prioritise critical business processes for eMatrix I and e-business applications for eMatrix II. The discussion of the test results was divided into eight sub-sections corresponding with the eight steps of the e-business selection framework.

It was discussed that the output from the eMatrices for the four companies was due to a number of factors. These factors included the level of competitiveness of the environment the companies are in, the aims and visions of the companies, and also the preferences of the managers and respondents to the survey. For eMatrices I, the top three business processes identified in each of the case studies can be seen to be concerned with internal processes as well as being customer-oriented. For eMatrices II, it was established that the e-business applications in the top three for each of the cases were mostly customer-focused. There were also discussions on how the BSC and VCA can be generated for an SME in the printing industry, and this led to the BSC and VCA generated through case studies in the research project which can be used as references for future research in a similar scope.

Discussions in section 8.3 showed that the applications of the selection framework were not limited only to the printing companies or the manufacturing sector, with examples of the e-business selection framework being used in a manufacturing company in the aerospace industry and a dotcom start-up in the service industry.

The next chapter will conclude the research and key discussions carried out in the thesis, including a revisit to the main contributions of the research: the areas of a BSC for a printing SME, VCA for a printing SME, the uses of QFD for a printing SME and e-business planning for a printing SME.

9. Conclusions

9.1 Chapter introduction

In Chapter 8, the developed selection framework was evaluated in a wider context as compared to Chapter 7. This chapter will conclude the thesis with discussions of the key contributions this research has made and any reflection on the research carried out. This chapter will also discuss the implications and limitations of the project as a whole and provide areas for further research.

9.2 Key academic contributions

As a result of this research project, a selection framework that can enhance the effectiveness and efficiency of e-business planning in SMEs has been developed. By integrating established and proven techniques of the BSC, VCA and QFD, the selection framework can transform customer needs and demands into e-business plans, whilst taking into account key internal factors including company strategies and objectives when prioritising possible e-business applications. The selection framework provides a structured, step-by-step approach to e-business planning, thus allowing SME managers to use the developed selection framework with ease and do without the major investment of man-hours often associated with the e-business planning process. Below is a summary of the seven key academic contributions of the research project:

1. The uses of QFD have been expanded to include e-business planning for SMEs in the printing industry. Before the commencement of this project, based on an extensive review of the literature, there is no evidence that QFD has ever been used in e-business planning despite its strengths in providing structured, prioritised planning.

2. The VCA can be used to assist in the generation of "hows". Depending on the nature of the planning to be carried out, different techniques can be used to generate the "hows" in QFD. As a result of this project, the VCA is demonstrated to be able to assist in the generation of "hows" in the case of e-business planning where business processes have to be taken into account during the planning process.

3. The developed selection framework has been demonstrated to work in the context of the four case studies, with final results reflecting on meeting the internal and external needs while taking into account the capabilities of the business processes as well as the feasibilities of implementing the e-business applications.

4. The developed selection framework provides a step-by-step approach to e-business application selection through structured planning. Through the deployment of the planning framework, managers will not be overwhelmed by the amount of possible solutions available to them as the selection framework will be able to allow the managers to prioritise these applications in relation to meeting needs while taking into account current business processes when going through the planning process.

9.3 Managerial implications

From the experience of carrying out the case studies in the four printing SMEs, the following four points were discovered:

1. Companies may not have documented the business processes.
2. Senior managers may not be exactly sure as to what is required of them during the interviews and surveys.
3. Senior managers may not know the exact targets set or that the company did not have detailed objectives set for measurement and evaluation purposes.
4. Other members of the company may be unwilling to discuss any issues that might be detrimental to them.

The developed e-business selection framework is a powerful management tool. The framework however, is built on the basis of perceived importance of the initial "whats" and the perceived importance of the inter-relationships between the "whats" and "hows" of both QFD eMatrices. This would cause managers to be concerned about the "rubbish in – rubbish out" notion, as any misinterpretation of the factors would result in the derailment of the company from the feasible and prioritised plan of actual e-business applications that require implementation. Thus, an experienced moderator familiar with the techniques of the BSC, the VCA and the QFD would be required to lecture the participants on the methodology. Preparation and training the participants, as well as asking the participants to prepare in advance for meetings,

would be able to minimise any potential derailments that might occur. The use of a focus group or planning committee could also prove to be an effective strategy to produce relevant data and analysis. However, with facial expressions and body language, a small group may be more dominant than the rest. There would also definitely be the risk of some participants trying to please others, perhaps for nothing more than a political reason. The "true lies" could nevertheless prove to be costly if there is no experienced moderator present during focus group or planning committee meetings.

