CRANFIELD UNIVERSITY

SCHOOL OF APPLIED SCIENCES

ENGD THESIS

Academic Year 2007

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Development of a Strategic Supply Chain Positioning Methodology for SMEs in Singapore

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OCT 2007

This thesis is submitted in partial fulfilment of the requirements for the Degree of Doctor of Engineering

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ABSTRACT

The Small and Medium Enterprises (SMEs) in Singapore face particular challenges from increasing competition from manufacturers in China, India and other East Asian countries. For these SMEs, survival and growth depend critically on defining their own competitive space among other companies in the manufacturing supply chains. Unfortunately there is little previous research on Strategic Supply Chain Positioning (SSCP) with most current frameworks and methodologies being developed from the perspective of the larger multinational companies (MNCs). Therefore this research has set out to develop a practical and robust SSCP methodology to support strategic decision making in SMEs in Singapore.

The research programme began with a review of the existing methodologies and selecting the most promising methodology for further evaluation. Testing of this methodology was then carried out through four industrial case studies. Based on the results of the evaluation, the methodology was refined and a pilot SSCP methodology for SMEs was developed. Further testing was then carried out with another four case studies to identify particular characteristics for further improvement. The final SSCP methodology was then developed as a computerised software tool and presented in Chapter 9 of this thesis.

The research has created a strategic supply chain positioning methodology that provides practical and procedural aid for strategic supply chain positioning efforts for SMEs in Singapore. This methodology guides the practitioner through a series of well-defined steps necessary to define the desired strategic positioning of the company in the supply chain. Such a methodology has been lacking in previous research and, hence, is the main contribution to knowledge in this thesis.

ACKNOWLEDGEMENTS

I would like to give my utmost sincere and grateful thanks to all the people who helped me to the successful completion of my EngD degree at Cranfield University. I am truly grateful to Prof. Tim Baines, my main supervisor, for his invaluable advice, his inspiration and his perseverance to guide me through this journey. I am also grateful to Dr Benny Tjahjono, my co-supervisor, for his guidance and encouragement. I would also like to thank Dr Mike Bourne, my management supervisor from the School of Management, for this support during this research.

I would like to express my gratitude to SIMTech for its sponsorship and support for the EngD programme and many thanks to my SIMTech supervisor, Dr Fong Aik Meng, for his backing and guidance. Finally, I need to recognise the support and encouragement of my family and friends during the hard times and long irregular working hours, especially my wife, Serene and my three children, Shih Yann, Shih Qi and Zhi Yong.

PUBLICATIONS

Lim, R. Y. G., T. Baines, B. Tjahjono, W. Chandraprakaikul (2006), *Integrated Strategic Supply Chain Planning for SMEs: An Empirical Study*, The International Journal of Logistics Management, Vol. 17, No. 2, pp. 260-276.

Lim, R. Y. G., Chandraprakaikul, W., Baines, T.(2007), *Development and evaluation of a resource-based supply chain positioning methodology for SMEs*, The 2nd International Conference on Operations and Supply Chain Management, Bangkok.

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GLOSSARY OF TERMS

SSCP	Strategic Supply Chain Positioning
SMEs	Small and Medium Sized Enterprises
MNCs	Multi-National Corporations
RBV	Resource-Based View
VI	Vertical Integration
HI	Horizontal Integration
GDP	Gross Domestic Product
MTI	Ministry of Trade and Industry
KPIs	Key Performance Indicators
EDB	Economic Development Board
PSB	Productivity and Standards Board
CDP	Capability Development Programme
FACTS	Financial, Attitude/Acceptability, Competence /Capability, Technological and Strategic Fit
SIMTech	Singapore Institute of Manufacturing Technology
R&D	Research and Development
CNC	Computer Numerical Control
SWOT	Strengths, Weaknesses, Opportunities, and Threats

CHAPTER 1: INTRODUCTION

The fast changing global economic landscape is placing even greater pressure on SMEs in Singapore to reliably define their strategic position in their supply chain networks. Unfortunately, little is known about how well existing decision methodologies support practitioners in the Singaporean business context. This chapter is structured to provide a brief description of the background of the research (Section 1.1); a summary of the research aim, objectives and programme (Section 1.2); the contribution to knowledge provided by this thesis (Section 1.3); and finally a description of the structure for the remainder of this thesis (Section 1.4).

1.1 BACKGROUND TO THE RESEARCH

The rapidly changing global economic landscape, coupled with the opening of manufacturing and markets in China, India and other East Asian countries, has presented a tough challenge for manufacturing in Singapore. This is especially so for SMEs, who are facing growing competitive pressures from low cost manufacturing locations in these countries whilst lagging behind developed nations in sophisticated high-tech manufacturing (Section 2.2). For the SMEs in Singapore, their key challenge therefore depends critically on deciding those activities that should be carried out internally and those that can be external in the supply chain network so as to regain competitiveness. Currently this decision has been formed in a rather fragmented manner, and as a result, there is an urgent to help SMEs in Singapore to identify what to do strategically to position themselves in the supply chain, so as to keep Singapore competitive in the ever-changing global economy (Section 2.4).

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There is little research that explicitly address strategic supply chain positioning, however various concepts exist that directly impact the strategic positioning of an

enterprise. These concepts include vertical and horizontal integration, make or buy, strategic alliances, sourcing/global sourcing/core competency, outsourcing/strategic outsourcing, strategic positioning and offshoring (Section 3.2). Research on vertical and horizontal integration has been proposed that cover specific industries (Crandall, 1968; Marx, 1976; OhUallachain and Wasserman, 1999; Richardson, 1996; Vernon and Graham, 1971; Schmalensee, 1973; Arrow, 1975 and, etc.). Research on make or buy includes researchers proposing different perspectives of make or buy such as (Jauch and Wilson, 1979; Ford and Farmer, 1986; McIvor et al., 1997; Humphreys et al., 2000; Platts et al., 2002: Probert, 1996: and etc). Research on core competency comprises of survey research (Gilgeous and Parveen, 2001), framework (Walsh and Linton, 2001) and model (Onyeiwu, 2003) (Section 3.2). Researchers who define strategic positioning in supply chains by taking a holistic view include Hill (1993), Valliespir and Kleinhans (2001), Johansen and Riis (2005), and Baines et al (2005) (Section 3.2).

In summary, much of the existing research work only address part of the supply chain and deal with the boundary interface to suppliers, customers, infrastructure, and product range independently. There is little research on strategic supply chain positioning taking a holistic view of all the four interfaces (Section 3.3.1). In addition, the current methodology is developed from the perspective of larger multinational companies (MNCs). SMEs in Singapore are very different in company size with more typical levels of comparative advantage (Section 3.3.1). The challenge therefore remains to explore current processes and develop a new strategic supply chain positioning (SSCP) methodology for SMEs in Singapore (Section 3.3.1). This has then led naturally to the research aim and objectives which are explained in the next section.

1.2 OVERVIEW OF RESEARCH AIM, OBJECTIVES AND PROGRAMME

The research aim, objectives and programme has been fully developed in Section 4.2, notably as:

> *"To develop a strategic supply chain positioning methodology to support the strategic decision making process in SMEs in Singapore and evaluate its effectiveness in practical implementation"*

In order to realise the research aim for this research project, the following 5 research objectives (Section 4.2) have been defined:

1. Selection of most promising methodology.
2. Evaluation of most promising methodology.
3. Formation of pilot methodology tailored to SMEs in Singapore.
4. Evaluation of pilot methodology.
5. Refinement and illustration of final methodology.

The research programme has followed five distinct phases. Phase 1 of the research is to select the most promising methodology. The research method used in this phase is to critically assess the capability of existing methodologies related to strategic supply chain positioning (SSCP) for the purpose to select the most promising methodology (Section 4.3.1).

Phase 2 of the research is to evaluate the effectiveness of the selected most promising methodology for SMEs in industry. The testing is to observe the application of the methodology in practice in order to evaluate whether it is workable, to determine whether the methodology provides a practical, procedural step, and to establish future research needed to refine and adapt the

methodology for SMEs in Singapore. The main focus of this phase is on industry testing, and therefore the research method used in this phase is case study method with participant intervention (Section 4.3.2).

Phase 3 of the research is to use the feedback data gathered from the evaluation results at phase 2 to identify, refine, improve the selected methodology, and form the pilot SSCP methodology tailored to SMEs in Singapore. The focus of this phase is on the refinement process as well as the formation process of the pilot methodology (Section 4.3.3).

Phase 4 of the research is to further evaluate and test of the applicability of the pilot SSCP methodology. The research method used is similar to that of phase 2 except for two changes. Firstly the industrial cases are changed to demonstrate that the pilot methodology is not limited to one set of circumstances. Secondly the role taken by the researcher is also changed with the researcher acting as an observer rather then as a participant to the implementation of the case projects (Section 4.3.4).

Finally, Phase 5 is to collate all the suggested changes from the case studies, identify areas that need changing, refine and develop a fully tested and documented final SSCP methodology in the form of a computerised software tool for SMEs in Singapore (Section 4.3.5).

1.3 OVERVIEW OF RESEARCH CONTRIBUTION

The main contribution to knowledge of this research is the creation of a strategic supply chain positioning methodology that provides practical and procedural aid for strategic supply chain positioning efforts for SMEs in Singapore. The purpose of the methodology developed in this thesis is to guide the practitioner through a series of well-defined steps necessary to succeed in the implementation of strategic positioning of the company in the supply chain.

This methodology has been shown in this research to be feasible, usable and useful for SMEs in Singapore. Such a methodology has been lacking in previous research, and hence, is the main contribution to knowledge in this thesis.

1.4 STRUCTURE OF THE THESIS

This thesis is structured to first provide a background to this research, along with the concept of strategic supply chain positioning and an overview of previous research. The research aim and programme are then presented, followed by review of existing methodologies to select most promising methodology, evaluation and testing of the selected methodology, development of the pilot SSCP methodology, further evaluation and testing of the pilot SSCP methodology, refinement to develop final methodology, and finally conclusions. The thesis structure is illustrated in Figure 1.1 and consists of the following sections:

Chapter 2 Reports the background of this research to define and establish the industrial context and the need for strategic supply chain positioning for SMEs in Singapore.

Chapter 3 Performs a literature review that sets the terminology used in this thesis, and explores the current research issues associated with strategic supply chain positioning as well as the research methods used. This chapter culminates in identifying research opportunities in the development of a strategic supply chain positioning methodology (SSCP) for SMEs in Singapore.

Chapter 4 Develops the precise research aim and the research objectives for this thesis. A structured five phase programme of research activities is then designed to execute the research. Individual

phases of this research programme are identified, and for each phase, a suitable research method is identified.

Chapter 5 Presents the execution of the first phase of the research programme by reviewing the literature of existing methodologies related to strategic supply chain positioning with the purpose to select the most promising methodology. This phase then defines the requirements of strategic supply chain positioning methodology for SMEs. Existing methodologies are then reviewed against this set of requirement sets to select the most promising methodology.

Chapter 6 Presents the execution of the second phase of the research programme and performs the evaluation and testing of the selected methodology by the case study method and design of the data collection protocol framework. The testing of the methodology in 4 case studies in the industry is to evaluate the feasibility, usability and usefulness of the methodology and to identify areas for improvements.

Chapter 7 Presents the execution of the third phase of the research programme and develops the pilot SSCP methodology tailored to SMEs in Singapore. This is realised based on the shortcomings identified in Chapter 6.

Chapter 8 Presents the execution of the fourth phase of the research programme and performs further evaluation and testing of the pilot SSCP methodology developed in the preceding chapter. This is achieved by testing the pilot SSCP methodology in another 4 case studies to provide confirmation and feedbacks on the feasibility, usability and usefulness of the methodology, and to identify

particular characteristics of the process to improve its chance to be widely applicable.

Chapter 9 Presents the fifth and final phase of this research programme and describes the final fully documented SSCP methodology for SMEs in Singapore, in the form of a computerised software tool. This is realised by collating all the suggested changes identified in Chapter 8 and refinement of the pilot SSCP methodology.

Chapter 10 Draws conclusions on the work described in this thesis, and highlights the contributions to knowledge of this thesis. The limitations of this research are described and recommendations are made for future work in the area of strategic supply chain positioning research.

In summary, this chapter has provided an overview of the research background, the research aim, objectives and programme, an overview of the research contributions, and the thesis structure. In the next chapter, the industrial context in the area of strategic supply chain positioning is presented.

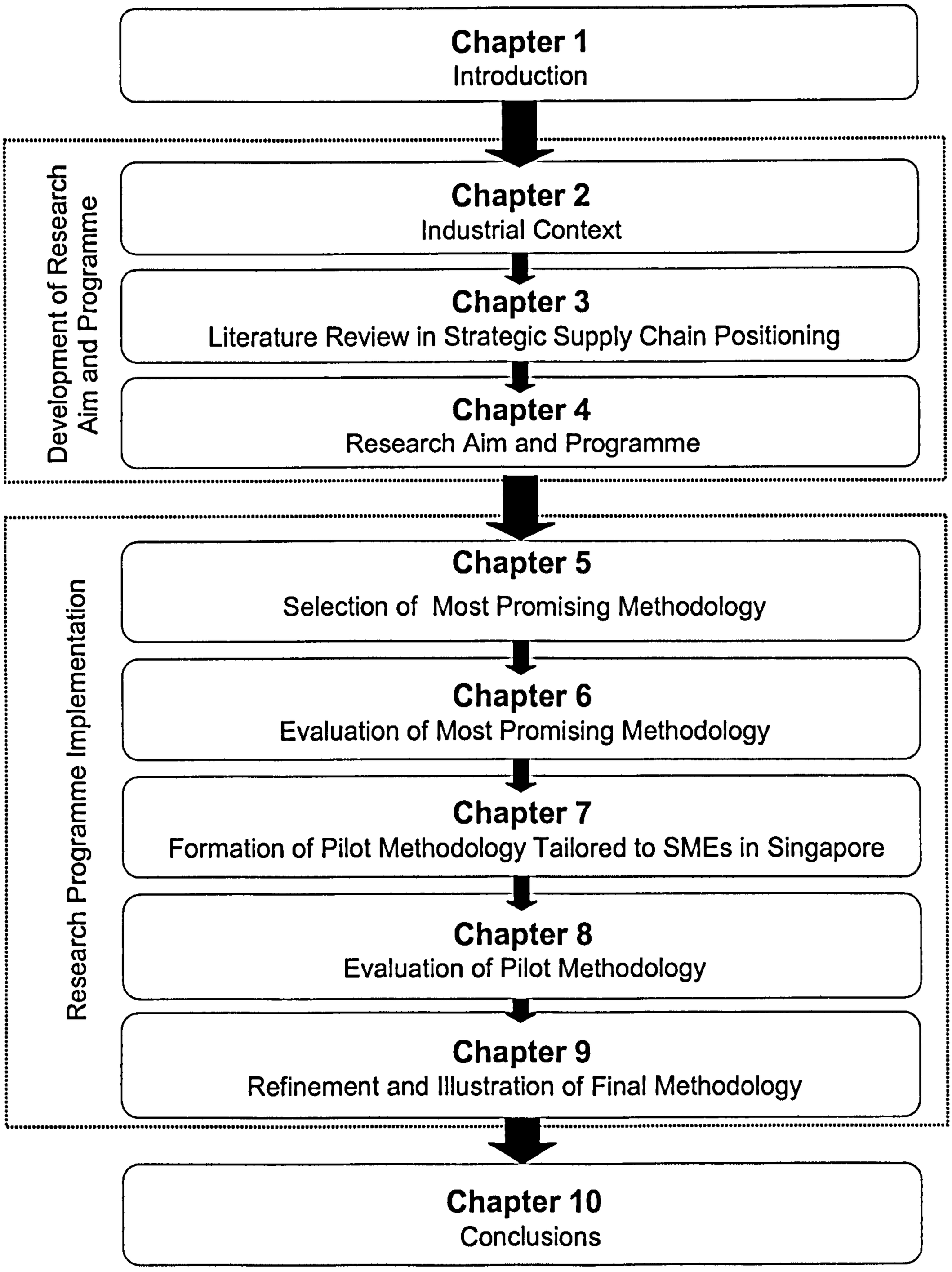


Figure 1.1: The structure of the thesis

CHAPTER 2: INDUSTRIAL CONTEXT

Chapter 1 has set out the background of the research, and an overview of the research aim, objectives and programme, followed by a summary of the research contributions. This chapter presents a review of the small and medium sized enterprises (SMEs) in Singapore. Its purpose is to provide an understanding of the context of manufacturing and SMEs in Singapore, introducing manufacturing within the Singapore economy, the current state of SMEs, and presenting the challenge of strategic supply chain positioning. Hence, this chapter is structured around 4 main sections. Manufacturing within the Singapore economy is discussed in Section 2.1, followed by the current state of SMEs in Singapore in Section 2.2. Section 2.3 discusses the competitive challenges of SMEs in Singapore. The Singapore Government Initiatives for SMEs is presented in Section 2.4. Finally Section 2.5 addresses the challenge of strategic supply chain positioning for SMEs in Singapore.

2.1 MANUFACTURING WITHIN THE SINGAPORE ECONOMY

Manufacturing has always played an important role in Singapore's economic development since the earliest days. With the transition from a labour-intensive economy in the 1960s to a knowledge-driven economy today, manufacturing remains an important growth engine for productivity and prosperity in Singapore, contributing between 22% and 26% of the country's Gross Domestic Product (GDP) in the last ten years (Department of Statistics Report, 2004).

Today, manufacturing contributes nearly a quarter of Singapore's GDP and a fifth of total employment, with over 6,000 multi-national companies (MNCs) and 100,000 small and medium sized enterprises (SMEs) operating in Singapore. Recently, the Ministry of Trade and Industry (MTI) Economic Review Committee - Sub-Committee on Manufacturing reaffirmed the sustainability and centrality of

manufacturing to Singapore's economy. Its report projected that manufacturing will remain crucial to the economy, with output in 2010 rising to S$200 to S$250 billion, and still accounting for some 20 percent of our GDP then (Economic Review Committee, 2002). Hence, given its critical role in Singapore's economic development, manufacturing will continue to remain a cornerstone of Singapore's long-term economic strategy.

To promote Singapore's economic growth, the Economic Development Board (EDB), the lead agency for developing the manufacturing sector in Singapore, has adopted a cluster development strategy for companies. This sets out to improve competitiveness through establishing linkages and integration of manufacturing activities and capabilities within and between clusters (Economic Development Board, 2005). Table 2.1 shows several key strategic and higher value industry clusters. The current state of the industry in each of the key strategic industry clusters is briefly described as follow:

Electronics & Precision Engineering Cluster - The electronics cluster is the lead contributor of the manufacturing sector and contributes 50% to the total manufacturing sector output. In the semiconductor industry, there are 12 operational wafer fabs, including 3 state-of-the-art 12-inch fabs that are under construction. The value chain of the semiconductor industry spans activities from IC design to wafer fabrication to assembly and test. In the data storage sector, Singapore manufactures about 33% of the world's hard disk drive, and this sector has moved up the value chain to include product design. To support these industries, there is a vibrant precision engineering cluster contributing about 10% of manufacturing output.

Chemicals Cluster - The chemicals cluster comprises of 3 major industries, namely petroleum, petrochemicals and specialty chemicals. This cluster contributes about 26% of the total output from the manufacturing sector. In this

Table 2.1: Key strategic industry clusters

Industry Clusters	Industries
Electronics Cluster	• EMS, Storage & Peripherals • Semiconductors • Electronics Modules & Components
Precision Engineering Cluster	• Machinery & Systems • Precision Modules & Components
Chemicals Cluster	• Petroleum • Petrochemicals • Bio & Consumer Chemistry • Specialty Chemicals • Performance Materials
Biomedical Sciences Cluster	• Pharmaceuticals • Medical Devices • Healthcare Services & Delivery • Biotechnology
Transport & Logistics Cluster	• Aviation • Maritime • Land Transport • Logistics & Distribution

cluster, areas like performance materials, electronic chemicals and materials are growing in importance as well as contribution.

Biomedical Sciences Cluster - The Biomedical Sciences cluster has been broadly categorised into four industry sectors - pharmaceuticals, medical technology, healthcare service and delivery, and biotechnology. Singapore's Biomedical Sciences Cluster grew positively by 3.2% from year 2000 and accounted for 7% of the Manufacturing Sector's output in 2002.

Transport Cluster - The transport cluster comprises key manufacturing and aftermarket activities in aviation, land transport, maritime and oil & gas sectors. This cluster is a key component of the manufacturing sector of Singapore's economy, contributing about 6% of manufacturing output. The total manufacturing output in 2002 for the manufacturing sector amounts to S$138 billion (US$77 billion).

In summary, this section has described the importance of manufacturing to the economic development of Singapore and the contribution from each of the key industry clusters to the manufacturing sector. Although the main contribution to the growth of the manufacturing sector in Singapore can be attributed to the presence of multinational companies (MNCs), however local small and medium enterprises (SMEs) are increasingly playing an important role contributing to the manufacturing sector. The next section highlights the current state of these SMEs in Singapore.

2.2 CURRENT STATE OF SMES IN SINGAPORE

In Singapore, a SME is defined as a company with at least 30% local shareholdings and less than $15 million in fixed productive assets (in terms of net book value). For the service company, it must have less than 200 employees (SPRING, 2007). According to a survey done by the Singapore Department of

Statistics Annual Survey of Services in 2004 there are about 100,000 SMEs in Singapore and they make up 90% of all enterprises in Singapore, contribute to about a quarter of Singapore's Gross Domestic Product (GDP), and employ almost half of the country's workforce (Department of Statistics Report, 2004).

SMEs play an important role in Singapore's economic development by supporting the manufacturing sector in the key strategic industry clusters of electronic, precision engineering, chemicals, biomedical and transport. SMEs are fast gaining recognition as the economic backbone of the nation. SMEs are crucial to the growth of the national economy as: 1) SMEs are a transitional model for the emergence of larger enterprises; 2) SMEs create employment; and 3) SMEs directly contribute to economic growth. (SPRING, 2007).

The productivity of SME is however only about half that of the non-SME establishment (ACTETSME, 2004). Wong and Singh (2002) has highlighted that this poor productivity performance of SMEs in Singapore can be attributed to several structural weaknesses – weak entrepreneurial culture, insufficient management know-how and professionalism, shortage of professional and technical manpower, insufficient use of technology, outmoded, unproductive methods of operation, and limited ability to tap economies of scale. Furthermore, SMEs in Singapore are not as dynamic as in other Asia countries such as Hong Kong and Taiwan, as they depend on MNCs for much of their economic activities (ACTETSME, 2004).