In summary, to increase the efficiency and effectiveness of future investigations and/or for using the selection framework, the following three recommendations should be applied:

1. Respondents or team members in the task group should be told in advance the conventions of using the BSC, VCA and QFD.
2. A very structured approach should be undertaken to facilitate and guide the direction in which the communication is heading.
3. The trust level between the investigators and the respondents, or within the team members should be increased, probably with social activities outside the context of the case or task group.

9.4 Reflection

For the duration of the research project, the researcher realised the need to reshape and refocus the approach to the research topic, especially since the nature of the research was exploratory. Despite the ups and downs, it was worth the time, effort and all other sacrifices to reach this destination. The author kept in mind throughout that the PhD investigation was a learning process to enable the author to be developed into an independent researcher.

9.4.1 Issues of bias

Researcher bias was a problem that needed to be considered and was also mentioned in section 5.4.1. Potential issues of bias in the case of the research project included the following:

1. Choice of industry – The question is why the printing industry was chosen when there are so many others and, perhaps more important industries around. There is obviously a certain degree of bias towards the chosen industry as the researcher has links within the printing industry to quickly establish contacts and agreements on case study timings as well as the level of access in these printing companies. Certainly, the researcher would have chosen other "more" important industries if these personal links and contacts were also available at the start of the research project. Besides, it has also been discussed earlier in sections 3.4 and 3.5 on why the printing industry was chosen to evaluate the selection framework and also the importance of the industry to the economy.

2. Choice of interviewees – The choice of interviewees can be argued to be bias as well. Some may question the need to interview only the managers and including the employees only at the stage when factors were to be ranked. The researcher agreed that if employees were also interviewed during the initial stages, steps one and two of the selection framework, there would be the possibility that new perspectives might have surfaced. However, one must also bear in mind that the case study companies are SMEs with traditional set-ups, carrying a heavy Chinese influence. In the Chinese culture, anything that was said of superiors or of the companies must normally be positive and almost never negative. Thus, it would be easier to restrict interviewees for step one and two of the e-business selection framework to management and the managers only, as these are the people with more authority and of higher educational standards, enabling the influence of the old, traditional Chinese culture to be minimised.

3. Deciding when sufficient data are collected – Although it looked as if the researcher had the power to decide when sufficient data has been collected, it was, however, not the case. There was no decision as to when to stop collecting data. The method of collecting the data and the amount of data to be collected were pre-determined. It was determined with guidance provided by experienced researchers that the four case studies carried out would be sufficient. The amount of data collected would be deemed sufficient once all the eight steps of the selection framework had enough data to be implemented and the results presented to management for verification. Quantitative research on the other hand would be more reliant on sufficiency of the data collected. This is because there is a minimum amount of quantitative data required to establish confidence

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levels and also to enable generalisation of data or results through statistical analysis. In addition, the data was collected through diverse data collection techniques to allow triangulation to be carried out to minimise bias as well as to ensure that sufficient data was collected.

9.5 Limitations of the research

There are limitations to all research projects, as there are as well, to the findings and results of the newly developed e-business selection framework. The objectives identified by the companies are not all quantified, as managers from the companies are not able to provide exact targets for some of the identified objectives. As the findings and results of the developed selection framework are based on the four case studies carried out, it therefore has to be stated that findings and results can only be established in the context of the four cases. This is especially true since the four cases are Chinese companies with traditional set-ups and values. If the findings and results are to be further generalised, more studies would be required to be carried out. There were also further discussions on the issues of methodology limitations in Chapter 5.

The developed selection framework is limited to assisting managers in e-business planning by prioritising possible e-business applications in relation to needs of the company. The developed selection framework is not able to provide an e-business implementation blueprint after attaining the prioritised list of possible e-business applications. Thus it is strictly to aid in planning, not implementing.

9.6 Areas for future research

Having proven that the selection framework is both practical and usable by SME managers in the printing industry, future research can progress in five directions:

1. To further evaluate the e-business selection framework in SMEs within the printing industry with more case studies to further establish, prove and generalise the feasibility of the selection framework in the printing industry.
2. To enlarge the testing industries to include others so as to establish if the selection framework is suitable and feasible for use in SMEs in other industries.

3. To include other countries and regions to further establish the suitability and feasibility of the developed selection framework.
4. To develop a complete e-business roadmap from the selection framework.
5. To engage the use of other techniques to define the inputs of "whats" and "hows" to be inputted into the eMatrices.