Besides, with the changing global manufacturing landscape, SMEs in Singapore are facing tough challenges. The world is undergoing tremendous changes, driven very much by an explosion of knowledge and technology that changes the way we do business and live our lives (Economic Review Committee, 2002). Coupled with this formidable change in technology is the opening of markets such as China, India and other East Asian countries. These markets are in turn generating an insatiable demand for advanced technologies and new business

models in their drive to improve their competitiveness and to leapfrog ahead (Economic Development Board, 2003).

Within the Asia Pacific region, most foreign direct investments are attracted to China. Manufacturers are lured by the low costs of operation and the proximity to a potential market of 1.2bn people. The risk for Singapore as with all Asian countries is that China is attracting funds and companies that might otherwise be allocated elsewhere in the region. The perception is that Singapore has become uncompetitive as a base for manufacturing, allied to a lack of a market for products either within Singapore or the immediate neighbours ((Economic Review Committee, 2002).

These changing landscapes have ushered in new challenges for SMEs. Presently, majority of the SMEs are unable to deal with these challenges and, to add to the situation, are frequently under pressure on the local or domestic markets from cheaper imports and foreign competition. The main concern for SMEs in Singapore is that they are in danger of being 'squeezed out' as they face increasing competition from low cost manufacturing locations whilst lagging behind developed nations in the sophistication of technology and innovation.

In his National Day Rally speech in 2004, Prime Minister Lee Hsien Loong highlighted this reality confronting many SME companies in Singapore when he said, "Countries which are better than us are getting cheaper and the countries which are cheaper than us are getting better." He further added, "It's like the scissors are closing and we are in the middle. And if we don't jump out and do something, we're going to be squeezed." (Singapore NDR, 2005). In this increasingly complicated scenario of global supply chain networks, SMEs often find themselves sandwiched between large customers, low cost manufacturers and high tech manufacturers. How well they respond to these challenges will have an impact beyond their individual survival. SMEs therefore need to adopt a more proactive approach to strategically position themselves in the supply chain.

In summary, this section has described the current state of SMEs in Singapore and highlighted some of the challenges faced by SMEs in the changing manufacturing landscape. The following section highlights some of the strategic initiatives implemented by the Singapore Government to help SMEs to better meet these challenges and to effectively develop the SME sector in Singapore.

2.3 SINGAPORE GOVERNMENT INITIATIVES FOR SMES

This section introduces some of the strategic initiatives implemented by the various public sector agencies to help SMEs overcome the challenges faced as mentioned in the previous section 2.2. The Singapore Government has recognised that assisting and growing the SMEs has become increasingly important for Singapore's future economic development. This is a key element of the overall strategy to develop Singapore into a major node in global business and a total business center (ACTETSME, 2004).

One strategic initiative launched by the Productivity and Standards Board (PSB), the lead agency directly involved in growing the SMEs in Singapore, is the SME 21 plan – a national blueprint aims to transform small and medium enterprises (SMEs) in Singapore over the next 10 years (Productivity and Standards Board, 2000). SME 21 is a 10-year strategic plan aimed at building up the capabilities of SMEs so as to enhance their contributions to Singapore's competitiveness and economic growth. The overall vision of SME 21 is to create vibrant and resilient SMEs that will enhance Singapore's competitiveness and economic growth (Productivity and Standards Board, 2000).

In the SME 21 (Productivity and Standards Board, 2000), there are basically three strategic goals that form the core of the SME 21 vision and these are:

- Grooming innovative high-growth SMEs – This goal aims to develop SMEs that can compete globally on a sustainable basis so that, over time,

a steady stream of SMEs can reach world-class status. These SMEs will produce innovative products and services

- Developing productive SME sectors - Encourages entrepreneurs to engage in high end activities. Ideally, the manufacturing set-up should span the entire value chain, from R&D to Commercialisation to post customer relationship management.
- Creating a knowledge-based, pro enterprise environment - Government needs to support R&D and IP development.

A three-pronged holistic approach will be taken in SME 21 to achieve the three goals. This comprises Enterprise-level Strategies, Sector-level Strategies and Broad-based Strategies, as shown in the respective Table 2.2, 2.3 and 2.4 (Productivity and Standards Board, 2000),

With this SME 21 plan a new breed of SMEs will be created which will be world-class business entities with the following attributes:

- Professionally managed organisation
- Excellence in process and customer service management
- Capabilities to create new knowledge and technology to develop high value-added products and services
- Ability to compete globally

Another proactive strategic initiative launched more recently by SPRING Singapore is the SME Capability Development Programme (CDP). This SME Capability Development Programme (CDP) is to help Singapore's SMEs become more competitive by enabling them to develop their capabilities in order to move up the value chain. Under this $35 million programme, SMEs can develop new capabilities on their own or as a consortium in order to gain competitive advantage against regional players (SPRING, 2006).

Table 2.2: Enterprise-level strategies (adapted from Productivity and Standards Board, 2000)

Enterprise-level Strategies	Programmes
Developing Entrepreneurs	• To help SMEs to develop strategic directions • To equip entrepreneurs with management and leadership skills
Managing Business Excellence	• To help SMEs manage their organisations professionally • To help SMEs learn from and apply best practices • To help transform SMEs into professionally-run organisations
Harnessing Technology and Knowledge for Growth	• To offer a wide array of integrated business support services and advice to SMEs • To facilitate connections between aspiring technopreneurs, innovative SMEs, researchers and experts and venture capitalists • To provide SMEs with access to management assistance, finance, and business and technical support services
Designing New Business Models for Competitive Advantage	• Strategic business planning package to enable SMEs to develop their own strategic business plans • Innovative business concept award to spur SMEs to continuously develop new business concepts

Table 2.3: Sector-level strategies (adapted from Productivity and Standards Board, 2000)

Sector-level Strategies	Programmes
Facilitating Collaborative Partnerships and Strategic Alliances	• To help domestic businesses become regional and global players • To help SMEs better manage their costs and resources, and focus on core activities • To share knowledge, experience and ideas, and leverage on each other's capabilities
Upgrading Domestic Service Sectors	• To raise the productivity of tradable and non-tradable sectors • To help domestic businesses overcome the disadvantage of size, build up capabilities to grow, leverage on the internet to do business and be internationally competitive

Table 2.4: Broad-level strategies (adapted from Productivity and Standards Board, 2000)

Broad-level Strategies	Programmes
Promoting Entrepreneurship	• To award SMEs and provide competitions to encourage SMEs to develop new business ideas and models • To promote local SMEs as preferred business partners to foreign companies
Financing for Growth	• To review SME schemes to ensure their relevance and effectiveness in the knowledge-based economy • To promote Economic Value Added as a tool for measuring the effectiveness of capital usage
Facilitating Market Access	• To publicise Singapore Connect widely to more SMEs, and accelerate link with databases of other countries, local and foreign industry associations • To promote the importance of branding to SMEs, and develop a unique Singapore brand image for SMEs to explore new markets overseas
Strengthening Local Talent	• To implement effective systems to facilitate lifelong learning and skills development in SME organisations • To develop more SME scholarships to groom local talent

Mr Inderjit Singh, who is a Member of Parliament and Chairman of the Government Parliamentary Committee for Finance, Trade and Industry, recently urged SMEs again to leverage on the CDP to upgrade and move up the value chain. He said, "SMEs need to develop new capabilities to offer higher value-added services to their customers. SMEs should also forge strategic partnerships with one another so as to increase their global network and reach, and to provide more seamless supply chain solutions to their regional clients. By coming together, SMEs can pool resources and complement one another's strengths." (Enterprise Today, 2007).

In summary, this section has highlighted the proactive role played by the Singapore Government in implementing several strategic initiatives to help SMEs to develop their capabilities in a systematic manner so that they can add value to their customers and enhance their competitiveness. These initiatives also help SMEs to develop and strengthen their management systems and processes so as to enable the growth of their enterprises. These strategic initiatives will build up a larger pool of SMEs committed to business excellence and working towards attaining high standards of performance under the business excellence framework. The next section will examine the challenges faced by SMEs to strategically position themselves in the supply chain.

2.4 THE CHALLENGE OF STRATEGIC SUPPLY CHAIN POSITIONING FOR SMES IN SINGAPORE

The previous sections has established the importance of manufacturing (Section 2.1): the increasing important role played by SMEs to the economic development of Singapore (Section 2.2); the challenges faced by SMEs in the changing manufacturing landscape (Section 2.2); and some of the strategic initiatives implemented by the Singapore Government to help SMEs face these multi-dimensional challenges and remain competitive (Section 2.3).

All these facts indicate that the key challenges for SMEs in Singapore therefore depend critically on defining their own position among companies in the manufacturing supply chain. Increasingly, these challenges cannot be effectively met by isolated change to specific organisational units, but instead depend critically on the relationships and interdependencies among different companies in the supply chain, and those that are unable to do so increasingly face the danger of losing their existing markets. The ongoing competitiveness of an organisation is very much tied to the dynamics of the supply chains in which it participates, and each organisation has its own 'position', a selection of internal and external activities that the organisation owns and controls in the supply chain. Key decisions are needed within the supply chain to define this position so as to maximise business competitiveness. However SMEs currently face several challenges in terms of structural weaknesses resulting in this decision being formed in a rather fragmented manner, thus leading to poor overall productivity performance (Productivity and Standards Board, 2000). Some of these challenges include:

- Weak entrepreneurial culture
- Insufficient management know-how and professionalism
- Shortage of professional and technical manpower
- Insufficient use of technology
- Outmoded, unproductive methods of operation
- Limited ability to tap economies of scale
- Small domestic market

The SME 21 plan (Productivity and Standards Board, 2000) has highlighted that SMEs need to overcome these challenges in order to be able to compete in the new economic landscape, which will be shaped by increasing globalisation, changing patterns of market demand, and accelerating pace of technological changes. Depending on how SMEs respond to them, these changing market forces can be threats or opportunities for SMEs.

SMEs therefore need to exploit these changing market forces as opportunities so as to be able to compete more effectively with the other players in certain niche areas. To realise this, they need to position themselves to build up distinctive competencies, exploit technology and knowledge for growth, and establish strategic alliances with their customers, suppliers and even competitors to enhance their potential. SMEs in Singapore therefore need help to identify what to do strategically to position themselves in the supply chain.

2.5 CHAPTER SUMMARY

This chapter has set out the importance of manufacturing to the Singapore economy and presented the current state of SMEs in the context of manufacturing and described the changing landscape of SMEs in Singapore. Finally the challenge of supply chain positioning for SMEs in Singapore has been described as the lack of know-how to identify what to do strategically to position themselves in the supply chain so as to achieve competitiveness.

CHAPTER 3: LITERATURE REVIEW ON STRATEGIC SUPPLY CHAIN POSITIONING

The motive of this research is to provide support for SMEs in Singapore to help them better manage their supply chain positioning. This chapter introduces supply chain positioning to set the terminology used in this thesis, and to explore the existing techniques and current research issues in strategic supply chain positioning (SSCP). These objectives are achieved by addressing the following questions through a review of the literature.

1. What is meant by strategic supply chain positioning (SSCP)?
2. What are the techniques that exist to help with SSCP?
3. What are the current research issues associated with SSCP?

The literature review is structured into 3 main sections, as illustrated in Figure 3.1. The concept of SSCP is discussed in section 3.1. Section 3.2 addresses the existing techniques to help with SSCP. Section 3.3 discusses the research issues associated with SSCP.

3.1 THE CONCEPT OF STRATEGIC SUPPLY CHAIN POSITIONING

The intention of this section is to answer the question, "What is strategic supply chain positioning?" The key to this understanding is in the concepts of "strategy", "supply chain", and "strategic supply chain positioning". Therefore this section explores these core elements in the next three sub-sections. Section 3.1.1 looks at the meaning of strategy, Section 3.1.2 examines the definition of supply chain, and Section 3.1.3 examines the definition of strategic supply chain positioning.

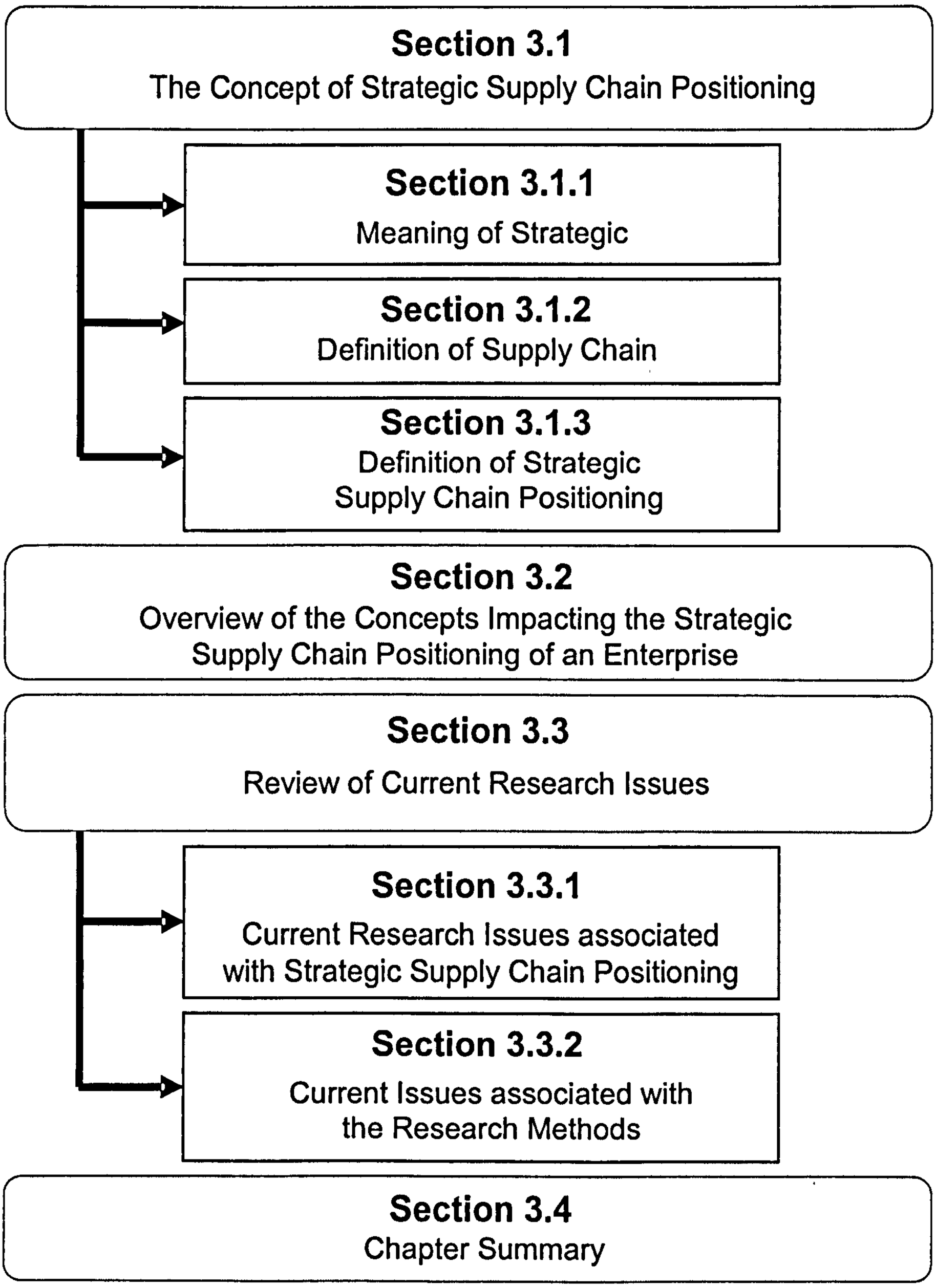


Figure 3.1: Literature review structure

3.1.1 Meaning of strategic (in the context of supply chain positioning)

The word "strategy" was originally derived from Greek and initially referred to the role of a General, but later came to mean "the art of the General" (Evered, 1983). In the context of business strategy, Chandler (1962) defines strategy as the determination of the basic long-term goals and the objectives of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out the goals. This is regarded as the first definition of modern day business strategy (Platts, 1990). Later Ansoff (1969) identifies that strategy guides and directs a firm's growth and change.

In the context of manufacturing, Skinner (1969) is seen as the first to introduce the concept of strategy. In this work Skinner refers to strategy as a set of plans and policies by which a company aims to gain advantage over its competitors.

The contribution of researchers such as Chandler, Ansoff and Skinner, amongst many others, can be clarified through viewing strategies at three levels of strategic planning in the organisation. Hayes and Wheelwright (1984) define these three levels as a hierarchical structure, and summarise the role that each strategy takes as:

> Corporate strategy: Definition of the businesses in which a corporation will participate, and the acquisition and allocation of key corporate resources to each of those businesses.
>
> Business strategy: The basis on which a business unit will achieve and maintain competitive advantage, in a way that links the strategy of the business to that of the corporate as a whole.

Functional strategy: Providing support to the competitive advantage being sought by the business strategy.

In this research, decision-making on supply chain positioning takes place at the strategic level within the company. This strategic level where supply chain positioning of a company takes place is defined as falling between the business strategy level and the functional strategy level of Hayes and Wheelwright's (1984) hierarchical structure. The linkage between supply chain positioning to other strategies at the business and functional levels within a company will help the company to have a clear direction to achieve its business aims.

3.1.2 Definition of supply chain

This section develops a definition of supply chain that is used throughout the thesis. There have been many definitions of supply chain thus far and supply chain continues to imply different things to different people and is not used consistently by all (Christopher and Peck, 2004). Some have restricted the view of supply chain to just the relational activities between a buyer and seller (eg: Cavinato, 1992). Such an approach focuses on the first-tier purchasing operations of a firm, and relationships with suppliers that might be characterised by such arrangements as buyer/seller alliances and partnerships.

A second view of supply chain takes a broader perspective by including all "upstream" suppliers to a firm as part of the supply chain (eg: Dobler and Burt, 1996). With this definition, an original equipment manufacturer would view its supply chain as containing all first-tiers, second-tiers, and etc, suppliers in the supply network.

A third view takes a "value chain" approach, in which all activities required to bring a product to the marketplace are considered part of the supply chain (eg: Christopher, 1992; Beamon, 1998; Marbert and Venkataramanan, 1998).

Christopher (1992) defines a supply chain as a network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. Beamon (1998) defines a supply chain as an integrated process wherein a number of various business entities (i.e. suppliers, manufacturers, distributors, and retailers work together in an effort to: (1) acquire raw materials/components, (2) convert these raw materials/components into specified final products, and (3) deliver these final products to retailers. This chain is traditionally characterised by the flow of materials and information both within and between business entities. Marbert and Venkataramanan (1998) define supply chain as the network of facilities and activities that performs the functions of product development, procurement of materials from vendors, the movement of materials between facilities, the manufacturing of products, the distribution of finished foods to customers, and after-market support for sustainability.

What is required is a definition of supply chain that covers most of the functions performed in a supply chain. Such a definition is offered by Marbert and Venkataramanan(1998), and is hence adopted in this thesis. Supply chain is therefore defined here as:

"Supply chain is the network of facilities and activities that performs the functions of product development, procurement of materials from vendors, the movement of materials between facilities, the manufacturing of products, the distribution of finished foods to customers, and after-market support for sustainability."

3.1.3 Definition of strategic supply chain positioning

In this section, the concept of strategic positioning is set in the context of supply chain. This section therefore describes and defines strategic supply chain positioning and draws out a representative definition.

Hill (1993) is amongst the first group of researchers to define strategic positioning. He views strategic positioning as a key strategic decision and defines it as associated with the firm's internal span of process, the degree and direction of vertical integration alternatives, and its links with suppliers, distributors and customers. Hill's definition of strategic positioning is focused on the vertical integration of the supply chain.

Valliespir and Kleinhans (2001) define strategic positioning of a company as modifying its activity on the chain and deciding upon the direction and limits of extension of the vertical integration (upstream and downstream). Their emphasis of strategic positioning is also on the vertical integration of the supply chain. They suggest that the position of a company, located between its suppliers and customers on its supply chain, is not perpetual, and therefore there is a need for a company to assess whether its position in the supply chain is best.

Johansen and Riis (2005) approach strategic positioning by defining a framework that comprises of three inter-related levels, three archetypal production firms and their production roles, each associated with a unique position in the supply chain. Their approach is different from others in that they have identified and pre-defined a set of unique positions with different production roles along the supply chain that a company can consider.

Baines et al. (2005) define strategic positioning as concerned with the process of choosing those production centred activities that an organisation should carry out internally, and those that should be external and under the ownership and control of suppliers, partners, distributors and even customers. Their definition of supply chain positioning extends traditional decision methodologies, such as those associated with make versus buy and outsourcing, by looking at the interactions between manufacturing operations and the wider supply chain networks associated with suppliers, customers, infrastructure and produce range.

From these definitions, strategic supply chain positioning focuses on company activities and includes not only the company itself but also the interactions to other operations in the supply chain networks. Whilst the other authors considered only certain aspects of the interactions to the supply chain networks like suppliers, customers and pre-defined types of position for a company, Baines et al. (2005)'s definition of strategic supply chain positioning take a more complete and holistic view of the organisation and the supply chain with four sets of interaction with the supply chain, namely suppliers, customers, infrastructure and produce range. This definition is closer to the requirement, as specified in the precious section 3.1.1, for a supply chain to cover most of the functions performed. Hence, with adaptation, strategic supply chain positioning is defined and adopted for the purpose of this research as:

"Process of choosing those set of activities that an organisation should carry out internally, and those that should be external, by taking a holistic view of the organisation and the four interactions with the supply chain – suppliers, customers, infrastructure and product range."

3.2 OVERVIEW OF THE CONCEPTS IMPACTING THE STRATEGIC SUPPLY CHAIN POSITIONING OF AN ENTERPRISE

This section explores the emergence of key concepts in the literature impacting the strategic supply chain positioning of an enterprise, and provides an overview of the evolution of these concepts with an illustration. Although, there are very few papers that explicitly address the issues of strategic supply chain positioning, various concepts exist that do directly impact the strategic positioning of an enterprise in the supply chain. The evolution of these concepts from past research can be organised into seven phases: (1) vertical and horizontal integration; (2) make or buy; (3) strategic alliances; (4) sourcing/ global sourcing/ core competency; (5) outsourcing/strategic outsourcing; (6) strategic positioning;

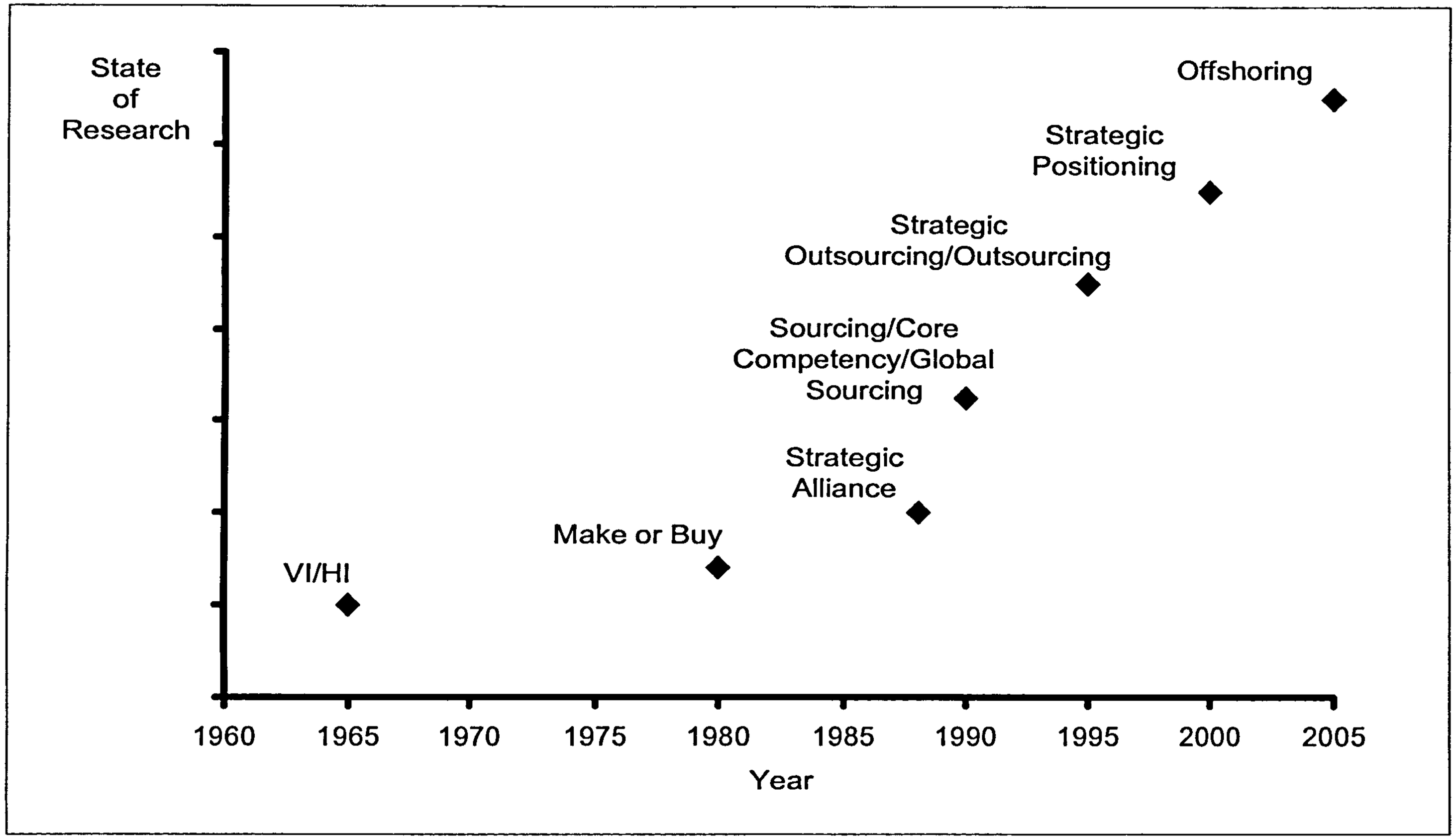


Figure 3.2: Emergence of key concepts impacting supply chain positioning

and (7) offshoring, as illustrated in Figure 3.2. Each of these is now explored in more detail.

1. *Vertical integration/Horizontal integration* - Vertical integration has been mentioned by both Hill (1993) and Valliespir and Kleinhans (2001) in relation to strategic positioning, and is generally regarded as the first concept to address supply chain positioning issues. In the late 1800s, vertical integration was adopted by companies to realise economies of scale and scope and to eliminate competition (Chandler, 1990). In the 1950s, vertical integration was adopted as a mechanism to control the sources of supplies and the distribution of products (Chandler, 1990). Then in the 1960s and 1970s, a turning point occurred where the factors that determine vertical and horizontal integration changed significantly (Singh, 1993). Throughout the 1980s and 1990s, companies were engaged in corporate restructuring and during this period, vertical and horizontal acquisition became an interesting topic for researchers in the study of vertical and horizontal integration. The study of vertical and horizontal integration have been proposed in many views such as generic view, specific industries (automobile industry: Crandall, 1968; Marx, 1976; OhUallachain and Wasserman, 1999 and, fashion apparel: Richardson, 1996), and economics view (Vernon and Graham, 1971; Schmalensee, 1973; Arrow, 1975 and, etc.). Vertical integration is relevant to strategic positioning as it deals explicitly with the direction and extent of the upstream and downstream boundary of a firm's activities.

2. *Make-or-buy* - Make-or-buy emerged as a separate topic around the early 1940s. The first make-or-buy paper, titled 'Make or Buy' was written by Cullington (1942). Since then there have been many researchers proposing different perspectives of make-or-buy such as; make-or-buy decision (Jauch and Wilson, 1979; Welch and Nayak, 1992; McIvor et al., 1997; Padillo and Diaby, 1999: Humphreys et al., 2002; Platts et al., 2002), make or buy strategy (Probert, 1996), accounting (Bassett, 1991), strategic management (Venkatesan, 1992), operations research (Balakrishnan, 1994) and economics (Poppo et al., 1995).

Similar to vertical integration, make-or-buy is also relevant to strategic positioning. However, from the perspective of the strategic positioning decision, make-or-buy only deals with the upstream boundary of the firm.

3. *Sourcing* – Sourcing emerged as a key research topic in 1960s and subsequently led to work on strategic alliance in the 1980s. In 1963, the first paper on sourcing and global sourcing titled 'Sourcing Aboard for Domestic Profit' was written by O'Connell and Benson (1963). Sourcing decisions have their origins from make-or-buy. In the early stage of sourcing research, researchers gave interest to international sourcing (Leontiades, 1971; Leff, 1974; Hefler, 1981), afterward researchers focused on a more strategic role (Spekman et al., 1999; Nellore et al., 2001; Tayles and Drury, 2001; Jennings, 2002). Like make-or-buy, sourcing only deals with the upstream boundary of the firm in the context of strategic positioning.

4. *Strategic Alliances* - The first paper dealing with cooperative and strategic alliances was written by James (1985) with the title 'Alliance: the new strategic focus'. Afterward, researchers in these fields have described and analysed the shift from traditional adversarial, buyer-supplier relationships towards longer-term, more cooperative relationships in which buyers and suppliers regard each other more as partners. The research in strategic alliances includes generic view (Devlin and Bleackley, 1988; Brouthers et al., 1995; Morrison and Mezentseff, 1997; Perks and Easton, 2000), specific industry research (pharmaceutical industry: Lin and Darling, 1999; electronic: Williams et al., 2002; aerospace: Smith, 2003) and practices in several countries (Sweden: Gebrekidan and Awuah, 2002; America and Germany: Abdou and Kliche, 2004). Strategic alliances and relationship among partnerships in the supply chain networks are relevant to strategic positioning, as it deals with the upstream and downstream boundary of a firm's activities in the supply chain.

5. *Outsourcing, core competency and strategic outsourcing* – These concepts all emerged around the same period (approximately in 1985 to early 1990s). The first outsourcing paper was published in 1987 by Callahan (1987) on the automotive industry, and from then, outsourcing research has been studied seriously since 1992. The first paper on strategic outsourcing was written by Quinn and Hilmer (1994), who explained the essence of core competency to strategic outsourcing in their paper. The last decade showed an evolution in outsourcing processes from traditional to strategic. Recent literature on outsourcing however has emphasised the need to adopt a strategic focus. The outsourcing research focusing on strategic role includes authors such as Quinn and Hilmer (1994), Alexander and Young (1996), McIvor (2000), and etc. The core competency concept emerged in 1990 and was highly influenced by sourcing and outsourcing decisions. This paper was written by Prahalad and Hamel (1990), in the Harvard Business Review which drew the readers' attention to the core competency of the corporation. They suggested that core competence is the idea that a company can succeed without a structural competitive advantage by becoming the best at a few key skills or in a few knowledge areas. Papers on core competency comprise of survey research (Gilgeous and Parveen, 2001), framework (Walsh and Linton, 2001) and model (Onyeiwu, 2003). Each of these topics, be it outsourcing, strategic outsourcing or core competency, deals directly with modifying the boundary of a firm in the supply chain. Hence these topics are all relevant to strategic positioning.

6. *Offshoring* - The trend towards globalisation and offshore sourcing has been growing rapidly for some years. Offshoring research has been explored by Williams (2003) and published in Strategic Finance. However despite the rapid growth in the trend of offshoring, there are only a small number of papers in this area. Similar to sourcing and outsourcing, offshoring also deals with modifying the boundary of a firm and is therefore relevant to strategic positioning.

3.3 REVIEW OF CURRENT RESEARCH ISSUES

Previous sections have introduced the concept of strategic supply chain positioning and the various other concepts impacting strategic supply chain positioning have been explored. Against this background this section reviews the issues that need to be addressed for future research in the field of strategic supply chain positioning. Finally, to appreciate the form that future research in such an area should take, issues associated with research methods are also explored.

3.3.1 Current research issues associated with strategic supply chain positioning

There are a number of research issues associated with strategic supply chain positioning in the literature. Most of the existing literature tends to focus on research in the four interfaces of the organisation with the supply chain independently. These include vertical/horizontal integration (eg: Crandall, 1968; Marx, 1976), make or buy decision and strategy (eg: Platts et al., 2002; Probert, 1996), international sourcing (eg: Leontiades, 1971; Leff, 1974), strategic alliances (eg: Devlin and Bleackley, 1988; Brouthers et al., 1995), and outsourcing paper (eg: Callahan, 1987). Much of these existing works only address part of the supply chain by dealing directly into each of the four interfaces independently, without considering a holistic view of all the four interactions simultaneously. These research work have not adopted a 'systems' style of thinking by considering that each interaction is impacted by, and can impact on each of the other three interactions.

Most previous works focus on the content related research rather than decision process related research (eg: Vernon and Graham, 1971; Gilgeous and Parveen, 2001, Walsh and Linton, 2001, Onyeiwu, 2003, and etc). Of the few decision

process related research, most are working on empirical methodology - taking data from existing database, rather than using the case study approach for the methodology. With content related research, the potential value to practitioners from the industry appears to be less useful. It will be difficult for practitioners to implement these concepts directly. For the current research on decision process, much of the process and data need to be validated in real industry so that the process can be rigorous and practical.

Of researchers dealing directly with strategic positioning, most tend to focus their research on developing mathematical model and framework. For example Vallespir and Kleinhans (2001) discussed how a company, positioned between its suppliers and customers on its supply chain, may wish to modify the scope of its activity on the chain, in order to expand vertically (integration of new activities) or conversely to retire from some activities. To support this decision-making process, they developed a fuzzy logic approach model to determine how many activities in the chain to occupy. Sen et al. (2001) focused the study on the need for integration of two basic supply chain positioning strategies, namely, build-to-stock and build-to-order. They developed mathematical model to help firms improve their supply chain strategies. These mathematical approaches such as fuzzy logic model may not be practical and would be difficult to implement in the industry.

From the few researchers dealing directly with strategic positioning, only Baines et al. (2005) proposed an integrated decision process for guiding manufacturers to decide upon the strategic position of their manufacturing organisation. Some tools and techniques such as workbook and framework for making decision processes have also been developed. Baines et al's decision process for strategic positioning has been developed from the perspective of larger multinational companies (MNCs).

In summary, much of the existing research work only addresses part of the supply chain and there is little research on strategic supply chain positioning taking a holistic view of all the four interfaces. Most previous works have also focused on content related research rather than decision process related research. There are also some works that have developed mathematical models. In addition, the current methodology is developed from the perspective of larger MNCs. The challenge therefore remains to explore current processes and develop a new strategic supply chain positioning (SSCP) methodology for small and medium sized enterprises (SMEs) in Singapore. This is a worthy topic for a focused research effort and is the chosen research area described in this thesis.

3.3.2 Current issues associated with the research methods

The importance of supply chain positioning research is understood and the research has outlined some of the shortcomings in the current literature. It is appropriate for this section to further explore some of the shortcomings associated with the way in which research has been carried out in this field and these are:

1. *Low level of theory testing of methodologies* – Low level of theory testing is one of the most frequently cited shortcomings associated with research in this field (Camerer, 1985; Hill, 1987; Adam and Swamidass, 1989). Both Camerer (1985) in the field of business strategy and Hill (1987) in the field of manufacturing strategy criticise the low level of theory testing underlying strategy research. Hill (1987) emphasises that research rigour must involve testing through application with direct involvement of the researcher, and he highlights that academics should:

    1. Crystallise events through first hand involvement with the issues, not a process of observation.

2. Bring a body of knowledge which they have applied, not acquired by reading.
3. Advise businesses on the relevance approaches, the means for applying them and the methods of evaluation.
4. Create new knowledge and concepts from work undertaken.

2. *Insufficient empirical work in implementation* – Another important issue is the lack of empirical research in implementation. McGuire (1986) observes that in most research, in the search for scientific rigour (internal validity), external validity or relevance to the organisations has been missed. Susman and Evered (1978) summarise that while the methods and techniques have become sophisticated, they have also become increasingly less useful for solving practical problems that members of organisations face.

3. *Lack of relevance to the real world* – Lack of relevance to the real world is also an issue. Platts (1993) criticises that traditional research approach of interviews and one day company visits and questionnaires are unrewarding and lacking relevance to industrial collaborators in the real world. Platts proposes three guidelines for research to rectify these shortcomings and these are:

1. The process must link to existing frameworks.
2. There must be adequate empirical testing and verification of any proposed process.
3. The results of the research must be relevant to the practicing managers.

Platts (1990) have developed these guidelines in his earlier work and since then there is a lack of verified alternatives in the literature to these guidelines of Platts. It is therefore appropriate to adopt these guidelines in conducting the research on strategic supply chain positioning.

3.4 CHAPTER SUMMARY

This chapter began by defining the concepts of strategic supply chain positioning. This is followed by exploring the emergence of key concepts in the literature impacting the strategic supply chain positioning of an enterprise, and provides an overview of the evolution of these concepts with an illustration. This chapter has reviewed the current research issues associated with strategic supply chain positioning as well as the methods of research. Finally, a worthy topic for a focused research effort to develop a new strategic supply chain positioning methodology for SMEs in Singapore has been identified, and is the chosen area for research in this thesis.

CHAPTER 4: RESEARCH AIM AND PROGRAMME

The intention of this research is to assist practitioners in the process of strategic supply chain positioning. A review of the industrial problem in Chapter 2 and a review of literature in Chapter 3 have established the area in which to direct future research. This chapter develops the research problem from earlier chapters (section 4.1) to generate a precise research aim (section 4.2) that will fulfill the intention of this research. It also includes a description of the research programme developed to realise this aim (section 4.3), the research methods chosen and reasons for selection.

4.1 THE RESEARCH PROBLEM

Manufacturing has played an important role in Singapore's economic development. With the transition from a labour-intensive economy in the 1960s to a knowledge-driven economy today, manufacturing remains an important growth engine for productivity and prosperity in Singapore (Section 2.1). Although much of Singapore's growth has been attributed to the presence of multinational companies (MNCs), SMEs are fast gaining recognition as the economic backbone of the nation and are crucial to the growth of the national economy (Section 2.2). The rapidly changing global economic landscape, coupled with the opening of manufacturing and markets in China, India and other East Asian countries, has presented a tough challenge for manufacturing in Singapore. This is especially so for SMEs, who are facing growing competitive pressures from low cost manufacturing locations in these countries whilst lagging behind developed nations in sophisticated high-tech manufacturing (Section 2.2). For the SMEs in Singapore, a key challenge therefore depends critically on finding their most favourable strategic position in the supply chain network so as to regain competitiveness (Section 2.4). Currently this decision has been formed in a rather fragmented manner, and as a result, SMEs in Singapore therefore

need help to identify what to do strategically to position themselves in the supply chain (Section 2.4).

The evidence drawn by the literature review in Chapter 3 shows clearly the research problem that much of the existing research work only address part of the supply chain and deal with the boundary interface to suppliers, customers, infrastructure, and product range independently. There is little research on strategic supply chain positioning (Section 3.3.1). Furthermore, the current methodologies are developed from the perspective of larger multinational companies (MNCs). SMEs in Singapore are very different in company size with more typical levels of comparative advantage (Section 3.3.1). The challenge therefore remains to explore current processes and develop a new strategic supply chain positioning (SSCP) methodology for SMEs in Singapore (Section 3.3.1).

The method of research into strategic supply chain positioning is addressed in the literature. In particular the literature is critical of impractical or unsupported conceptual solutions (Section 3.3.2). Furthermore, there is strong advice that research work should link existing contributions, provide adequate empirical testing and verification, and ensure relevance to the practising manager. Such advice should be observed when developing a research aim and programme (Section 3.3.2). This has then led naturally to the research aim and programme which are explained in the following sections.

4.2 DEVELOPMENT OF RESEARCH AIM AND OBJECTIVES

On the basis of the research problem described above, the research aim for this thesis that will, if satisfied, make a worthy contribution to knowledge about the decision process of strategic supply chain positioning is:

> *"To develop a strategic supply chain positioning methodology to support the strategic decision making process in SMEs in Singapore and evaluate its effectiveness in practical implementation"*

Realising this aim will enhance the decision making process in strategic supply chain positioning for SMEs in Singapore, by providing them with a structured and practical methodology to deal with its implementation. To fulfill the research aim the following 5 research objectives have been defined:

1. Selection of most promising methodology.
2. Evaluation of most promising methodology.
3. Formation of pilot methodology tailored to SMEs in Singapore.
4. Evaluation of pilot methodology.
5. Refinement and illustration of final methodology.

The following section addresses the development of the research programme to realise this aim.

4.3 DEVELOPMENT OF RESEARCH PROGRAMME

The research aim and objectives defined above naturally lead to a five-phase research programme to direct the activities of this research. The overall research programme is graphically illustrated in Figure 4.1, which forms the basis for the layout of this thesis where each phase is presented as a separate chapter, within which, detailed research activities are discussed. This section describes each phase of the research programme, the associated objective and the guiding research method and rationale necessary to realise each objective.

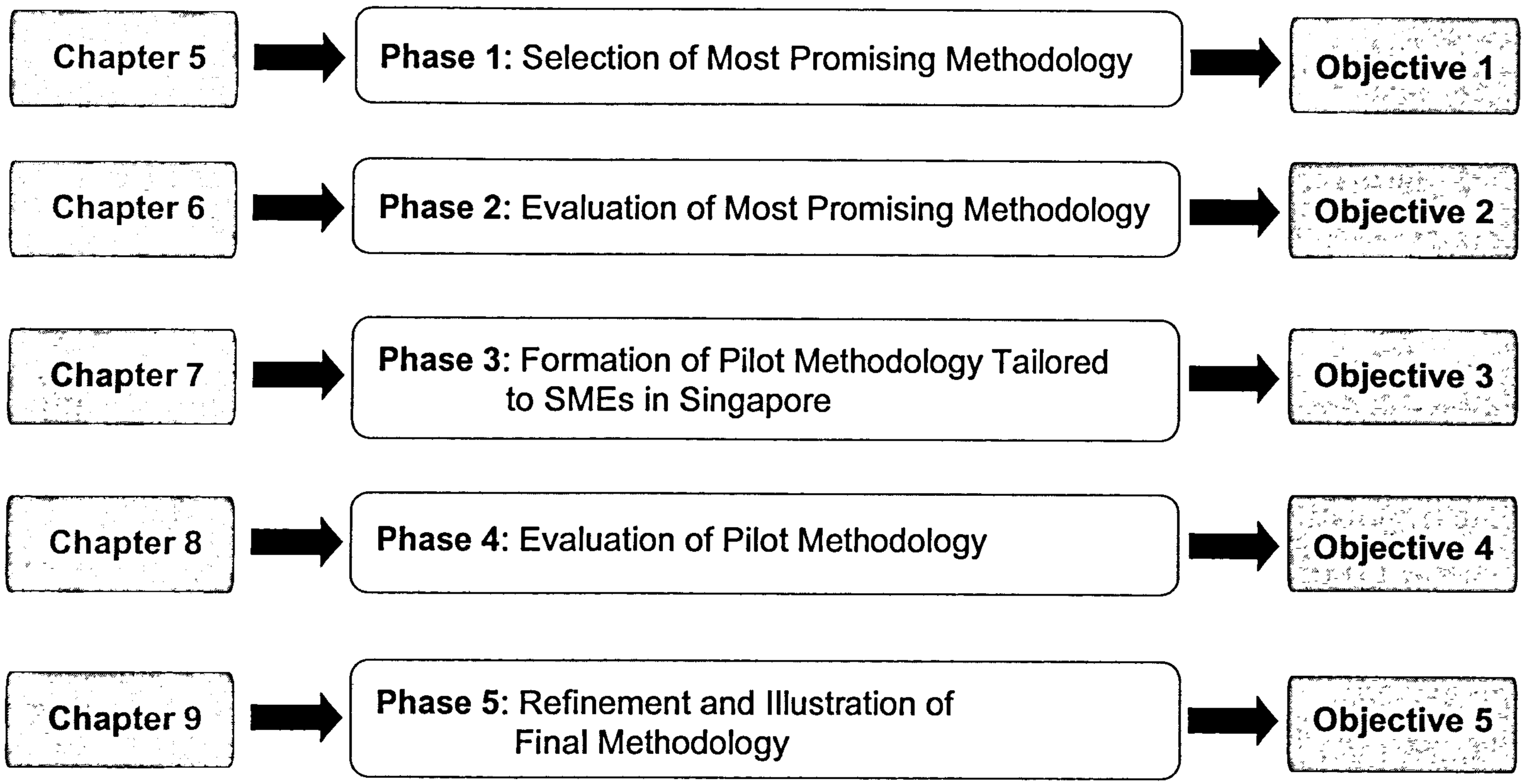


Figure 4.1: Overview of research programme

4.3.1 Phase 1: Selection of most promising methodology

The first objective of this research programme is to review the literature with the purpose to select a most promising methodology. There are a number of different approaches advocated in the literature to address the development of a methodology. According to Baines (1995), in his research on manufacturing strategy, there are basically three ways to address the development of the methodology. Each of these is now explored in more detail.

One method is to develop the methodology by completely ignoring existing knowledge. In this way it may be possible to deliver a fundamentally new approach and novel methodology, but the concern here is that considerable effort may be expanded only to arrive at a methodology that already exists. A second method is to develop the methodology on the basis of the existing knowledge about strategic supply chain positioning methodology in the literature. However, the weaknesses in the existing literature may mislead research efforts and deliver a sub-optimum solution. Furthermore, both the first and second method will eventually require testing to be carried out to gain confidence that the developed methodology is suitable for strategic supply chain positioning and to avoid being criticised as an unsupported conceptual solution. A third method is to first critically assess the capability of existing methodologies, and, on the basis of this foundation of knowledge, develop a new strategic supply chain positioning methodology.