Access permission is currently being sought from companies mainly in China but also in other countries and regions to further evaluate the e-business selection framework. A prototype to provide a more complete e-business implementation roadmap is currently being developed by integrating the e-business selection framework with traditional systems development lifecycle techniques.

9.7 Chapter summary

This chapter has concluded the thesis with a presentation and also discussions on the key findings. Key findings included both academic and managerial implications of the research. The key academic contributions of the research were to the areas of QFD, BSC, VCA, e-business planning framework and Chinese SMEs in the printing industry. The newly developed e-business selection framework can be argued to be a powerful management tool, although there is risk of "rubbish in, rubbish out" on the usage of the selection framework.

The reflections from doing the research project as well as the limitations of the research were also discussed. Reflections included the issue of bias on the choice of industry, interviewees and whether there was sufficient data to evaluate the selection framework, while the main limitation of the research was that only four case studies were carried out to evaluate the selection framework.

Lastly, the author has set the directions for future research as a result of the findings from this project, stating that access permission is currently being sought from companies to further evaluate the selection framework.

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Appendices

Appendix I. The History Of Printing

Although Johann Gensfleisch zum Gutenburg is recognised as the man whom had invented printing in 1456, printing is actually invented by the Chinese back in the 8th century (Adams et al., 1996; BBC; Dotprint, 1997a, 2001a; Jones, 1997). It was as early as 255 B.C. when the Chinese started to "sign" by printing their seals (Adams et al., 1996). Engraved block printing is believed to be invented in 593, the 13th year of the Chinese Shui Dynasty and large-scale block printing started in 953 under the administration of a Chinese named Feng Tao (Adams et al., 1996; Wu, 2000a). In 1401, another Chinese, Pi Sheng, invented the movable type (Adams et al., 1996). William Caxton, England's first printer, was the first man to bring printing technology into England in 1476 (Dotprint, 2001a). By 1501, there were to be 1000 printers in Europe producing 35,000 titles and 20 million copies (Jones, 1997).

The first printing presses were made of wood and it was not until 1772 that William Haas of Basel built the first press where all parts subjected to stress were iron. In 1798, the first printing press made completely from iron is built by Earl Stanhope; while also in that same year, Aloys Senefelder invented lithography (BBC; Dotprint, 1997b). By 1801, Senefelder has patented his design and in 1803, incorporated metal plates with lithography (Dotprint, 1997c). In 1812, Friedrich Konig, a German engineer in England, developed the first steam operated twin cylinder printing press (BBC; Dotprint, 1997c; Dotprint, 2001a). Steam printing together with lithography has made it possible to increase printing production while lowering costs. The first books featuring full colour Baxter prints are published in 1934 (Dotprint, 1997c). By 1837, the printing industry is entirely transformed from the way it was as in 1756.

The printing and finishing equipment market is currently dominated by manufacturers from Germany and Japan, with Heidelberg, MAN Roland and KBA from Germany and Komori and Mitsubishi from Japan (Dotprint, 2001b; Printing World, 2001). Other smaller manufacturers include Edale and Morgana Systems of England that concentrate on niche markets with technology-led products (Dotprint, 2001b). The Chinese printing industry is however, though unsurprisingly; dominate by printing and finishing equipment manufacturers from the cities of Beijing and Shanghai, and the provinces of Wenzhou and Zhejiang. The first digital printing presses are introduced into the Chinese market in the early 1990s. Manufacturers of these future presses include Apple, Cannon, Heidelberg, IBM Printing Systems, Indigo, Komori, MAN

Roland, Oce, Quickmaster, Ryobi, Xeikon and Xerox (Dotprint, 2001c; Ducey, 2002; Printing World, 2002a, 2002b).