The third method is preferred in this research. Therefore, for phase 1 of this research, first the requirements of a strategic supply chain positioning (SSCP) methodology are defined (Section 5.2). This is followed by a literature review of the various existing methodologies related to strategic supply chain positioning (Section 5.3). Finally, the various methodologies are evaluated against the set of requirements to select the most promising SSCP methodology which is carried

forward for detailed evaluation and testing in the next phase (Section 5.4). The results from this phase are presented in Chapter 5.

4.3.2 Phase 2: Evaluation of most promising methodology

The second objective of the research programme is to evaluate the effectiveness of the selected most promising SSCP methodology for SMEs in industry. The testing is to observe the application of the methodology in practice in order to evaluate whether it is workable, to determine whether the methodology provides a practical, procedural step, and to establish future research needed to refine and adapt the methodology for SMEs in Singapore. Therefore industry testing is the main focus of this phase 2 of the research programme.

In order to achieve this testing in real industry setting, a case study method with participant intervention (Argyris, 1970) is the appropriate research method to achieve the relevance and rigour needed. The case study method is good not only at investigating how and why questions, but it is also particularly suitable for developing new theory, testing and refining theory (Voss et al. 2002). This case study forms the basis for the evaluation of the selected methodology to determine the relationship between the process used and the outcomes. Detailed information on the conduct of the case study and data collection methods is provided in Chapter 6.

4.3.3 Phase 3: Formation of pilot methodology tailored to SMEs in Singapore

The third objective of the research programme is to use the feedback data gathered from the evaluation results at phase 2 to identify, refine, improve the selected methodology, and form the pilot methodology tailored to SMEs in Singapore. The refinement process involves the review of the changes

suggested by the case study companies and suggestions for improvement are used to modify the selected methodology and form the pilot methodology. Hence, at this phase of the research programme, the focus will be on the refinement process as well as the formation process of the pilot methodology tailored to SMEs in Singapore.

The formation process and the structure of the pilot methodology are presented in chapter 7. The resulting pilot methodology is used for the evaluation and testing in phase 4 of the research programme.

4.3.4 Phase 4: Evaluation of pilot methodology

The fourth objective of the research programme is to further evaluate and test the applicability of the pilot methodology. To realise this objective, the research method used is similar to that of phase 2, and hence industry testing is the main focus of this phase 4 of the research programme.

The industrial cases will need to be changed to demonstrate that the pilot methodology is not limited to one set of circumstances. Another aspect of the method which needs to be altered is the role taken by the researcher. In the evaluation at phase 2, the testing is conducted by the researcher being intimately involved in the development of the methodology, and acting as an external facilitator. According to Platts et al., (1998), this poses the danger that the facilitator achieves success by means of process consultancy skills. Drawing upon Platt's suggestions, it is appropriate to use facilitators who are new to the methodology in this fourth phase of evaluation and testing. In this way, the effect of assumed consultancy skills is minimised.

Hence, the researcher should act as an observer to the implementation of the case projects and observe the development of the implementation of the methodology. This phase of testing is discussed in Chapter 8.

4.3.5 Phase 5: Refinement and illustration of the final methodology

The fifth and the last objective of the research programme is to collate all the suggested changes from the case studies, identify areas that need changing, refine, improve, and develop a fully documented final SSCP methodology to make it easier to use for deployment to SMEs in Singapore.

The final SSCP methodology and its structure are documented in Chapter 9. The outcome of the research programme is an evaluated, tested and refined final SSCP methodology in the form of a computerised software tool.

4.4 CHAPTER SUMMARY

This chapter has set out the research problem, followed by establishing the research aim and objectives for this thesis. The chapter then considered the overall research programme adopted, the research methods chosen and reasons for selection to deliver the well-defined research objectives.

A five-phase research programme had been proposed that would satisfy the academic rigour and industry relevance. Phase 1 deals with the review of the literature with the purpose to select a most promising methodology. A set of requirements has been defined for selecting the SSCP methodology, against which the various existing methodologies related to SSCP are analysed, so as to identify the most promising SSCP methodology. In Phase 2, the selected methodology is evaluated and tested in industry case studies. This is to observe the application of the methodology in practice in order to evaluate whether it is workable, and to establish future research needed to refine and adapt the methodology for SMEs in Singapore. Phase 3 then uses the feedback data gathered from phase 2 to identify, refine, improve the selected methodology, and

form the pilot methodology tailored to SMEs in Singapore. At Phase 4, the pilot methodology is further evaluated and tested for applicability for SSCP. Then at Phase 5, all the suggested changes are collated from the case studies, areas that need changing are identified, and develop a fully documented final SSCP methodology for SMEs in Singapore. All these phases are described in chapters 5 to 9 in this thesis.

CHAPTER 5: SELECTION OF MOST PROMISING METHODOLOGY

In Chapter 4, the research aim, objectives and programme have been set out. The aim of this research is to develop a strategic supply chain positioning (SSCP) methodology to support the strategic decision making process in SMEs in Singapore and evaluate its effectiveness in practical implementation. This chapter deals with the objective of phase 1 to realise this goal, by reviewing existing methodologies that are relevant to strategic supply chain positioning (SSCP) methodology. This chapter is structured to first present the objective and method of this phase of the research in section 5.1, followed by defining the requirements of a SSCP methodology in section 5.2. A literature review of the various existing methodologies related to SSCP is presented in section 5.3. The various methodologies are then appraised against the set of requirements to select the most promising SSCP methodology in section 5.4. Finally, this chapter concludes by presenting the selected SSCP methodology in section 5.5.

5.1 PHASE 1 OBJECTIVE AND METHOD

The objective of this phase 1 of the research programme is to review the literature with the purpose to select a most promising methodology. As established in Section 4.3.1, the research method preferred in this research is to first critically assess the capability of existing methodologies, and on the basis of this foundation of knowledge, develop a new SSCP methodology.

Many SSCP related methodologies can be found by searching through the literature. The research method used in this chapter to guide in identifying relevant publication databases is to search from the perspective of the definition of strategic supply chain positioning (Section 4.3.1). In Section 3.1.3 strategic supply chain positioning is defined in this research as the process of choosing

those set of activities that an organisation should carry out internally, and those that should be external, by taking a holistic view of the organisation and the four interactions with the supply chain – suppliers, customers, infrastructure and product range. This definition highlights that the search for relevant literature on SSCP related methodologies should cover the holistic view of the supply chain as well as the interactions with the suppliers, customers, infrastructure and product range of the supply chain. Suitable sources include journals, published books on methods, tools and techniques employed.

With the scope of literature review established, research on supplier interface should cover a wide range of relationship types possible with suppliers, such as make-versus-buy, strategic sourcing and suppliers selection. Research on customer interface includes marketing literature and physical distribution management channels. Research on product range covers horizontal integration decisions. Research on the infrastructure interface deals with the capabilities, services and facilities associated with manufacture. Finally, research should also cover works on supply chain positioning taking a holistic view of all the four interfaces.

At this phase of the research, it is important to review comprehensively the literature on various existing research methods related to SSCP methodologies, and not be constrained to only a particular research method associated with methodology (Section 4.3.1). This is for the purpose to establish a full extent of knowledge on SSCP. Therefore the review of literature at this phase includes study/review, model, framework, approach and methodology related to SSCP.

Section 4.3.1 has also established that this phase should define the requirements of a SSCP methodology. There are a number of methods that can be used to establish the requirements. To provide a generic methodology, the most appropriate method is to explore the literature to find out what has been discussed in the area of methodology. This is performed by investigating

research in the area of manufacturing strategy formulation methodology to extract requirements. These methodology requirements are then used for defining the set of requirements, against which SSCP methodologies can be evaluated.

This phase 1 of the research programme therefore has four parts. Firstly to define the requirements of a SSCP methodology, secondly to provide an overview of existing methodologies related to SSCP, thirdly to select a most promising SSCP methodology by appraising these methodologies against the set of requirements, and finally to describe the overview of the selected SSCP methodology to be carried forward for detailed evaluation and testing in the next phase. A graphical illustration of the process is shown in Figure 5.1. This chapter sets out to execute this structure in the sections below.

5.2 DEFINING THE REQUIREMENTS OF A SSCP METHODOLOGY

For the purpose of defining the requirements of a methodology, this research takes as a starting point work in the area of manufacturing strategy formulation. Platts (1994) draws from several sources of literature to identify that strategy formulation methodologies need to be both operational and practical. Platts then further sets out to identify common features of successful formulation and from there identify a number of requirements of strategy formulation methodologies. In this context, Platts (1994) summarises the following set of requirements:

1. Point of Entry: A methodology should have clear objectives, identify scope of problem, indicate the stages the methodology cover, and intended outcome which would result from the methodology.
2. Procedural: A good methodology should have well defined procedures, clear specification of the steps to be taken, has simple tools and

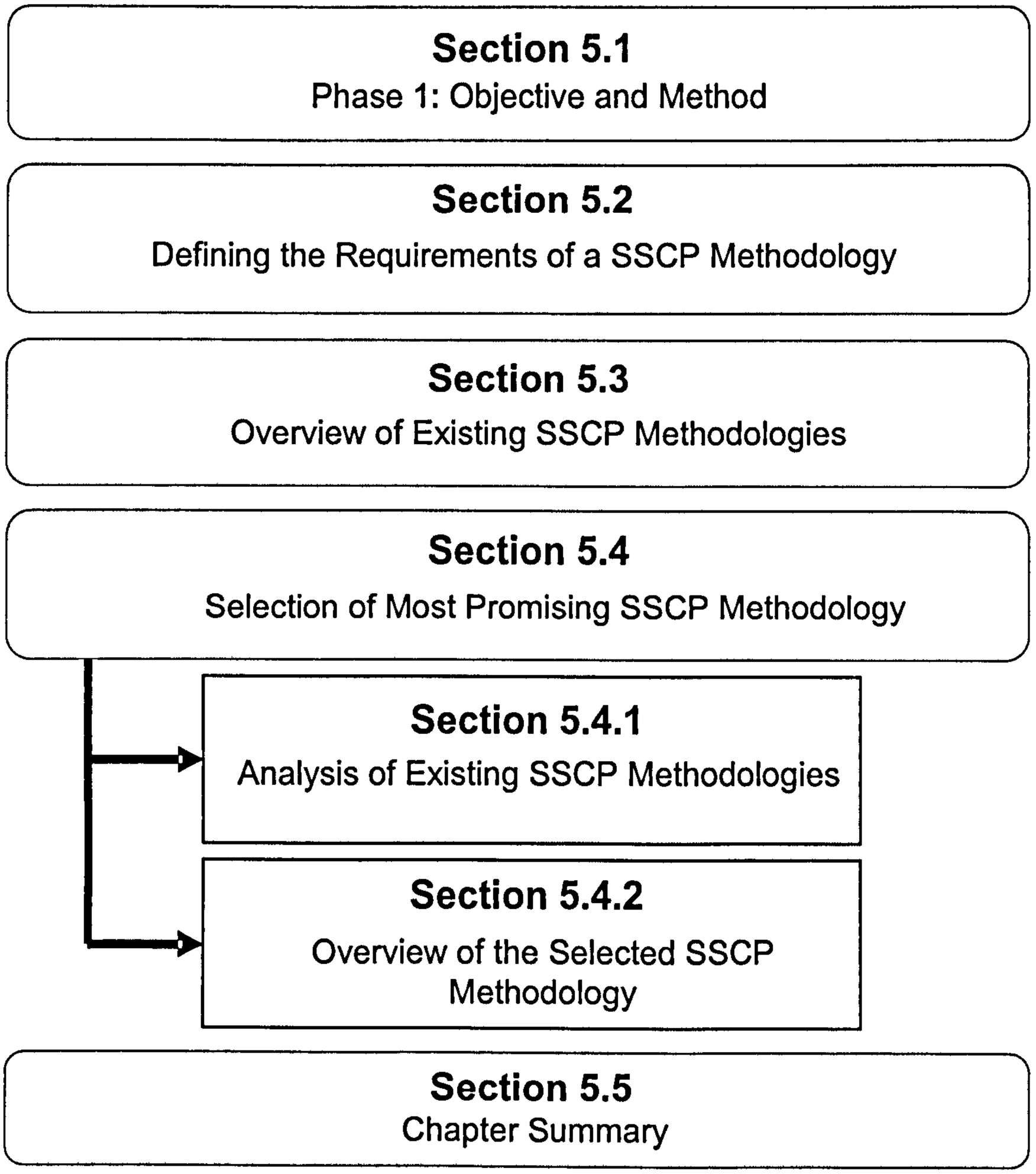


Figure 5.1: Method for selection of most promising methodology

techniques, and provides output and documentation at each stage of the process.

3. Participation: A methodology should provide for individual and group participation, identify problems, develop improvements, and make decisions leading to actions.
4. Project Management: The methodology should provide project management to ensure the project is adequately resourced and works to a clear timescale.

This set of requirements appears to be more general requirements for strategy formulation methodologies, and is therefore relevant and applicable for evaluation of SSCP related methodologies. In order to have more specific requirements, these four broad requirements comprising point of entry, procedural, participation and project management are further divided into seven specific requirements and categorised as seven key performance indicators, which are shown in Table 5.1. In the table, the second column lists the seven specific requirements and the third column describes each of these requirements. The fourth column categorises these requirements into seven key performance indicators, which are: 1. Clear objectives and outcome; 2. Structure; 3. Simple tools and techniques; 4. Outputs; 5. Documentation; 6. Participation; and 7. Project management.

In summary, this section has defined a set of requirements in the form of key performance indicators (KPIs) for SSCP methodology. The importance of this is that these KPIs defined are later used to compare the various existing SSCP related methodologies in order to select the most promising SSCP methodology.

5.3 OVERVIEW OF EXISTING SSCP METHODOLOGIES

This section examines existing SSCP methodologies previously identified in section 5.1. Section 5.1 has established that the search for relevant literature on

Table 5.1: Requirements of a SSCP methodology

S/No.	Requirements	Descriptions	Key Performance Indicators
1	Clear objectives, scope and outcome (Point of Entry)	The methodology should have clear objectives, identify scope of problem, indicate the stages the methodology cover, and intended outcome which would result from the methodology.	Clear objective and outcome
2	Well defined procedures and step approach (Procedural)	A good methodology should have well defined procedures and provides guidelines in a step by step manner to assist the users.	Structure
3	Simple tools and techniques (Procedural)	Provides simple tools and techniques to facilitate the process.	Simple tools and techniques
4	Output at each stage of process (Procedural)	Provides deliverables at each stage of the process and the final deliverable.	Outputs
5	Documentation of process (Procedural)	Provides documentation of the process.	Documentation
6	Individual and group participation to identify problems and make decisions to actions (Participation)	Describes the participants in the methodology, enables individual and group participations, particularly involving cross-functional groups to identify problems, develop improvements, and make decisions leading to actions.	Participation
7	Project Management	The methodology should provide project management to ensure the project is adequately resourced and works to a clear timescale.	Project Management

SSCP related methodologies should cover the holistic view of the supply chain as well as the interactions with the suppliers, customers, infrastructure and product range of the supply chain. Therefore these existing SSCP methodologies are described by reference to where they fall within the following five perspectives: supplier interface approach; customer interface approach; product range approach; infrastructure interface approach; and holistic view of supply chain approach. In addition, section 5.1 established that the review of literature should cover research methods like study/review, model, framework, approach and methodology related to SSCP. In this aspect, for each of the SSCP methodologies, the associated research method is also identified and shown in Appendix A. The tables in Appendix A are given a prefix letter 'A' when referred to the main text. Hence, Table A.1 shows the review of existing SSCP related methodologies with details of the researchers, contributions to research, and the research methods used. A brief description of these research and their relations to SSCP is as follows:

1. *Supplier Interface Approach* - Research on supplier interface covers a wide range of relationship types with suppliers to the in-bound material supply chain. This is addressed directly under the umbrella of make-versus-buy, strategic sourcing and suppliers selection. Authors who have proposed frameworks and models in make-or-buy decisions include Jauch and Wilson (1979), Welch and Nayak (1992), Probert (1996), McIvor et al. (1997), Padillo and Diaby (1999), Humphreys et al. (2002), and Platts (2002). Probert (1996) reports that make-or-buy issue is of major concern within manufacturing businesses as it is directly linked to the basis on which a firm chooses to compete. Probert describes the development and use of a systematic approach to formulating a make-or-buy strategy. Research on strategic sourcing includes writers such as Quinn and Hilmer (1994), Tayles and Drury (2001), Jennings (2002), Barragan et al. (2003), Freytag and Kirk (2003), Jin (2004), and Talluri and Narasimhan (2004); global sourcing by Narasimhan and Carter (1990), Cavusgil et al. (1993), Fraering and Prasad (1999), Nellore et. al (2001), Kotabe and Murray (2004); manufacturing

sourcing practices by Narashimhan and Das (2000), and Baines and Kay (2002). Various researchers have proposed several ways for supplier selection methods including Nydick and Hill (1992), Weber and Ellram (1993), Chao et al. (1993), Masella and Rangone (2000), Sarkis and Talluri (2002), Barla (2003), Dulmin and Mininno (2003), and Humphreys et al. (2003). From this review of research from the perspective of supplier interface approach shown in Table A.1, only Probert (1996), Padillo and Diaby (1999), and Platts (2002) have developed methodology for make-or-buy. Most researchers developed models, frameworks and approaches, with some conducting studies and reviews in their research.

2. *Customer Interface Approach* - The customer interface is covered in marketing literature by such author as Christopher (1992 &1998). Another aspect of customer interface is physical distribution management channels and authors concerned include Jeffries (1974); comprehensive review of major physical distribution channels by Bowersox (1969); distribution for international market by Stock and Lambert (1983); cooperation in distribution channels by Gill and Allerheiligen (1996). From the perspective of customer interface approach, Table A.1 shows that most research here focused on study, review, discussion and identification of issues relating to physical distribution.

3. *Product Range Approach* - The consequence of combining the supplier and customer interface approaches is a sequence of activities for which an organisation takes direct operational responsibility, often termed vertical integration (Hayes and Wheelwright, 1984) or span of process (Mills et al, 1996). These vertical integration issues are replicated across the range of product families manufactured, hence product range issues must also be considered. These could be thought of as horizontal integration decisions, though this term is often used for integration across businesses rather than individual supply chains. For each product family manufactured, there are also infrastructure supply chain issues to be considered. From this discussion, it can be seen that research in the

product range approach is a combination of research relating to supplier, customer as well as infrastructure interface approaches.

4. *Infrastructure Interface Approach* - The infrastructure interface deals with the capabilities, services and facilities associated with manufacture; and may for example include machinery, IT and people. An organisation must choose what level of competence it requires in a production activity, and this competence is highly influenced by the level of integration into the infrastructure supply base. The support/technology supply decision area within manufacturing companies has been investigated by such researchers as Baines et al (1999) writing on technology sourcing. Chiesa and Manzini (1998) have developed their work based upon identifying appropriate organisational mode for external acquisition of technology. Some of the processes have an alternative emphasis. For example, Durrani et al. (1998) develop a model which provides a formalised approach to technology acquisition. Li et al. (2003) develop a stochastic programming model to aid manufacturing firms in making strategic decisions in technology acquisition. Tracey et al. (1999) investigate the formulation of strategic plans that are consistent with investment in and use of manufacturing technology. Moller et al. (2003) develop a framework to guide companies in developing and handling competence-based relationships with technology suppliers. Other authors who have focused their attention on the management of the technology boundary include Swamidass (1987), Twiss and Goodridge (1989), Gerwin and Kolodny (1992), Goodman and Lawless (1994), Jones et al (2000), Probert et al (2000), and Baines (2004). For research in infrastructure interface approach, it can be seen from Table A.1 that only Baines et al. (1999, 2004) and Probert et al. (2000) have developed methodology for technology management. The other researchers have focused on study/review, model, framework and approach in their research.

5. *Holistic View of Supply Chain Approach* - There is little research on supply chain positioning taking a holistic view of all the four interfaces. Hill (1993)

defines strategic positioning as a key strategic decision for manufacturers and is associated with the firm's internal span of process, the degree and direction of vertical integration alternatives and its links and relationships with suppliers, distributors and customers. Vallespir and Kleinhans (2001) develop a fuzzy logic model to support the decision-making process of a company, positioned in a supply chain, to decide and modify the scope of its activity on the chain. Johansen and Riis (2005) explain the characteristics of the future industrial company and develop a framework for the strategic positioning for the future. Baines et al. (2005) propose an integrated decision process for guiding manufacturers to decide upon the strategic position of their manufacturing organisation. Some tools and techniques such as workbook and framework for making decision processes have been developed. For research from this perspective of taking a holistic view of the supply chain, Table A.1 shows that only Baines et al. (2005) has developed a methodology for strategic positioning.

In summary, this section has examined the various SSCP related methodologies. The methodologies have been grouped into the five main approaches and the research methods are identified for each of the existing SSCP related methodologies. Table A.1 has been created to show the review of each literature with details on researchers, contributions to research as well as the research method used. These methodologies are evaluated in the next section in order to select a most promising SSCP methodology.

5.4 SELECTING THE MOST PROMISING SSCP METHODOLOGY

The comparison of the various methodologies against the set of requirements is carried out in this section. This is with the purpose to select a most promising SSCP methodology. This is followed by an overview description of the selected SSCP methodology.

5.4.1 Analysis of existing SSCP methodologies

This section presents a detailed analysis of existing SSCP methodologies identified under the SSCP umbrella against the set of requirements. The set of requirements have been grouped into the seven key performance indicators (KPIs) identified in section 5.2 and shown in Table 5.1.

The analysis of the various SSCP methodologies are then carried out against these seven KPIs comprising: 1. Clear objective and outcome; 2. Structure; 3. Simple tools and techniques; 4. Outputs; 5. Documentation; 6. Participation, and; 7. Project management. Each of the SSCP methodologies has been analysed against each of the seven KPIs on whether it meets the criteria, and this is shown in Table A.2 in Appendix A. Table A.2 shows the results of the analysis of SSCP methodologies against requirements.

From the results of the analysis shown in Table A.2, only a few of the SSCP related methodologies appear to satisfy all the KPIs. Some of the SSCP methodologies are able to meet the four KPIs of clear objective and outcome, structure, simple tools and techniques, and outputs. However, majority of the research work only provide clear objective and outcome, and include simple tools and techniques.

For the six SSCP related methodologies that appear to satisfy all the KPIs, these methodologies are: methodology for make-or-buy by Probert (1996) and Platts et al. (2002); methodology for technology sourcing by Baines et al (1999); methodology for technology management by Probert et al. (2000); methodology for manufacturing technology acquisition by Baines (2004); and methodology for strategic positioning by Baines et al. (2005).

Based on further analysis, the SSCP methodology provided by Baines et al. (2005) has been found to be most promising methodology. The methodology

appears to have satisfied the general methodology requirements as well as provides a more holistic approach to strategic supply chain positioning, whereas the other five methodologies only address part of the supply chain.

5.4.2 Overview of the selected SSCP methodology

The SSCP methodology provided by Baines et al is comprised of 5 Stages that take the practitioner through a review of competitive market strategy; identifying key decision criteria; mapping the activity landscape; assessing the impact of making a change; and then consolidation of outcome. Baines et al SSCP methodology is summarised as below in Table 5.4. The following sections describe each of these stages in more detail.

Stage 1: Scope Issues

The first stage is about understanding how a company is competing in the market. Its purpose is to confirm the company's strategy, identify gaps between current and desired position and issue definition. This stage is implemented by first identifying a set of main products and customers, then reviewing the competitive strategy, and then assessing how current performance compares with customer requirements, along with that of competitor performance. The performance gaps are reviewed and critical ones identified, and an issues statement is produced.

Stage 2: Identify Key Decision Criteria

This stage sets out to identify a balanced and weighted set of key decision criteria that the host company usually uses to evaluate project initiatives. These criteria are termed FACTS (Financial, Attitude/Acceptability, Competence /Capability, Technological and Strategic fit), and will ensure that any proposals generated are consistent with the form that business cases take in the company. The output is a set of five balanced key decision criteria.

Table 5.4: Baines et al's SSCP methodology

Stages	Process	Output
STAGE 1: SCOPE ISSUES	Confirm company's competitive strategy between current and desired position and issue definition	Qualified issue statement
STAGE 2: IDENTIFY KEY DECISION CRITERIA	Conduct analysis to generate decision criteria	Key decision criteria
STAGE 3: IDENTIFY ACTIVITY LANDSCAPE	Generate activity landscape by considering each key business area in turn, and from this, identify those activities that have greatest significance in the key decision criteria	Significant activities Related activities
STAGE 4: ASSESS IMPACT	Identify those activities where a change in state will improve/sustain business performance against key decision criteria	Ranked activities identified for change
STAGE 5: CONSOLIDATE OUTCOMES	Reflect on key outcomes from earlier stages, and identify immediate associated initiatives	Project summary

Stage 3: Identify Activity Landscape

The purpose of Stage 3 is to produce a map of internal and external activities that are 'significantly' involved in the delivery of the product and services to the customer. On completion of this stage, the map will illustrate all activities that sit within the company, along with those in the wider supply chain, but directly related to delivering the products and services relevant to the 'issue statement' generated in the first stage.

Stage 4: Assess Impact

The purpose of this stage is to identify those activities where a change in state would improve/sustain business performance against Key Decision Criteria. This is largely based on a qualitative impact analysis using the Key Decision Criteria generated earlier. The final output from this stage is a ranked list of proposed activities identified for change, in order of potential effectiveness to the business performance.

Stage 5: Consolidate Outcomes

The final stage of the process is used to reflect on key outcomes from earlier stages. This provides an opportunity for a company to combine all the decisions agreed upon during the process and then provides a basis for validation and implementation.

5.6 CHAPTER SUMMARY

In summary, much of the existing research work only address part of the supply chain and deals with the boundary interface to suppliers, customers, infrastructure and product range independently. From the literature, Baines et al. (2005)'s integrated decision process was found to be the most promising methodology. The challenge now remains to build upon the existing Baines et al. (2005)'s integrated decision process and refines and adapts it to fit more closely

for SMEs in Singapore. This has then led naturally to the next chapter where the methodology is further evaluated through testing in industrial case studies.

CHAPTER 6: EVALUATION OF MOST PROMISING METHODOLOGY

This chapter deals with the objective of phase 2 of the research programme to evaluate and test the selected SSCP methodology in industrial case studies. This chapter is structured as follows. The objective and method of conducting this part of the research is first discussed in Section 6.1. The selection of companies is then discussed in Section 6.2. Section 6.3 describes the design of the data collection protocol. The application of the methodology in 4 test cases in the industry is explained in Section 6.4, followed by the presentation of the results in Section 6.5. The principal evaluation results, which emerged from the analysis, are described, and observations from the testing highlighted in Section 6.6.

6.1 PHASE 2: OBJECTIVE AND METHOD

The objective of this phase 2 of the research programme is to evaluate and test the effectiveness of the selected SSCP methodology from phase 1 in industry case studies. Section 4.3.2 has established that the testing is to observe the application of the methodology in practice in order to evaluate whether it is workable, to determine whether the methodology provides a practical, procedural step, and to establish future research needed to refine and adapt the methodology for SMEs in Singapore. This means that the main focus of this phase 2 is a rigorous evaluation and testing of the methodology through application in industry.

To achieve this evaluation, the appropriate research method is the case study method (Yin, 1993) with participant intervention (sometimes referred to as action research) (Argyris, 1970) (Section 4.3.2). Many authors have employed the case study method as a useful research technique (Eisenhardt, 1989; Miles and

Huberman, 1994; and Yin, 1994). Yin strongly recommends that the researcher be involved in the development of case design. The method is best suited to 'how' and 'why' questions and is also suitable for qualitative, quantitative methods, single or multiple cases, for testing and building theory from empirical evaluative research.

In addition to the case study method, the "intervention" approach is also used to test the selected SSCP methodology as the case study involved a great deal of intervention and participation of the researcher. Intervention is an act of entering an organisation for the purpose of changing it (Argyris et al., 1978). The researcher's role is to apply, facilitate, seek changes and learning; this type of intervention may be referred to as action research (Coghlan, 1994), but this thesis prefers the term 'intervention'.

The case study design starts with the selection of companies from a range of industry segments across the supply chain to provide a useful and different perspective of strategic positioning. This is followed by a design of the data collection protocol, which involves defining the assessment criteria (specific measures), data collection framework (who, when and how to collect data), and data collection instruments (interview and observation). After this, the case studies are executed, where individual case study is carried out as each 'complete' study and data collected. Finally, data from all the case studies are collated and the multiple-case evaluation results as well as observations from the application of the methodology are presented. A graphical illustration of the process is shown in Figure 6.1, and the resulting framework and procedure of the overall case study design is shown in Figure 6.2.

The following research method adopted throughout this chapter is presented. First, to discuss the selection of companies; second, to describe the design of the data collection protocol; third, to execute the case testing; and finally, to present the results of the evaluation and testing.

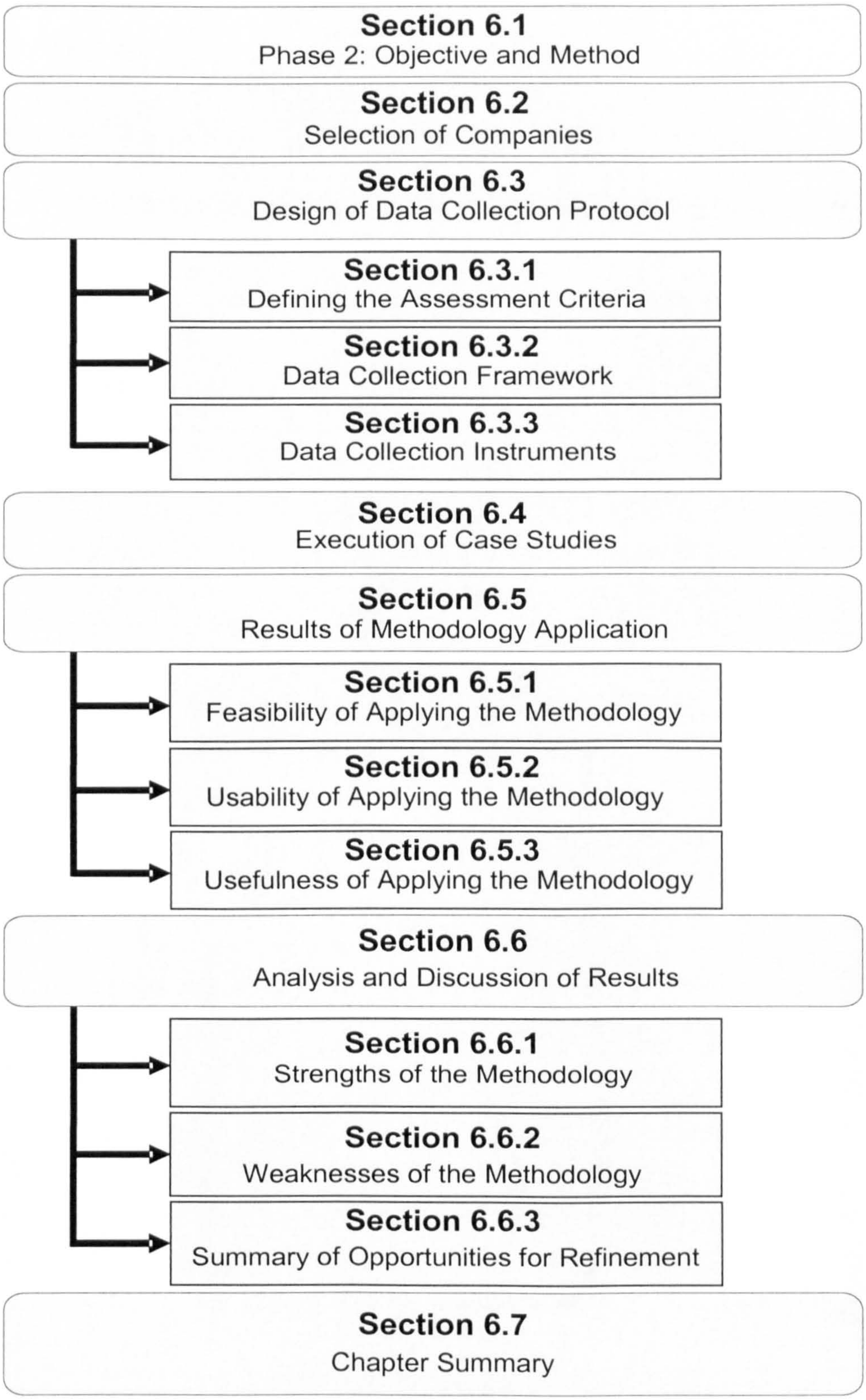


Figure 6.1: Method for evaluation of most promising methodology

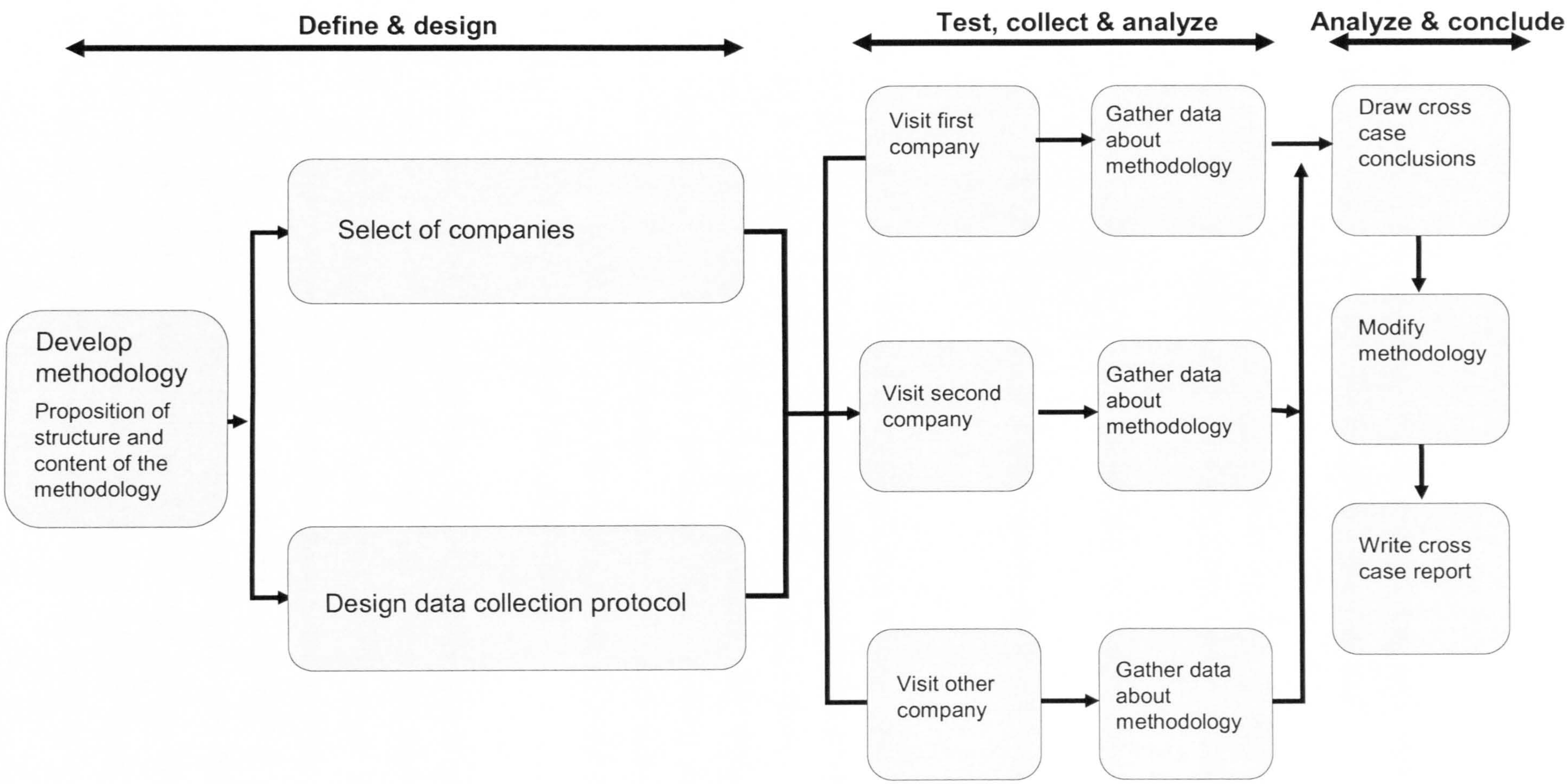


Figure 6.2: The case study research framework and procedure based on Yin (1994)

6.2 SELECTION OF COMPANIES

This section justifies the selection of companies for the evaluation. To guide in this selection, the following pre-defined criteria have been set:

1. The scope of the project has to cover a range of segments involving different types of companies representing the various nodes of the supply chain.
2. The test site should be considering a supply chain positioning improvement initiative.
3. The test site should have no methodology in place, and is exploring a new structured approach.

Once the pre-defined criteria have been determined, the next step was to decide on the type of cases to cover a range of industry segments involving different companies to represent the various nodes of the supply chain. A number of different types of cases were identified and they covered the different segments of the supply chain ranging from machining shop, contract manufacturing, equipment manufacturing, to distribution. Since the case study approach is relatively resource intensive, this research has therefore decided on four cases to represent the different segments of the supply chain.

To select the companies for the four cases, a three-stage approach was adopted. First, a list of companies from the mailing list of Singapore Institute of Manufacturing Technology (SIMTech) was chosen that cover the segments identified, and emails were sent to these companies inviting them to participate in the case study. The second stage involved responding to interested companies giving further details about the methodology and the assessment process. The final stage of selection was to visit these companies for a formal introduction meeting, presentation and to discuss possibility of collaboration, project scope, time-scale and roles. At the end of the meeting, a decision was

Table 6.1: Profile of companies for evaluation of selected methodology

	Case 1	Case 2	Case 3	Case 4
Size	>100	50-249	50-290	50-295
Ownership/ Industry segment	Local SME Distributor	Local SME Contract Manufacturer	Local SME Contract Manufacturer	Local SME Equipment Manufacturer
Business/ Products	Distributor for fasteners, electro-mechanical hardware, sleevings and tubings	Precision plastic tooling and components supplier	Precision components for hard disk drive and semiconductor equipment	Designs and manufacturing of CNC machining centers
Access via	Managing Director	Operational Manager	Executive Director	Manufacturing Director
Participating team	Sales & Marketing Materials Finance	Sales CAM Tooling Production	Sales & Marketing Finance Design Production QC Purchasing	Sales R&D Customer Service Production Turnkey Application
Facilitator	1	1	1	1
Date of case project	Sept -Nov 2005	Oct - Dec 2005	Nov 2005 – Jan 2006	Dec 2005 – Feb 2006

made on whether to continue or not. Based on the above set of criteria and selection process, four companies were selected for the case studies. Table 6.1 shows a profile of the characteristics of these four case companies for evaluation of the selected methodology. A fuller description of each company is given in Section 6.4. All the preparation, tests and evaluation took place between September 2005 and March 2006.

6.3 DESIGN OF DATA COLLECTION PROTOCOL

This section describes the process taken to design the data collection protocol for testing the methodology as part of the case study.

6.3.1 Defining the assessment criteria

The purpose of this section is to define the assessment criteria to enable rigorous evaluation and testing of the methodology. To achieve this, the assessment criteria need to be practically based In order to evaluate the effectiveness and success of the SSCP methodology in use. The process-based approach for the assessment criteria was adopted based on the earlier work of Platts (1990). Platts established three criteria for assessment of any practical methodology and these are:

- Feasibility - Could the methodology be followed?
- Usability - How easily could the methodology be applied and followed?
- Usefulness - Did the methodology provide a useful output that met expections?

With the assessment criteria identified, a set of performance indicators need to be formulated to measure whether the methodology was performing well. For

this, a set of twelve performance indicators were adapted from Enrique (2004) and they are derived as follow:

Feasibility

The testing of feasibility is straightforward according to Platts. If each step in the methodology was followed consistently as laid down, this demonstrates the methodology is feasible. Alternatively, feasibility can be thought of as a test for point of entry or capability of the organisation to follow the methodology, for example risk assessment on the methodology. If the methodology does not appear to be feasible for instance, this needs tailoring for extra credibility. Hence, feasibility is assessed based on four performance indicators comprising of completeness, consistency, success factor and contingency.

Usability

For the methodology to be accessible to users and managers, the techniques and tools have to be relatively easy to use and user friendly. Factors include the clarity and simplicity of the methodology, getting ownership and support, organisational and cultural factors, facilitation skills, resource availability, elapsed time, the problems and difficulties faced in using the methodology and asking users for their opinions using both qualitative and quantitative questionnaires and followed by interviews. Hence, usability can be measured based on five performance indicators of time, ease of use, understanding, participation and flexibility.

Usefulness

Following the completion of the methodology, its success is assessed. There is a cost involved in undertaking the methodology. Assuming the methodology can be followed and is easy to use, the management team should consider whether

the results obtained from undertaking the case project are worth the time they invested. To add to this, two other criteria are considered. The team should also consider whether the methodology produces a good output and that they are satisfied with the methodology and are likely to use it again. This refers to the overall usefulness of the methodology. Hence, usefulness is assessed based on three performance indicators in terms of effectiveness, efficiency and satisfaction.

The three assessment criteria with their corresponding twelve performance indicators and their definitions are summarised in Table 6.2.

6.3.2 Data collection framework

Having established the data collection to be based on the feasibility, usability and usefulness and defined their performance indicators, the purpose of this section is to determine the data collection framework.

Table 6.3 presents the data collection framework designed to address the following research issues considered as part of the process research:

- When: When should data be sought?
- Who: From whom should data be collected?
- How: How should the data be collected and what form of data collection should be used?

6.3.3 Data Collection Instruments

The last activity within the design of the data collection protocol was designing how to gather the data through the use of data collection instruments. Questionnaire-based interviewing techniques and participant observation have been identified as the most appropriate data collection instruments to gather

Table 6.2: Performance indicators for assessment criteria

Assessment Criteria	Performance Indicators	Definition
Feasibility	Completeness	Completeness of all the stages in the methodology
	Consistency	Consistency of the sequence of all the stages in the methodology
	Applicability	Applicability of the methodology in the organisation
	Contingency	Capability of the methodology to provide alternative solution
Usability	Time	Amount of time sufficiently allocated for each stage of the methodology
	Ease of use	Ease of use of the tools and techniques in each stage of the methodology.
	Understanding	Understanding of each stage during execution, terms used, and problems encountered
	Participation	Participation of all members involved at each stage of the methodology
	Flexibility	Changes made to the stages of the methodology during application
Usefulness	Efficiency	Efficiency of resources used to apply the methodology
	Effectiveness	Successful output from using the methodology
	Satisfaction	Willingness to use the methodology again

Table 6.3: Data collection framework

Categories of Assessment	**Performance Questions**	**Performance Indicators**	**When**	**Who**	**How**
In what ways can a methodology success be evaluated	*What questions should be asked to be able to comment on each category of success?*	*What responses indicate answers to the questions?*	*When should responses be sought?*	*Who should provide responses?*	*How should the data be collected?*
Feasibility	Could the methodology be followed?	Completeness Consistency Success Contingency	Post completion	Participants/ Facilitator	Post completion Questionaire Interview
Usability	How easily could the methodology be followed?	Time Ease of use Understanding Participation Flexibility	Post completion	Participants/ Facilitator	Post Completion Questionnaire Interview Diary Participant Observation
Usefulness	Did the methodology provide a useful output that met expectations?	Efficiency Effectiveness Satisfaction	Post completion	Participants	Post completion Questionaire Interview

both qualitative and quantitative data in order to assess the application (feasibility, usability, usefulness) of the methodology. This requires the design of a set of assessment questions.

Questionnaire Design and Validity

For question design, a set of assessment questions was adapted from the work of Enrique (2004) to test the usage of the methods, tools and techniques. The purpose of the assessment questionnaire was to find out how the methodology was used, and to identify areas that may need further refinement. Enrique (2004) based his approach to question design on the nine-step guidelines (Churchill, 1998) to develop the questionnaire.

1. *Information sought*. Presented in Table 6.2.
2. *Type of questionnaire*. A paper-based questionnaire was selected.
3. *Individual question content*. With a total of 12 performance indicators identified (Table 6.2), example of questions categorised into sections to match the performance indicators of the assessment criteria is shown in Table 6.4. A full sample of the questionnaire for post assessment is exhibited in Appendix B.
4. *Forms of response*. In addition to generating the set of questions, the scale used to measure respondents' attitude to the questions was also decided. The ranking scale chosen for the questionnaire was the Likert scale. In this project, a five-point scale was chosen, where 1 indicates not at all (strong disagreement) and 5 indicates very (strong agreement). The main reason for using a five scale was to restrict the number of choices required thereby avoiding the neutral ground.
5. *Question wording*. The questions were designed to be simple and unambiguous.
6. *Sequence of questions*. The sequence of questions is designed according to the assessment criteria of feasibility, usability and usefulness.