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Appendix II. Atlas eMatrix I "Whats" Ratings

Atlas eMatrix I "WHATs" Rating of 1-10

Respondent / Factors	Managing Director	Human Resources	Market-ing	Product-ion	Staff Repres-entative 1	Staff Repres-entative 2	Staff Repres-entative 3	Custom-er 1	Custom-er 2	Total	No. Count	Average
Financial:												
Variable costs control	6	7	7	-	6	5	7	6	5	49	8	6.1
Profit growth	10	8	7	-	5	5	10	8	7	60	8	7.5
Sales growth	10	10	10	-	7	6	10	9	10	72	8	9.0
Profit margin	10	10	8	-	5	5	8	7	8	61	8	7.6
Fixed costs growth	10	6	10	-	6	5	7	7	7	58	8	7.3
Customer:												
Before-sales services – in a survey	10	8	7	8	6	-	7	9	6	61	8	7.6
After-sales services – in a survey	10	8	9	9	6	-	9	10	8	69	8	8.6
Customer retention	8	8	10	8	6	6	10	9	10	75	9	8.3
Customer satisfaction	8	9	10	8	5	6	10	8	10	74	9	8.2
On-time delivery	9	8	10	8	5	9	10	10	10	79	9	8.8
Innovative solutions	8	6	8	8	5	9	6	8	8	66	9	7.3
Co-operative projects	8	6	8	8	5	6	6	8	5	60	9	6.7
Customer complaints	9	8	10	7	5	5	10	9	8	71	9	7.9
Sole or Preferred supplier – in a survey	10	6	7	7	6	6	9	7	6	64	9	7.1
Business Process:												
Benching-marking with key competitors	8	6	8	8	5	-	10	8	7	60	8	7.5
Schedule planning	8	7	10	7	6	7	10	9	6	70	9	7.8
Operation efficiency	9	8	10	7	6	8	10	10	8	76	9	8.4
Stock availability	8	8	8	7	6	7	9	7	6	66	9	7.3
Machine downtime	7	8	8	7	7	5	9	7	6	64	9	7.1
Production cycle time	8	8	10	7	5	-	9	6	7	60	8	7.5
Rejections	9	9	10	8	6	2	10	5	10	69	9	7.7
Wastage	9	8	10	7	5	7	8	10	10	74	9	8.2
Unit cost	9	7	7	-	5	-	8	7	6	49	7	7.0
Innovation and Growth:												
New account opened	8	8	10	8	5	-	7	10	10	66	8	8.3
Development time invested to Next Generation products	7	6	6	7	-	-	6	10	8	50	7	7.1
New product introductions	7	8	6	7	-	9	6	9	6	58	8	7.3
Staff satisfaction – in a survey	8	7	5	7	5	7	7	8	5	59	9	6.6
Training investment	7	7	10	6	4	5	7	7	5	58	9	6.4
Value-adding time	8	7	8	7	5	-	7	7	5	54	8	6.8

Appendix III. Fun Press eMatrix I "Whats" Ratings

Fun Press eMatrix I "WHATs" Rating of 1-10

Respondent / Factors	General Manager	Production Operation	Finance	Customer 1	Customer 2	Customer 3	Customer 4	Total	No. Count	Average
Financial:										
Fixed costs growth	9	8	10	5	10	-	-	42	5	8.4
Profit growth	10	10	10	9	-	-	-	39	4	9.8
Sales growth	10	10	10	8	9	6	-	53	6	8.8
Unit costs	9	10	10	6	7	-	-	42	5	8.4
Customer:										
Brand Image	7	9	10	9	-	5	6	46	6	7.7
Brand recognition	7	10	10	5	9	8	7	56	7	8.0
Customer retention	7	10	10	8	-	7	-	42	5	8.4
Customer satisfaction	8	10	10	8	10	8	7	61	7	8.7
Number of co-operative projects	6	7	8	7	-	9	-	37	5	7.4
On-time delivery	10	10	10	4	10	-	10	54	6	9.0
Repeat business	8	10	10	7	10	9	-	54	6	9.0
Business Process:										
Bench-marking with key competitors	8	8	10	6	-	9	5	46	6	7.7
Comparison with competitors	8	9	10	4	-	7		38	5	7.6
Operation efficiency	10	10	10	9	-	6	6	51	6	8.5
Production cycle time	10	10	10	5	-	-	-	35	4	8.8
Rejections	8	9	8	5	-	-	-	30	4	7.5
Schedule planning	5	8	8	5	-	8	-	34	5	6.8
Stock availability	7	10	10	5	-	6	8	46	6	7.7
Sustain product quality	10	9	10	8	-	-	10	47	5	9.4
Wastage	6	9	10	5	-	-	-	30	4	7.5
Unit cost	7	9	9	5	-	-	-	30	4	7.5
Innovation and Growth:										
Outlets opened	9	10	10	8	-	-	8	45	5	9.0
Speed of innovation	6	5	10	9	-	-	9	39	5	7.8
Technology leadership	8	6	10	10	-	-	6	40	5	8.0
Training Investment	7	10	7	10	-	-	-	34	4	8.5