Table 6.4: Matching questions to performance indicators

Assessment Criteria	Performance Indicators	Questions
Feasibility	Completeness	Was all the stages in the methodology completed?
	Consistency	Did you feel that the sequence of the stages was inconsistent?
	Applicability	Did you find the methodology applicable to your organisation?
	Contingency	If the project encountered problems, did the methodology provide alternative solutions?
Usability	Time	Was sufficient time allocated for each stage of the methodology?
	Ease of use	Did you find the tools and techniques in each stage easy to use?
	Understanding	Did you understand the execution, terms used, and did you encounter any problems at each stage?
	Participation	Did you get the chance to be involved and contribute at each stage?
	Flexibility	Were any changes made to the stages during application?
Usefulness	Efficiency	Did the project consume excessive resource of time and people?
	Effectiveness	Was there a successful output after using the methodology?
	Satisfaction	Would you use the methodology again?

7. *Physical characteristics of the questionnaire*. The questionnaire focuses on the functionality of the process approach of the methodology.
8. *Re-examination and revision*. The questions were revisited several times for the previous seven steps and revisions made after careful considerations.
9. *Questionnaire pre-testing*. Two issues were considered in the pre-testing of the questionnaire and these were the content and face validities. Content validity refers to how adequately the contents of the questionnaire reflect the information sought. Face validity refers to whether the scales used are applicable and satisfactory.

Participant Observation

Yin (1994) argues that this is a unique mode of observation. The researcher was directly involved in facilitating and observing the case study as participant and observer. The researcher was a lead team member and shared the team members' experiences. The challenge of participant observation is often the validity of observation which resulted from bias of subjective interpretation of situations (Denzin, 1989). To reduce this bias, the researcher cross checked findings from the project participants and eliminated inaccurate interpretations (Alder and Adler, 1987).

In this section, a process-based approach has been adopted to design and develop the data collection protocol. The protocol determines the assessment criteria, performance indicators, data collection framework (when, who and how to collect data), and the data collection instruments (the sets of questions) used to evaluate the case studies.

6.4 EXECUTION OF THE CASE STUDIES

An overview of four case studies is presented in this section. Each case study provided a useful and different perspective of strategic positioning to gain competitive advantage. A detailed description of each case study application is set out in the Appendix C.

Case 1 is a leading distributor of quality fasteners, electronic hardware, sleevings, tubings and other electro-mechanical parts. Case 1 has established an enviable reputation in its inventory programme, which includes ship-to-stock, hub, two-bin system, amongst others. Excellent customer service and good quality control are key factors in the way they do business and their biggest advantage over the competitors is the wide product range case 1 handles. This means that they are capable of handling all types of customers with a one-stop shop solution, be they big or small. Case 1's on-time delivery, competitive pricing and proactive approach have set industry standards that their repeat customers have become accustomed to. Case 1's quality and delivery performances are rated 99% but what matters most is the 100% satisfaction and assurance of the customers.

The application of the methodology began with Stage 1 where the project members identified the whole company as the business area for review. The current competitive strategy was assessed to be Customer Intimacy and so was their desired competitive strategy as their utmost priority is customer satisfaction. The summary of competitive gaps was analysed and showed that the company exceeded both their customers and competitors in Customer Intimacy and Operational Excellence. The over-riding challenges were identified by project members for Case 1 to become the leading regional distributor and to sustain their market share by product price advantage. In Stage 2, using the FACTS criteria, the project members identified profit margin as the top priority, followed

by management support, impact on customer required 'activities', technology importance to business, and impact on competitiveness.

In Stage 3, the significant activities were identified as business development, order processing, follow up delivery dates, ensure on-time delivery, check order conformance dates, receipt of goods ordered, ensure accuracy of items ordered, inspection of incoming goods, rejected parts replacement and payment to supplier. For Stage 4, the strengths of the company were identified and decision made to keep these activities and continue to grow them in order to fulfill the company's future plan. These activities included business development, order processing, follow up delivery dates, ensure on-time delivery, receipt of goods ordered, ensure accuracy of items ordered, and payment to supplier. Weaknesses were also identified such as check order conformance dates, inspection of incoming goods ordered, and rejected parts replacement. Decision was made to outsource these activities. In Stage 5, summarising the results, the activities which are the strengths of the company were proposed to be kept and grown upon while the weaknesses were proposed to be outsourced. By working on the proposed actions, customer satisfaction would be increased, time to market reduced and reliability improved. Future actions would work on increasing market share and improving quality within the next six months.

Case 2 is one of Singapore's leading vertically integrated contract manufacturer serving the wireless telecommunications, consumer electronics and computing and automotive industries. Case 2 provides a wide range of products and services which includes industrial and product design, manufacture, assembly mold design and fabrication, injection molding, class 100k clean room molding, related secondary processes and component assembly. Case 2 has the ability to generate customer patronage and loyalty by consistently offering quality products and services at competitive prices and reliable delivery time. Continuous success is dependent to a significant extent on company's ability to retain the services of the key management and efficient operation. Most of the Case 2's customers

have multi-site manufacturing locations in the countries in which Case 2 operates, supporting its vision of becoming a regional contract manufacturer.

For Stage 1, the project members identified the data storage business area for review of competitive position. Case 2's current competitive strategy was assessed to be Operational Excellence and so was their desired competitive strategy as success is dependent to a significant extent on the company's ability to retain the services of key management and to excel in its operations. The summary of competitive gaps showed that the company matched the customer requirements in terms of Customer Intimacy and Operational Excellence. However, the company lagged behind their competitors in product availability and product price for Operational Excellence, and after-sales support for Customer Intimacy. The over-riding challenges for Case 2 were to globalise their operations and add value to their customers through quality and technology, as well as to focus on strengthening the timely product/process design and development. In Stage 2, after summarising FACTS, profit margin was at the top of the priority list, followed by technology strength, attitude towards decision making, ability to retain required competency and impact of competitiveness.

In Stage 3, the significant activities identified were tool and die mold part design, plan and schedule inhouse/sub-out operations, grinding/milling/wire-cut, inspect inhouse/sub-out, precision plastic injection molding, NC programming, new product development, mold assembly and testing, customer service and marketing. For Stage 4, the strengths identified included activities such as tool and die mold part design, new product development, plan and schedule inhouse/sub-out operations, grinding/milling/wire-cut, customer service and marketing. For the weaknesses identified, to overcome them, the company needed to adopt new technologies, in-source those sub-contracted operations to achieve higher quality and shorter time to market, reduce product price, acquire new technologies, increase manpower and high-tech machines. In Stage 5, summarising the final results, the strengths were proposed to be kept and grown

upon, while those portion of activities which are currently outsourced like grinding/milling/wire-cut and inspect inhouse/sub-out were proposed to be in-sourced. By working on the proposed actions, labor cost would be reduced and market share would be increased. Future actions would work on increasing market share, reducing cost and increasing productivity within the next six to nine months.

Case 3 is a contract manufacturer engaged mainly in the manufacture of equipment and automated assembly lines. Case 3 has been formed by the strategic alliance between two Singapore companies A and B. Company A was a supplier of assembly and test equipment services to manufacturers in the hard-disk drive industry. Company B was a supplier of precision machining components and equipment modules for both the front-end and back-end semiconductor equipment manufacturers. The strategic alliance was formed to meet the global demands from many customers to design and develop a variety of challenging complex products. These precision components and equipment are mainly for the hard disk drive manufacturers, semiconductor equipment manufacturers and other industries in the electronic, machine tools, and etc. Case 3 has been able to gain the confidence of its customers through its commitment to quality, reliability, on time delivery and competitive prices.

The application of the methodology followed the same format as Case 1 and 2. In Stage 1 the project members identified the semiconductor and testing equipment business area for review. Case 3's current competitive strategy was assessed to be Operational Excellence and so was their desired competitive strategy which would also focus on best quality product and providing the best total cost and delivery on time. The competitive gaps analysis showed that in the area of operational excellence the company currently matched with the customer requirement and competitor performance, and exceeded in quality conformance. However, the company lagged behind the competitor in after sales support. The over-riding challenges for Case 3 were to reduce costs, improve quality and

flexibility in manufacturing of testing equipment for the hard-disk drive and semiconductor equipment business. In Stage 2, using the FACTS criteria, profit margin was at the top of the priority list and followed by resource capacity, fit with customer requirement, corporate support and technology capability.

In Stage 3, the significant activities were identified as they included design, product definition and schedule, product transfer, production capacity, purchasing, customer service, standard parts purchase, quality control, new technology and market diversification. For Stage 4, the strengths of the company were identified as design, product definition and schedule, product transfer, production capacity, purchasing, quality control, and customer service, which needed to be kept and continue to grow. To overcome the weaknesses, the company needed to adopt new technologies, in-source standard parts purchase, reduce product price by increasing production capacity, and bring in-house market diversification. For Stage 5, the strengths of the company were proposed to be kept and grown upon with the exception of new technology which was proposed to be outsourced. By working on the proposed actions, quality would be enhanced, market share increased and after sales support improved. Future actions would work on increasing productivity, increasing the reliability of product, reducing cost and increasing market share in the future six to nine months.

Case 4 is a Singapore company that designs, manufactures and markets Computer Numerical Control (CNC) machining centers regionally. Case 4 has subsidiaries strategically located in Singapore and China. It has placed strong commitment to research and development to enable the company to become a leading regional machine tools builder. Through its subsidiary companies, Case 4 offers many types of services including major overhauling and retrofitting on all types of CNC equipment, factory automation and robotics.

The application of the methodology began with Stage 1 where the project members identified the milling machine business area for the purpose of review of competitive position. Case 4's current competitive strategy was assessed to be Operational Excellence while their desired competitive strategy was Product Leadership as the company plans to focus on invention, commercialisation and market exploitation, by frequently reviewing their product portfolio. The competitive gaps analysis showed that in the area of operational excellence the company currently matched with the customer requirement, but lagged the competitor performance in product availability. The over-riding challenge for Case 4 was to become the regional leader in machine tool and to increase the production output, and shorten the lead-time and delivery time to customers. They also wanted to sustain customer orders, stay competitive in the market, introduce new technologies, strengthen R&D to design and build value-added intelligent machines. In Stage 2, using the FACTS criteria, the project members identified profit margin was at the top of the priority list and followed by management capability to implement, fit with customer requirement, process maturity and degree of change in core competence requirement.

In Stage 3, the significant activities were identified as rough/fine machining of raw casting, optional features sub-assembly, final sub-assemblies for spindle sub-assembly, bed/column/table sub-assembly and coolant tank sub-assembly, product transfer, design and prototyping, standard parts purchase, design definition and specification, customer service, new product development and market diversification. For Stage 4, the strengths of the company were identified which included design and prototyping, new product development, standard parts purchase (bought from local market) and product transfer. Weaknesses identified included rough/fine machining of raw castings, optional features sub-assembly, final sub-assemblies, design definition and specification for turnkey applications and customer service, which were required to be outsourced. The opportunity such as market diversification was considered necessary to bring in-house. In Stage 5, summarising the results, design and prototyping, design

definition and specification, customer service, and new product development were proposed to be kept and grown upon. Rough/fine machining of raw castings, optional features sub-assembly, and final sub-assemblies were proposed to be outsourced, while standard parts supply and product transfer were to be brought in-house. By working on the proposed actions, there would be a reduction in time and labor cost and the new ability to make new products available to the correct market segment. Future actions would work on product innovation, providing latest technology, improving research and development, providing high quality customer care and increasing production in the next six months.

Having given an overview of the applications, the analyses of the cases are presented.

6.5 RESULTS OF METHODOLOGY APPLICATION

This section presents the results of testing the methodology to the four cases based on the post completion questionnaire and researcher observation addressing the evaluation criteria of feasibility, usability, and usefulness. Following the completion of the test case, both quantitative and qualitative analysis were carried out.

The purpose of the post completion assessment was to provide a way of recording the overall performance of the methodology on all the criteria established for the application and assessment of the methodology. Quantitative questions were rated on a 5-point scale (5 being the most positive response, 1 being the most negative response and 3 being don't know). Where zero is shown, this indicates no response was given. The total percentage against each criteria is calculated as follows: the sum of scores is divided by the maximum possible score given to the total number of questions by all the respondents. A detailed post assessment result of the quantitative analysis for the participants

for each case study is set out in Appendix D. These results are now discussed in the following sections.

6.5.1 Feasibility of applying the methodology

The feasibility criteria were intended to establish that the methodology can be followed. The four companies followed the methodology and this demonstrates that it is feasible as the average of the scores from the four cases is 70.4%. Table 6.5 summaries the scores made by the participants of four companies regarding the feasibility test of applying the selected methodology during the post completion questionnaire.

Three process participants in Case 1 shown in Appendix D, responded to the four questions on feasibility and rated the methodology as 83.35%, four participants in Case 2 scored 56.25%, six participants in Case 3 rated 70% and five participants in Case 4 scored 72%. Most of the participants felt that the overall structure of the methodology proved feasible and did work for their companies. At the same time they thought that it could be improved further by considering the competences of the companies and adding more detail in this area to the content of the methodology.

6.5.2 Usability of applying the methodology

The measure of usability was also tested post completion and here, the research sought both quantitative and description statements from both facilitators and process users. The usability criterion was intended to prove that the methodology can be easily followed.

The scores made by the participants of four companies regarding the usability test during the post completion questionnaire were summarised as shown in Table 6.6. The usability of the methodology was rated as 65.3% based on the

average scores of the four companies. Based on the nine quantitative questions, three participants rated the usability of the methodology shown in Appendix D as 70.22% in Case 1, 57.8% in Case 2, 67.78% in Case 3, 65.3% in Case 4.

6.5.3 Usefulness of applying the methodology

For the measure of the usefulness of the methodology, from the participants' perspective, the following feedback was received. Of the six questions asked, three users scored 81% in Case 1, four users rated it 62.5% in Case 2, six users answered 63.9% in Case 3, five participants rated it 74..67% in Case 4. The overall feedback from the post questionnaire on the usefulness of the methodology was positive; on a whole 70.5% was recorded as shown in Table 6.7.

6.6 ANALYSIS AND DISCUSSION OF RESULTS

The objective of this section is to analyse the results from the execution of the methodology applied to all case studies and present the analysis in a structured form. The analysis in this section follows the structure of a SWOT analysis (strengths, weakness, opportunities, and threats). First the strengths of the methodology are considered, followed by the analysis of the weaknesses, and finally opportunities for refinement will be described.

6.6.1 Strengths of the methodology

The case study results indicate that there are quite a number of strengths in the decision process of the methodology. First, as a whole, the methodology is very comprehensive and systematic comprising of five stages such as:

Table 6.5: Feasibility results of applying the selected methodology

	FEASIBILITY			
	Case 1	**Case 2**	**Case 3**	**Case 4**
R: Respondents	Average of 3R	Average of 4R	Average Of 6R	Average of 5R
Q.1 Completeness	4.0	2.75	4	4.2
Q.2 Consistency	4.7	3	3	3.8
Q.3 Applicability	4.3	3	3.67	3.8
Q.4 Contingency	3.67	2.5	3.33	2.6
RESULTS	83.35%	56.25%	70%	72%
	70.4%			

Table 6.6: Usability results of applying the selected methodology

	USABILITY			
	Case 1	**Case 2**	**Case 3**	**Case 4**
R: Respondents	Average of 3R	Average of 4R	Average of 6R	Average of 5R
Q.6 Time	3.3	3.25	3	3.6
Q.7 Ease of Use	4.0	2.75	3	3.2
Q.8 Understanding	4.0	3	3.5	3
Q.9 Robustness	4.0	2.25	3.83	3.8
Q.10 Issues	3.3	3	3.33	3.2
Q.11 Preparation	2.7	2.25	3	2.6
Q.12 Participation	3.3	3	4.17	3.2
Q.13 Case study	4.3	3	3.5	3.6
Q.14 Consultation	2.7	3.5	3.17	3.2
RESULTS	70.22%	57.8%	67.78%	65.3%
	65.3%			

Table 6.7: Usefulness results of applying the selected methodology

	USEFULNESS			
	Case 1	**Case 2**	**Case 3**	**Case 4**
R: Respondents	Average of 3R	Average of 4R	Average of 6R	Average of 5R
Q.23 Successful	4.33	3.25	3.17	3.6
Q.24 Effectiveness	4.67	3	3.67	3.8
Q.25 Contribution	3.67	3.5	3.5	3.4
Q.26 Influence	4	3.25	3.33	3.8
Q.27 Efficiency	3.3	2.5	3.17	3.8
Q.28 Usefulness	4.3	3.25	2.33	4
RESULTS	81%	62.5%	63.9%	74.67%
	70.5%			

- Stage 1- Scope issues;
- Stage 2 - Identify key decision criteria;
- Stage 3 - Identify activity landscape;
- Stage 4 - Assess impact; and
- Stage 5 - Consolidate outcomes.

With these five stages, it is structured to consider holistically and simultaneously the strategic supply chain positioning decision from the view of the four different interfaces of the supply chain with suppliers, customers, infrastructure and product range. The methodology also considers that the activities in a company and its supply chain are dynamic in nature and have emerging, mature or declining capabilities that will change as time goes by. Finally, the methodology provides a link from the decision about the activity ownership to the competitive strategy of the company to identify its competitive space.

Secondly, each of the stages also has their own unique strength, namely:

- **Stage 1** provides a useful set of key criteria in the form of worksheets to help companies identify their competitive strategy, be it operational excellence, product leadership or customer intimacy.
- **Stage 2** provides a balanced and weighted set of quantitative and qualitative decision criteria for the evaluation of proposed changes generated by the strategic positioning analysis. Similar to stage 1, stage 2 also provides some initial suggested factors in each of the decision criteria to guide company in their decision process.
- **Stage 3** provides a generic approach in identifying significant activities from all aspects of a company's possible competitiveness. In addition, the methodology goes further to identify their key enabling related activities.
- **Stage 4** provides a ranked listing of those activities where a change in ownership (such as outsource, insource) or change of state (such as grow, strengthen or eliminate need for) would have a positive benefit to

the business performance as detailed in the stage 1. This was carried out by defining the condition of the Significant Activities using a form of SWOT analysis and then deciding the most appropriate action that could be taken to improve the issue scoped. This stage also provided a detailed qualitative impact analysis using the Key Decision Criteria (and their relative weightings).

- **Stage 5** provides the panel to agree that the company needed to verify all the decision by confirming the accuracy of the data used, and then to adopt as a priority a series of initiatives.

6.6.2 Weaknesses of the methodology

In the application of the methodology, a number of weaknesses were noted in the decision process. First, on the overall, the methodology was developed mainly to cover companies in the manufacturing industry and not for other industry such as distribution. During the case study, close discussion and guidance was found to feature heavily during stages 1, 2 and 3.

Most participants commented that the methodology was developed from the perspective of larger multinational companies (MNCs) and not specifically for the SMEs and Singapore industry context. They highlighted that the methodology adopted a market-based approach by first looking at the market and followed by organising the activities to strategically position the company to meet the needs of the market. This approach may be suitable for MNCs, but unlike the MNCs, the organisation of SMEs is quite different and is comparatively small and flat in structure. Most participants have indicated that they require the methodology to better consider the competences of organisation by first identifying the strength of the activities and resources of the company and followed by looking at the market to strategically position the company. Some of the reasons raised by the participants to prefer a competency approach include:

1. SMEs need to focus on a small number of activities and excel in one carefully defined capability and retain merely adequate capabilities in other requirements.
2. SMEs have fewer resources and can afford fewer mistakes, and therefore decision-making capabilities are more critical in SMEs than in large companies.
3. SMEs must assess their competitive positions and those of their supply chains based on their limited critical resources and position themselves to respond to the market conditions.

Another weakness observed was that the methodology was dependent on the skills and experiences of the facilitators as well as the panel members. This was especially so during stage 3, to guide the practitioners to map the activities of the organisation to an appropriate level of detail and during stage 4 where the facilitators guided practitioners to judge carefully impact assessments.

Besides the weaknesses of the methodology as a whole, some other weaknesses occurred at the various stages within the methodology itself, namely:

Stage 1:

For stage 1, from the feedback obtained during application of the methodology, the key criteria for identification of competitive strategy were found to cater generally for companies in the UK. Several key criteria need to be modified to suit companies in the Singapore industry context. It was known that a few statements in the tables for current competitive strategy and desired competitive strategy were not clear to the panel members. As a result of this when filling the worksheets of key criteria, the columns indicating 'Agree', 'Disagree' and 'Don't Know' votes were not accurate.

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Secondly, the problem scope/overriding issues were not taken into consideration when deciding the desired competitive strategy of the company. The desired competitive strategy was decided solely on the basis of how the company wanted to do business in future. Thus the core problem currently faced by the company was ignored and remained unaddressed while selecting the desired strategy. Sometimes this could cause a contradiction between the selected desired strategy and the problem area. If the problem scope would have been considered for deciding the desired strategy at this stage itself this would result in the selection of the correct desired competitive strategy. Hence deciding the strategy should be based on the current problem and how company should be doing business in future as this will cover a broader spectrum and give a more adaptable desired strategy.

Thirdly, in this stage the competitive performance gaps are considered to be critical only if they directly address the desired competitive strategy. The others are not so critical and are ignored. Thus if one of the important customer need is not a part of the desired strategy then it could be overlooked. To avoid this, the customer and market needs of the product should be taken into account at the stage of selecting the desired strategy itself. Otherwise this could result in ignoring what the customer wants and what is demanded by the market. Furthermore if this need is fulfilled by the competitor it would result in customer and revenue loss to the company.

Lastly, most participants indicated that the analysis of current competitive strategy, desired competitive strategy and competitive performance gaps for customer/competitor adopted at this stage 1 should be shifted to a later stage. Instead, a resource-based approach where the activities and resources are analysed first at the early stage was preferred and would be more appropriate for SMEs.

Stage 2:

For stage 2, the feedbacks obtained have suggested that most participants found the FACTS criteria selection confusing and did not flow correctly from stage 1. This was due to the fact that the criteria were not used until the fourth stage of assessing impact and their selection at the second stage has not much meaning but was instead like a diversion of the methodology after stage 1. Many participants have found this stage not relevant and would not be required.

Stage 3:

For stage 3, the main weakness found was the time consuming task required to map the related activities, both inside and outside the organisation that may in some way be relevant to the issues being addressed. Considerable time was needed to conduct this analysis, and strong facilitation was important and needed to help the participants from becoming overwhelmed in details. The suggested activities in the methodology were very general and therefore extra efforts were needed to change those activities for individual industry.

For activity mapping, the participants expressed that the guideline provided to map the internal and external activities for the four interfaces with suppliers, customers, infrastructure and product range were not directly obvious to them. In addition, the initial activity mapping was complex and this caused certain crucial activities to be left out. Within the decision aid, the infrastructure boundary was open to misinterpretation and was difficult to map, it is not clear what should be included under this banner (e.g.: technology, human resources, information, knowledge) and how should it be dealt with. Hence, many participants suggested that a more structured method including a visualisation technique to guide them to map out the activities in the company systematically should be introduced.

6.6.3 Summary of opportunities for refinement

The opportunities to improve the methodology can be derived from the analysis of the strengths and weaknesses outlined in the above sub-sections. There are a number of opportunities that exist to improve the efficiency and effectiveness of the methodology, and these fall into two categories, namely:

1. *Overall structure of the methodology* - First, overall, the structure of the methodology can be improved from that of a market-based approach to a competency approach. This necessitates changing the structure as well as the content of the stages to include competency approach like resource-based view (RBV) methods, which is not available in the current selected methodology. Furthermore, the methodology can be simplified to cater for the SMEs as well as improved to cover other industry besides just for manufacturing.

2. *Individual stages* - Second, for the individual stages, as discussed earlier, stages 1, 2 and 3 require further improvement. For stage 1, improvement to the content can be made on the key criteria for identification of competitive strategy, alignment of the desired competitive strategy with the problem scope/overriding issues and competitive performance gaps, and shifting of some of the contents to later stages. For stage 2, this can be removed since many participants have found this stage to be not relevant. Regarding stage 3, improvement can be made to introduce a more structured method and a visualisation technique to guide participants to map out the activities in the company.

6.7 CHAPTER SUMMARY

This chapter has addressed the second objective of the research programme, namely, to gain an in-depth understanding of how well the methodology worked, and how it influenced the decisions and actions of senior executives carrying out in real projects. The results gained have indicated a number of improvements

necessary to the selected methodology, and these form the basis of the work in the following chapter.

CHAPTER 7: FORMATION OF PILOT METHODOLOGY TAILORED TO SMES IN SINGAPORE

The evaluation, testing and analysis of the selected methodology in Chapter 6 provided an insight into the strengths, weaknesses and opportunities for improvement of the methodology. This chapter now deals with phase 3 of the research programme, namely, the development of the pilot strategic supply chain position (SCCP) methodology tailored to SMEs in Singapore. The chapter first presents the objective and method of this phase of the research in Section 7.1, followed by a selection of leading methods in resource-based view (RBV) in Section 7.2. The content and structure of the pilot SSCP methodology are then determined in Sections 7.3 and 7.4. Finally an overview of the pilot SSCP methodology is described in Section 7.5

7.1 PHASE 3: OBJECTIVE AND METHOD

The objective of this phase 3 of the research programme is to form the pilot SSCP methodology tailored to SMEs in Singapore. From the testing carried out at phase 2, a number of developments and improvements needing changes have been identified, namely: 1. Overall structure of the methodology - include competency approach like resource-based view (RBV) methods, simplifying for SMEs, and covering other industry besides manufacturing (Section 6.6.3); 2. Individual stages – include improvement on the key criteria, alignment of desired competitive strategy with problems scope and competitive performance gaps, and shifting of contents for stage 1, removing stage 2, and improving stage 3 with a more structured method and visualisation technique for activity mapping (Section 6.6.3).

Faced with this challenge, the appropriate research method chosen to form the pilot SSCP methodology is to extract the strengths of the current selected methodology, and adopt the suggested changes for improvement of the selected methodology. To include resource-based view (RBV) methods in the pilot methodology, the appropriate approach is to review comprehensively the relevant literature on RBV to select leading methods. The search for relevant literature on RBV is to cover the selection of leading methods on resource definitions and classifications, evaluation criteria of critical resources, and identification of capabilities. Having selected the RBV methods from literature, these can then be combined with other suggested changes to the strengths of the current selected methodology to form the structure and content of the pilot SSCP methodology.

To realise this phase 3 of the research programme, there are therefore four main parts. Firstly, to select leading existing methods in RBV from literature (Section 7.2); secondly to determine the structure of the methodology (Section 7.3); thirdly to determine the content (Section 7.4); and finally to describe an overview of the new pilot SSCP methodology (Section 7.5). This structure is graphically illustrated in Figure 7.1 and this chapter sets out to execute this structure in the following sections.

7.2 SELECTION OF LEADING METHODS IN RESOURCE-BASED VIEW OF THE FIRM

This section reviews relevant literature on RBV to select leading methods on resource definitions and classifications, evaluation of critical resources, and finally identification of capabilities that can contribute to the formation of the pilot SSCP methodology.

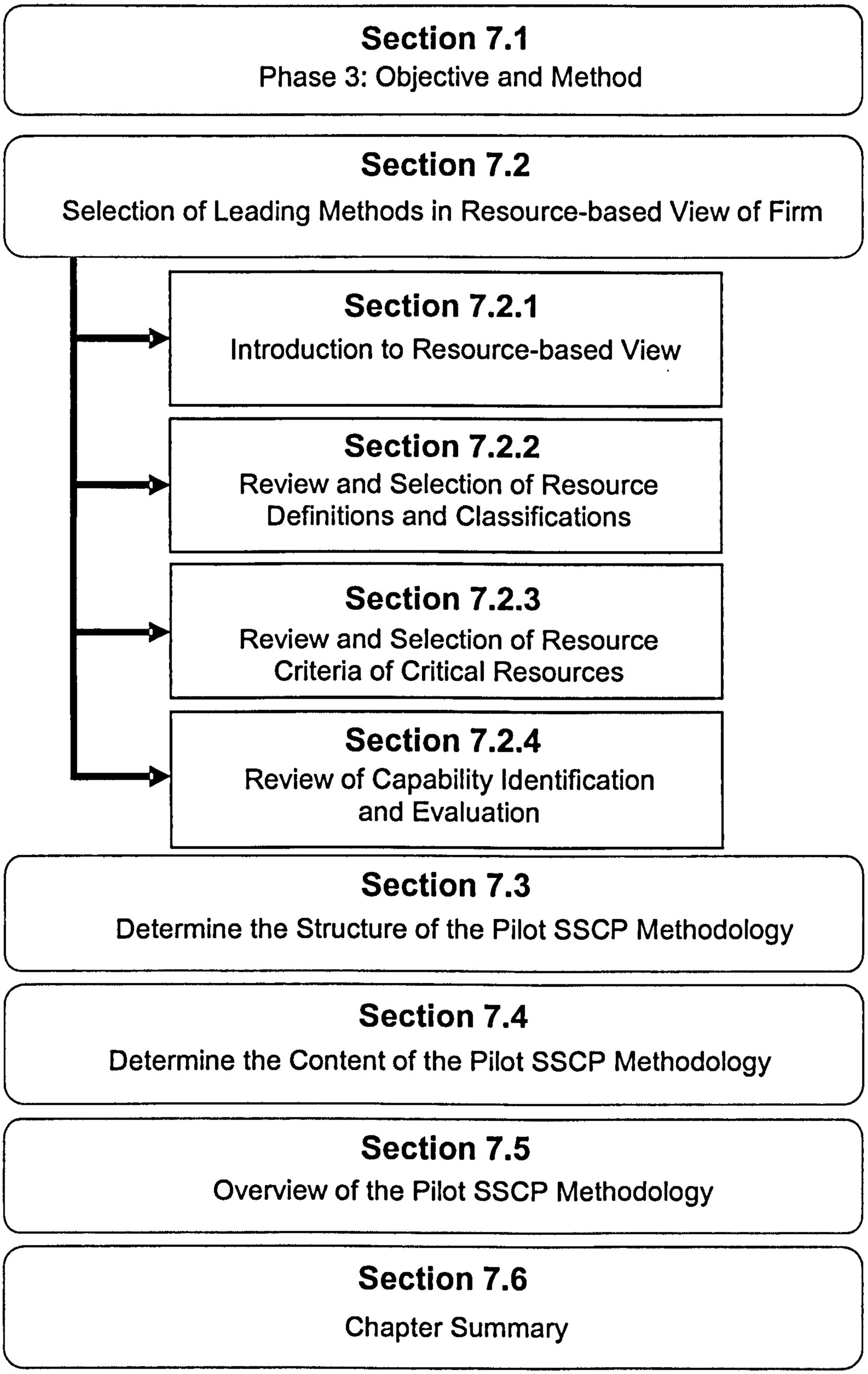


Figure 7.1: Formation of the pilot SSCP methodology

7.2.1 Introduction to resource-based view

The resource-based view (RBV) theory is one of the research areas that has increasingly received considerable attention from literature on strategic management and has been embraced by many researchers (e.g., Prahalad and Hamel, 1990; Grant, 1991; Barney, 1991; Mahoney and Pandian, 1992; Stalk et al., 1992; Peteraf, 1993; Amit and Shoemaker, 1993; Collis and Montgomery, 1995, Mills et al., 2003). The resource-based view (RBV) proposes that competitive advantage of a company is linked to and dependent on its resources and capabilities that differentiate it from its competitors

From the perspective of RBV, the company's resources and capabilities should be the foundation for the company's strategy as they are the primary source of competitive advantage and provide a much more stable basis to define the company's identify than the dynamic and often unpredictable external environment (Grant, 1991). The acceptance of the concept of the firm as a unit of resources and capabilities has prompted interest in identifying the nature of these varying resources and capabilities, and in evaluating their potential for generating competitive advantage. For this reason, the RBV gives special attention to studying the factors that cause these differences to persist (Barney, 1991; Grant, 1991; Mahoney and Pandian, 1992; Amit and Schoemaker, 1993). The diverse nature of resources and capabilities is an essential element in the development of the competitive strategy of a company.

7.2.2 Review and selection of resource definitions and classifications

Resources come in many forms, from common factor inputs that are widely available and easily purchased in arm-length transitions, to highly differentiated resources; like brand name, that is developed over many years and is very

difficult to replicate. Hence there are many different definitions and classifications of resources that have been proposed by different authors, varying from the very broad to the very specific. A brief description of these different definitions and classifications of resources is as follows:

Authors who have defined resources as a bundle of assets, capabilities and processes include Barney (1991), Black and Boal (1994), Collis and Montgomery (1995), and Marino (1996). Barney (1991) defines resources as a bundle of assets, capabilities, organisational processes, firm attributes, information and knowledge. Resources are firm-specific assets which are difficult, if not impossible, to imitate. Patents, trademarks, certain specialised production facilities and experienced engineers are examples. Barney (1991) then groups all firm resources into three categories: physical capital resources, human capital resources and organisational capital resources. Black and Boal (1994) view resources as a network of assets. They categorise resources into two types: contained resources and system resources. Collis and Montgomery (1995) define resources as different collections of assets (physical and intangible) and capabilities. These assets and capabilities determine how a company performs its functional activities. They classify resources simply as physical, intangible and organisational capability. Marino (1996) defines resources broadly as assets, capabilities, knowledge and processes. He proposes that assets can be divided into three categories as physical (plant, equipment, production technology and finance), human (training, abilities and experience), and organisational (reputation, internal systems and processes).

Other authors have defined resources as tangible and intangible assets and these include Hooley et al. (1998), Lewis (2003), and Mills et al. (2003). Hooley et al. (1998) propose assets instead of resources and define assets as resource endowments of the company, which can be divided broadly into tangible and intangible assets. Hooley et al. (1998) further propose that assets can be grouped depending on their source, namely: physical, financial, operations,

human, marketing, legal, and systems assets. Lewis (2003) defines resources as tangible (e.g. machines, facilities) and intangible resources (e.g. skills, knowledge, experience of people and systems). Mills et al. (2003) adopt the definition of resources by Wernerfelt (1984) that a firm's resources at a given time could be defined as those tangible and intangible assets which are tied semi-permanently to the firm. Mills et al. (2003) divide the resources into a set of resource categories comprising of tangible, knowledge, skill and experience, system and procedural resources, cultural resources, network resources and resources with potential dynamic capability.

Bowman (2006) defines resources as assets and termed strategic assets as specific to the firm that either help the firm win business, or they assist in the delivery of products or services at lower costs then competing firms. Bowman has suggested five categories of strategic assets and these are tangible assets, system assets, cultural assets, knowledge assets and relational assets.

Grant (1991) defines resources as inputs into the production process, such as equipment, finance and etc, and these resources form the basic units of analysis, and are the basis for competitive advantage and profitability. Grant (1991) suggests six major categories of resources such as financial, physical, human, technological, reputation and organisational.

This review of the various resource classifications by the many authors are summarised and shown in Table 7.1. From the table, the number of occurrences for each of the classifications was then analysed to select the most common set of resource classification representative of those proposed by the various authors. Based on the analysis, the selected set of resource classifications to be included in the pilot SSCP methodology is summarised in Table 7.2.

Table 7.1: Resource classification by various authors

Resources	Barney	Grant	Collis & Montgomery	Black & Boal	Marino	Hooley et al.	Lewis	Mills et al.	Bowman	Number of occurrences
Financial	Δ	▲		Δ	Δ	▲	Δ	Δ		7
Physical	▲	▲	▲	Δ	▲	▲	Δ	Δ	Δ	9
Human	▲	▲	Δ	Δ	▲	▲	Δ	Δ	Δ	9
Technological	Δ	▲	Δ	Δ		Δ			Δ	6
Reputation		▲	Δ		Δ	Δ		Δ	Δ	6
Organisational	▲	▲	▲	Δ	▲	Δ			Δ	7
Skills	Δ			Δ	Δ	Δ		▲	Δ	6
Know-how	Δ		Δ			Δ		▲	▲	5
Tangible							▲	▲	▲	3
Intangible			▲				▲	▲		3
Positional	Δ					Δ		Δ	Δ	4
Cultural	Δ		Δ					▲	▲	4
System	Δ		Δ	▲		▲	Δ	▲	▲	7
Network								▲		1
Dynamic Capability								▲		1
Relational									▲	1
Contained				▲						1
Capabilities			Δ					Δ		2
Marketing						▲				1
Legal						▲		Δ	Δ	3
Operation						▲				1

▲ – Main category Δ — Sub category

Table 7.2: Selected resource classifications

Resources	Description
Physical resources	All the firm's assets with the physical form
Financial resources	The firm's borrowing capacity and its internal funds generation determine its resilience and capacity for investment
Human resources	Human available, expertise, skills and know-how which are capable by firm.
Technological resources	Technology that are advanced and may be high-tech so that competitors can not utilise easily
Organisational resources	Skills of groups as well as the organisational routines and interactions through co-ordinations
Reputation	the opinion that customers have about the company, or how much value or recognise, based on past events

7.2.3 Review and selection of evaluation criteria of critical resources

Resource-based view (RBV) theory does not consider all resources possessed by a company but focuses only on critical (strategic) resources, those that are the basis of the company's competitive advantage. Many authors have variously termed these critical (strategic) resources and proposed a number of evaluation criteria to test and identify these resources (e.g., Prahalad and Hamel, 1990; Grant, 1991; Barney, 1991; Mahoney and Pandian, 1992; Stalk et al., 1992; Peteraf, 1993; Amit and Shoemaker, 1993; Collis and Montgomery, 1995, Mills et al., 2003). A brief description of these different evaluation criteria to test and identify the critical resources is as follows:

Barney (1991) has identified that not all the company's resources hold the potential of sustainable competitive advantages. He defines strategic resources as those that can generate sustainable competitive advantages and proposes four indicators to identify the potential of resources to be a source of sustainable competitive advantage, and these are value, rareness, inimitability, and non-substitutability.

Grant (1991) points out that resources are the basis for maximising rents, and therefore the profitability, of a company. To evaluate the rent-earning potential of resources, Grant proposes two criteria: sustainability (sustaining competitive advantage over time) and appropriability (ability to appropriate the returns). He further divides sustainability into four characteristics which are important determinants for sustainable competitive advantage and these are durability, transparency, transferability, and replicability. Appropriability is divided into degree of control and clear ownership.

Amit and Shoemaker (1993) define strategic assets as resources that are difficult to trade and imitate, scarce, appropriable and specialised, to enable the

company to gain competitive advantage. They describe the desired attributes of strategic assets as complimentarity, scarcity, low tradeability, inimitability, limited substitutability, appropriability, durability, and overlap with strategic industry factors.

Black and Boal (1994) define strategic resources as a network of relationship of resources (assets) needed to create sustainable competitive advantage. To identify these strategic system resources, Black and Boal propose five strategic dimensions, namely tradeability, acquisition, network (scarcity and inimitability), substitutability, and cogency (complementarity, durability and appropriability).

Collis and Montgomery (1995) discuss that valuable resources cannot be evaluated in isolation from the market as their values are determined in the interplay with market forces. For a valuable resource to qualify as the basis for competitive advantage, it must pass a number of external market tests of its value. They propose the tests of inimitability, durability, appropriability, substitutability, and competitive superiority for the evaluation of valuable resources.

Fahy and Smithee (1999) review various conditions and characteristics of advantage-generating resources and conclude that they can be considered under the headings of value, barriers to duplication and appropriability.

Lewis (2003) identifies that certain resources can be classified as strategic resources if they are scarce, have restricted mobility, and are difficult or impossible to imitate or substitute. He therefore proposes to use the constructs of scarcity, imperfect mobility, and imperfect imitation/substitution to identify strategic resources.

Mills et al. (2003) suggest three metrics to evaluate and identify strategic resources - those that are more important and potentially strategic, from the

ordinary resources. The three metrics with their sub-criteria are value (importance, tradability and rarity), sustainability (substitutability, imitability and durability), and mobility (versatility and replicability).

Bowman (2006) defines critical resources as strategic assets and adopts the argument that these strategic assets need to be valuable, rare, inimitable and non-substitutable. These strategic assets must be significantly valuable and rare to differentiate from entry assets as well as inimitable and non-substitutable by other competitors so that they cannot be replicated and produced by other means. Bowman uses these four criteria to test and identify resources that are strategic assets.

The review of the various evaluation criteria for critical resources by the many authors are summarised and shown in Table 7.3. After evaluation of the number of occurrences for each of the evaluation criteria and consideration for ease of understanding and use by the practitioners of SMEs, the selected set of evaluation criteria to be included in the pilot SSCP methodology is shown in Table 7.4.

7.2.4 Review of capability identification and evaluation

As mentioned in section 7.2.1, other than resource, another important value of the company is capability and together they are the foundation for the company's strategy and primary source of competitive advantage (Grant, 1991).

Grant (1991) describes capabilities of a company as what it can do as a result of teams of resources working together, and can be identified and appraised by the functional classification of activities in a company. A capability is an organisational routine or a number of interacting routines, and an organisation itself is a huge network of routines. Grant uses the same two criteria of

Table 7.3: Evaluation criteria of critical resources by different authors

Authors	Resource Evaluation Criteria
Barney (1991)	1. Valuable 2. Rareness 3. Inimitability 4. Non-substitutability
Grant (1991)	1. Sustainability - Durability, Transparency, Transferability, Replicability 2. Appropriability - Clear Ownership, Control
Amit and Shoemaker (1993)	1. Complementarity 2. Scarcity 3. Low tradeability 4. Inimitability 5. Limited Substitutability 6. Appropriability 7. Durability 8. Overlap with Strategic Industry Factors
Black and Boal (1994)	1. Tradeability 2. Acquisition 3. Network – Scarcity, Inimitability 4. Substitutability 5. Cogency – Complementarity, Durability, Appropriability
Collis and Montgomery (1995)	1. Inimitability 2. Durability 3. Appropriability 4. Substitutability 5. Competitive Superiority
Fahy and Smithee (1996)	1. Value 2. Barriers to duplication 3. Appropriability
Lewis (2003)	1. Scarcity 2. Imperfect Mobility 3. Imperfect Imitation/Substitution
Mill et al. (2003)	1. Value – Importance, Tradability, Rarity 2. Sustainability – Substitutability, Imitability, Durability 3. Mobility – Versatility, Replicability
Bowman (2006)	1. Valuable 2. Rare 3. Inimitable 4. Non-substitutable

Table 7.4: Selected evaluation criteria of critical resources

Evaluation Criteria	Description	Scale
Superiority	Evaluates if and to what extent the resource contributes to differentiating the company from its competitors	1 (Low value) <> 5 (High value)
Imitability	Analyses actual and potential competitors' difficulty in imitating the resource, e.g., its physical uniqueness, path dependency, casual ambiguity or economic deterrence	1 (Easy to acquire) <> 5 (Difficult to acquire)
Durability	Measures if the resource's benefits will also be generated in the long term	1 (Short life span) <> 5 (Long life span)
Substitutability	Assesses how difficult it is for competitors to replace the resource with an alternative that gives the same advantages	1 (Easy to replace) <> 5 (Difficult to replace)
Appropriability	Verifies if the company owning the resource is able to exploit the generated advantages generated in the market	1 (Lesser portion of market profit) <> 5 (Higher portion of market profit)

sustainability and appropriability for evaluating resources and capabilities. Amit and Shoemaker (1993) also identify capabilities as referring to a firm's capacity to deploy resources, usually in combination, using organisational processes, to affect a desired end.

Collis and Montgomery (1995), Marino (1996), and Fahy and Smithee (1999) have all described capabilities as rooted in the routines of organisations. Collis and Montgomery (1995) describe organisational capability as embedded in company's routines and processes. They propose the test of competitive superiority to assess which activities that a company does better than their competitors. Marino (1996) defines capabilities as rooted more in processes and business routines of a company and also proposes the same criteria to test the strengths to sort out core capabilities. Fahy and Smithee (1999) propose that capabilities encompass the skills of individuals or groups as well as the organisational routines and interactions through which all the firm's resources are coordinated.

Other authors have described capabilities of an organisation as comprising of a set of specific activities and they include Hooley et al. (1998), Lewis (2003), and Mills et al. (2003). Hooley et al. (1998) describe that organisational capabilities refer to the abilities of an enterprise to organise, manage, and coordinate specific set of activities (organisational activities), and are in general based on assets working together. They further divide capabilities into corporate, group and individual capabilities at the strategic, functional and operational levels. Lewis (2003) describes capabilities as processes and an organisation consists of a number of business processes, each of which will comprise of a number of activities. He further distinguishes between "structural" processes and "infrastructural" processes. Mills et al. (2003) define capability (competence) as an activity that a company carries out in the same way as Penrose (1959) uses the term service.

From this review of the various definitions of capability and their evaluations by the many authors, the pilot SSCP methodology adopts the definition of capability as organisational activities that are embedded in the company's routines and processes. For evaluation of capability, the test of competitive superiority is used to assess which activities that a company does better than its competitors.

7.3 DETERMINE THE STRUCTURE OF THE PILOT SSCP METHODOLOGY

This section sets out to establish the structure of the pilot SSCP methodology. From the testing carried out at phase 2, a number of developments and improvements needing changes to the structure of the selected methodology have been identified. Phase 2 (Section 6.6.3) has established that the structure of the methodology can be improved from that of a market-based approach to a competency approach using the RBV methods, which is not available in the current selected methodology. The methodology can also be simplified to cater for the SMEs as well as improved to cover other industry besides just for manufacturing.

The suggested changes to the structure of the selected methodology have been used for improvement aimed at forming a new structure for the pilot SSCP methodology. The selected methodology provided by Baines et al. (2005) is comprised of 5 stages that take the practitioner through a review of competitive market strategy; identifying key decision criteria; mapping the activity landscape; assessing the impact of making a change; and then consolidation of outcome (Section 5.4.2). This structure was changed based on the RBV methods to form the overall structure of the pilot SSCP methodology which now has 6 stages comprising of defining the scope issue; identifying the current activities and resources; selecting the significant activities and critical resources; reviewing the competitive strategy; examining the alignment of the performance and strategy; and finally formulating the strategy for actions to be taken. Table 7.5 illustrates

the main changes made to the structure and the titles of the various stages of the selected methodology to form the pilot SSCP methodology. With the structure of the pilot SSC methodology determined, the next section determines the content of the various stages.

7.4 DETERMINE THE CONTENT OF THE PILOT SSCP METHODOLOGY

The purpose of this section is to determine the content of the various stages in the pilot SSCP methodology. Phase 2 (Section 6.6.3) has established that stages 1, 2 and 3 of the selected methodology require further improvement. For stage 1, improvement to the content can be made on the key criteria for identification of competitive strategy, alignment of the desired competitive strategy with the problem scope/overriding issues and competitive performance gaps, and shifting of some of the contents to later stages. For stage 2, this can be removed since many participants have found this stage to be not relevant. Regarding stage 3, improvement can be made to introduce a more structured method and a visualisation technique to guide participants to map out the activities in the company.

These improvement changes were made and together with some of the strengths of stages 4 and 5 of the selected methodology (Section 6.6.1), they were incorporated into the content of stages 1 to 6 of the pilot SSCP methodology as shown in Table 7.6. In addition, leading RBV methods including resource definitions and classifications (Table 7.2 in Section 7.2.2), evaluation criteria of critical resources (Table 7.4 in Section 7.2.3), and identification and evaluation of capabilities (Section 7.2.4), were also incorporated in stages 2 and 3 to form the complete content of the pilot SSCP methodology.

Having established the structure and content of the pilot SSCP methodology, the next section describes the overview of the pilot SSCP methodology.

Table 7.5: Main changes to structure and titles of stages

Selected Methodology (Before)	Pilot SSCP Methodology (After)
Stage 1 - Scope issues	Stage 1 - Scope issues
Stage 2 -Identify key decision criteria	Stage 2 - Identify activity and resource landscape
Stage 3 -Identify activity landscape	Stage 3 - Identify significant activities and critical resources
Stage 4 – Assess impact	Stage 4 -Review competitive strategy
Stage 5 - Consolidate outcomes	Stage 5 - Check alignment between performance and strategy
	Stage 6 - Formulate strategy

Table 7.6: Main changes to contents of the individual stages

Stages of Selected Methodology	Main changes made to contents	Incorporated into the stages of the Pilot SSCP Methodology
Stage 1 – Scope issues	Problem scope/overriding issues	Stage 1 - Scope issues
Stage 3 – Identify activity landscape	Structured method and visualisation technique	Stage 2 - Identify activity and resource landscape
Stage 4 - Assess Impact		Stage 3 - Identify significant activities and critical resources
Stage 1 – Scope issues	Key criteria for identification of competitive strategy	Stage 4 – Review competitive strategy
Stage 1 – Scope issues	Alignment of competitive gaps to strategy	Stage 5 - Check alignment between performance and strategy
Stage 5 - Consolidate Outcomes		Stage 6 - Formulate strategy

7.5 OVERVIEW OF THE PILOT SSCP METHODOLOGY

A 6-stage practical pilot SSCP methodology has been developed as shown in Figure 7.2. A detailed description of the complete pilot SSCP methodology is presented in Appendix E. This section describes the overview of the pilot SSCP methodology which consists of the following 6 stages:

- Stage 1: Scope issues
- Stage 2: Identify activity and resource landscape
- Stage 3: Identify significant activities and critical resources
- Stage 4: Review competitive strategy
- Stage 5: Check alignment between performance and strategy
- Stage 6: Formulate strategy

Stage 1: Scope Issues

The first stage of the methodology is to understand the current situation of the organisation and to identify the boundary of the organisation to be analysed. This stage is implemented by first understanding the current situation of the organisation, identifying the products and services to be analysed so that a clear business area can be identified, and then highlighting some current over-riding issues and challenges. The output of this first stage of the methodology is an issues statement.

Stage 2: Identify Activity and Resource Landscape

The purpose of stage 2 is to produce an unfiltered landscape of activities and resources of the company that are involved in delivering the products and services identified in stage 1. Activity landscape is mapped according to the organisational processes which have the 4 interfaces to the supply chain such as suppliers, customers, product range and infrastructure. Resource landscape is then mapped according to the activity landscape. The outputs from this stage are the initial activity and resource landscape maps of the company.

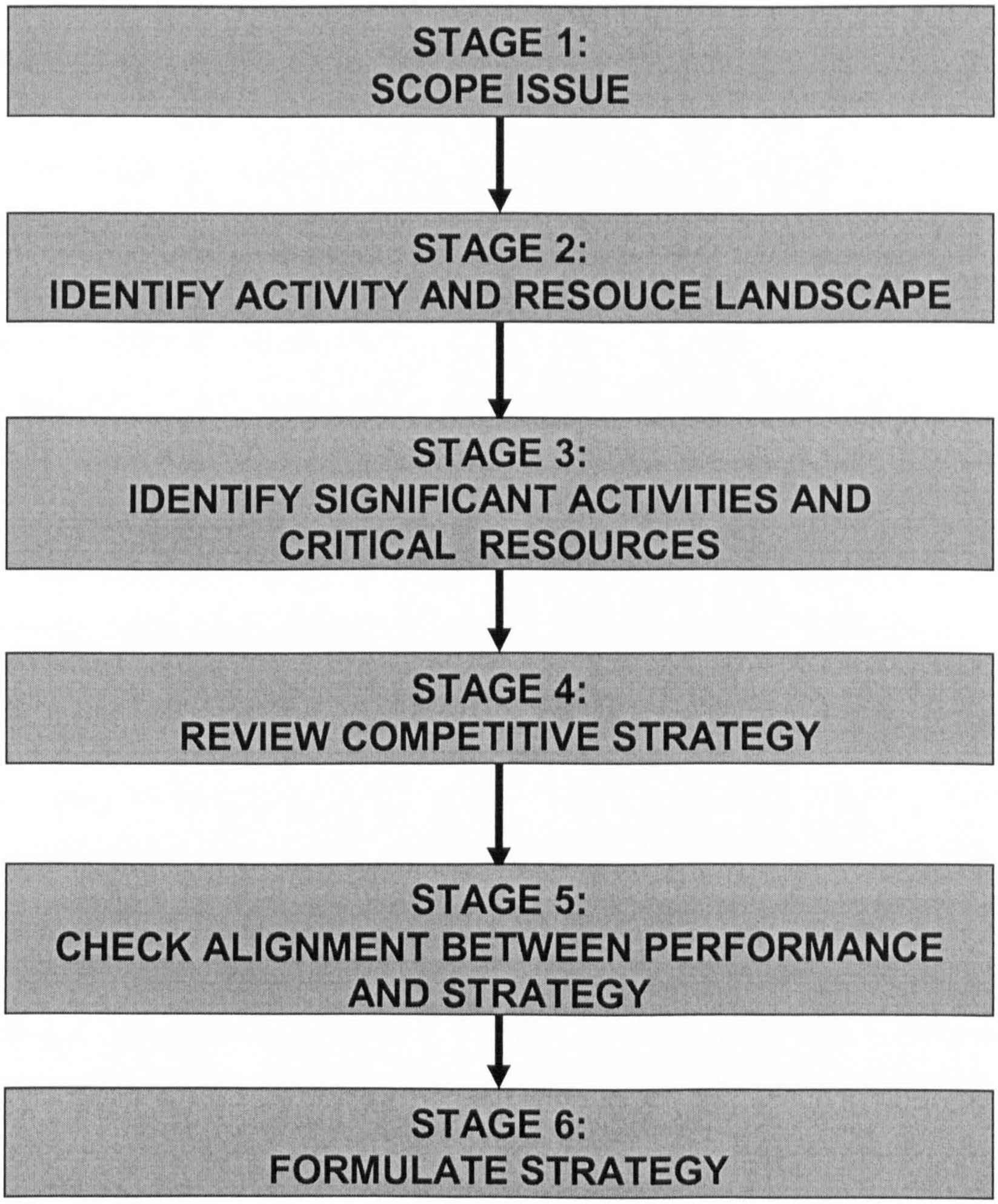


Figure 7.2: Pilot SSCP methodology

Stage 3: Identify Significant Activities and Critical Resources

The purpose of stage 3 is to identify and provide a landscape of significant activities and critical resources by evaluating the initial activity and resource maps identified from stage 2. These significant activities are those activities which are more important than others to the company. The critical resources are the core resources of the company underpinning the activities. The final output from this stage is a list of significant activities and critical resources of the company that can provide a sustainable competitive advantage for the company.

Stage 4: Review Competitive Strategy

The objective of stage 4 is to understand and confirm the company's current strategy and desired strategy in the future. This stage is also to analyse the current performance of the company as compared with customer requirements and competitor performance. The outputs of this stage are the current and desired competitive strategy as well as the competitive gap analysis.

Stage 5: Check Alignment between Performance and Strategy

The purpose of stage 5 is to check the alignment considering the current and desired strategy, significant activities, critical resources, and competitive gaps. From the alignment check, it can be observed whether the company's critical resources and activities can be used to enhance the competitive strategy to gain sustainable competitive advantage. Required changes can then be implemented to minimise the competitive gaps. The outputs for this stage are the alignment checks for significant activities/critical resources and strategy, and competitive gaps and strategy.

Stage 6: Formulate Strategy

The final stage of the methodology is to combine all the decisions agreed upon, and to analyse and propose the actions to be taken for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps. This stage provides a basis for validation and formulation of

the implementation plan. The final output from this stage is the summary of proposed actions.

7.6 CHAPTER SUMMARY

This chapter explained the process of forming the new pilot SSCP methodology. A six-stage pilot SSCP methodology was created by combining the strengths of the selected methodology and suggested changes for improvement, which included leading RBV methods. The selection of leading RBV methods covered resource definitions and classifications, evaluation criteria of critical resources, and identification of capabilities. An overview of the structure and content of the pilot SSCP methodology was provided, followed by a brief description of each of the six stages of the methodology. This pilot SSCP methodology is then further evaluated through testing in industrial case studies in the next chapter.

CHAPTER 8: EVALUATION OF PILOT SSCP METHODOLOGY

Since the pilot SSCP methodology has been developed in Chapter 7, this chapter will discuss further evaluation and testing of the pilot SSCP methodology in another 4 industry case studies. Evaluation of the pilot SSCP methodology is the focus of this chapter to achieve the objective of phase 4 of the research programme. Accordingly, the structure of this chapter is presented in these sections, namely: Section 8.1 describes the objective and method for realising this phase 4 of evaluation; an overview of the application of the methodology by the companies that used the methodology is presented in Section 8.2. The evaluation results are discussed in Section 8.3 and analysis and discussion of the results are highlighted in Section 8.4.

8.1 PHASE 4 OBJECTIVE AND METHOD

The objective of this phase 4 of the research programme is to evaluate the pilot SSCP methodology in 5 case studies from the industry. As established in Section 4.3.4, the evaluation of the methodology is to gain an in-depth understanding of how well the methodology works, and to determine whether the methodology is generic and robust to be used by SMEs in Singapore. To realise this objective, industry evaluation and testing is the main focus of this phase 4 of the research programme.

Section 4.3.4 also established that in this phase both the industrial cases as well as the role taken by the researcher need to change in the evaluation of the pilot SSCP methodology. This is to first demonstrate that the pilot SSCP methodology is not limited to just one set of companies and circumstances, and second to demonstrate that the methodology can be used independently of the researcher who developed the approach. According to Platts et al. (1998), if the researcher

who developed the methodology is also intimately involved in the facilitation, it poses the danger that the facilitator achieves success by means of process consultancy skills. It is therefore appropriate in this phase 4 to use facilitators who are new to the methodology so that the effect of assumed consultancy skills is minimised.

In contrast to phase 2 in Chapter 6, the appropriate research method chosen is a case study method without the researcher intervention. For the evaluation and testing of the methodology, students are used as facilitators and are allowed to use the methodology closely to reflect the long-term aim of the research, namely to allow the methodology to be used independently of the researcher. The role of the researcher at this phase is as an observer to the implementation of the case projects, and observes the development of the implementation of the methodology.

Apart from the different role of the researcher, the case study design is adopted from phase 2 which involves multiple cases with the framework and procedure based on Yin (1994) as illustrated in Figure 6.1 in Section 6.1. The data collection protocol is also adopted from phase 2, which involves defining the assessment criteria (feasibility, usability and usefulness), data collection framework (who, when and how to collect data), and data collection instruments (interview and observation). The assessment criteria, the data collection framework, and the data collection instruments used are as described in Sections 6.3.1, 6.3.2 and 6.3.3 respectively. A graphical illustration of the process is shown in Figure 8.1

There are therefore three parts to this phase 4 in the research, firstly, to discuss the selection of companies; secondly, to execute the case testing; and finally to present the results of the evaluation and testing.

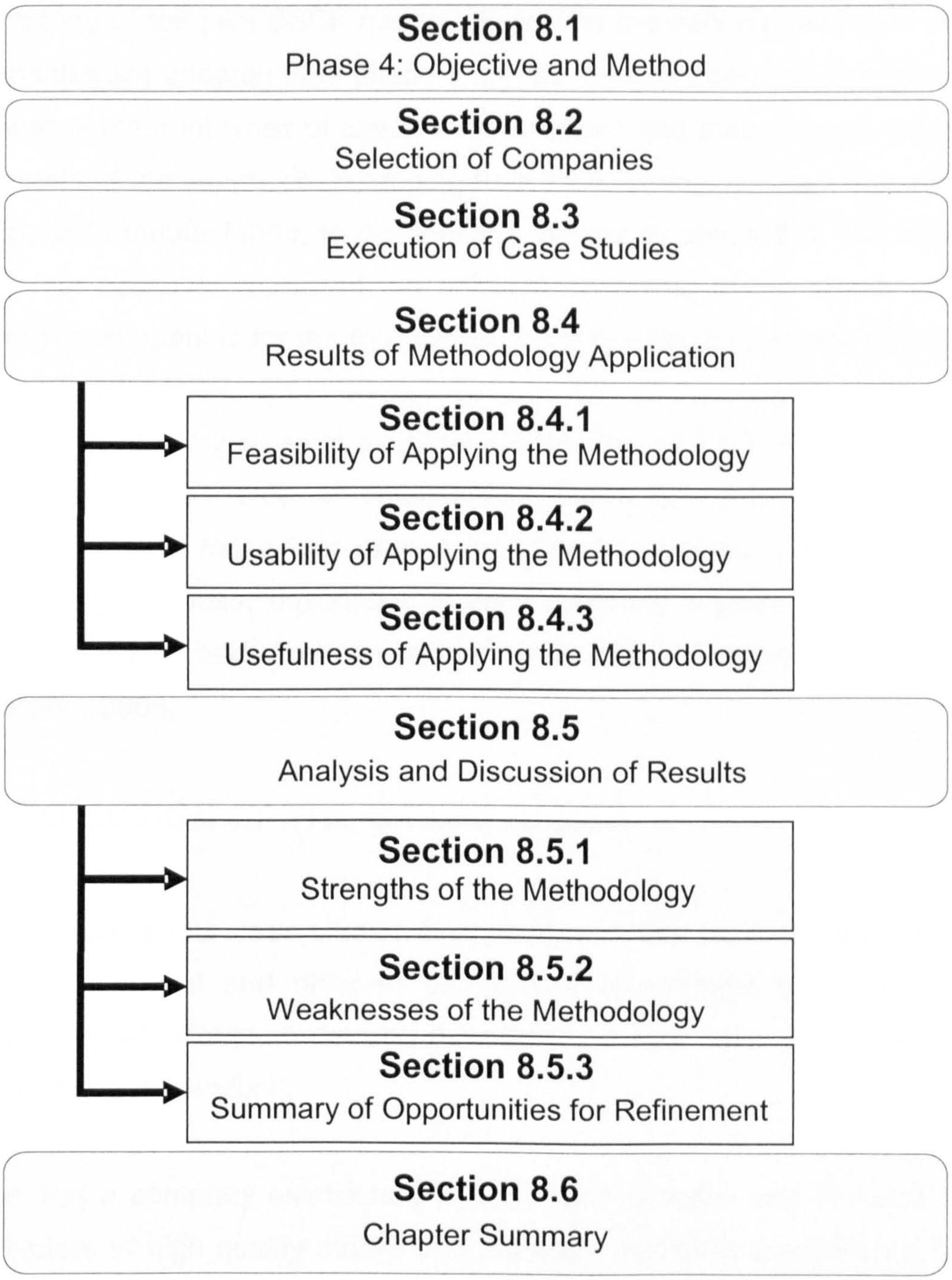


Figure 8.1: Method for evaluation of pilot SSCP methodology

8.2 SELECTION OF COMPANIES

This section sets out the selection of companies for test sites for the evaluation and testing of the pilot SSCP methodology. The pre-defined criteria for selecting companies are adopted from phase 2 and have been described in section 6.2. A number of different types of cases were identified and they covered the different segments of the supply chain ranging from PCB testing, contract manufacturing, equipment manufacturing, to distribution. Similar to phase 2, it was decided to have four cases to represent the different segments of the supply chain. To select the companies for the four cases, the three-stage approach from phase 2 was adopted. The four companies selected for the case studies were different from that of phase 2 so as to demonstrate that the pilot SSCP methodology was not limited to one type of organisation. Table 8.1 shows a profile of the characteristics of these four case companies for evaluation of the pilot SSCP methodology. A fuller description of each company is given in Section 8.3. All the preparation, tests and evaluation took place between July 2006 and December 2006.

8.3 EXECUTION OF THE CASE STUDIES

An overview of four case studies is presented in this section. Each case study provided a useful and different perspective of strategic positioning to gain competitive advantage. A detailed description of each case study application is set out in the Appendix F.

Case 5 is a company established in 1987, and is today one of Asia's leading distributors of high quality mobile and industrial hydraulic components. Besides the Singapore office and workshop, it has two other branches located in Malaysia and Thailand. The products are distributed to local and overseas customers in South East Asia region and are used in a wide range of industries, including construction, manufacturing and marine. The company aims to be the

Table 8.1: Profile of companies for evaluation of pilot SSCP methodology

	Case 5	Case 6	Case 7	Case 8
Size	>50	50-200	50-350	> 70
Ownership/ Industry segment	Local SME Distributor	Local SME Contract Manufacturer	Local SME Equipment Manufacturer	Local SME PCB Tester
Business/ Products	Distributor of high quality mobile and industrial hydraulic components.	Manufacturer of metal related accessories for oil and gas, aerospace and semiconductor industries	Design and manufacturing of CNC turning machines	Manufacture burn-in testing equipment and provide third-party semiconductor and burn-in testing services.
Access via	Sales Manager	Production Manager	Production Director	Vice President Testing
Participating team	Sales Workshop Warehouse/ Distribution	Sales QA/QC Production Purchasing	Sales Finance Engineering Production Warehousing & Delivery	Manufacturing Test Operations Logistics
Facilitator	1	1	1	1
Date of case project	July -Sept 2006	Aug – Oct 2006	Sept -Nov 2006	Oct - Dec 2006

leader in the customisation of hydraulics accessories for low volume pump and cylinder (repair and replacement), and is continuously improving in the area of customisation in order to gain broader market share and meet the demand of customers. Case 5 also plans to have localised operations in every South East Asian country by providing a complete source of high quality and great value customised fluid power products, so as to expand in tandem with the fast growing regional markets.

The application of the methodology began with Stage 1 where the project members, noting that Case 5 is a small company, have identified the whole company as the business area for review. The over-riding challenge was identified by project members for Case 5 to become the leader in the customisation of hydraulics accessories. Although the current operation caters fully for the customisation of products, Case 5 still needs to continuously improve in the area of customisation in order to meet the increasing demand of customers and to gain a larger market share. For Stage 2, the project members have identified six company level activities and these include: suppliers, branches, warehouse and distribution, accounting and administration, workshop, and sales. From these company level activities, the related process activities were then identified. After mapping the initial activities of the company, the initial resource map was developed based on the resource category of physical, financial, human, technological, organisational, and reputation. In Stage 3, the project members have identified significant activities as purchasing, machining, welding, distribution, QC/assembly, sales and marketing, forecasting, order processing, and quotation. Critical resources identified include network with suppliers, organisational culture, logistic network relationship with logistic company, dealer network, expertise in end products, knowledge of market demand, leadership skill, network with customers, alignment within company, relationship with supervisors and strong team work.

In Stage 4, the current competitive strategy was assessed to be Customer

Intimacy and so was their desired competitive strategy as the company needs to focus on service and product customisation in order to gain customer satisfaction from all their customers. According to the competitive gaps analysis, the company exceeded their competitors in the area of service customisation and product price. However the company lagged behind competitors and in fulfilling customer requirement in the area of product availability, time to market and new product introduction rate. For Stage 5, the current significant activities and critical resources were identified to align and support the current competitive strategy of Customer Intimacy as well as Operational Excellence. The current competitive gaps between the company and customers and competitors performance were critical and improvement were needed in the area of Operational Excellence. Further improvement in Customer Intimacy would also be needed.

For the final Stage 6, the project members brainstormed and proposed the actions to be carried out for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps. Summarising the results, Case 5, as a distributor, found that their current and desired strategies are mainly concerned with Customer Intimacy and their performance exceeded their competitors. Their significant activities such as sales and marketing, order processing and etc. are also very aligned to Customer Intimacy, with other supporting activities like distribution, machining and QA/QC assembly aligning to Operational Excellence. Their critical resources are mainly human and organisational resources where they have vast experiences and essential knowledge, while their physical and technological resources have no advantages over others.

Case 6 is one of the contract manufacturing companies operating in the metal industry, supplying various kinds of metal accessories for different customers. The company is now manufacturing various kinds of metal sheets by the operations of drilling, milling, grinding, shaping, and coating, so as to fulfill the requirements of the customers. Case 6's main target market is the oil and gas

industry providing metal accessories to its customer with hundred percent satisfactions by applying on-time delivery with the introduction of full quality and reliable products. Case 6 is currently facing the problem of on-time delivery where only 65% of work done have been delivered on time. In addition, as a contract manufacturing company, their two main customers make up 80% of all their orders which is risky for the company if these orders were to terminate.

In Stage 1 the project members have decided to apply the methodology to cover the whole company. For the over-riding challenge faced by Case 6, firstly they are facing the problem of on-time delivery whereby only 65% of work done have been delivered on time. This has been attributed to the loosely coupled network of front-end customer sites with the back-end production sites. Furthermore, as a contract manufacturing company, their two main customers make up 80% of all their orders, which is risky for the company if these orders were to terminate. The company, therefore, wants to reduce relying on the 2 main customers by pursuing new customers to approximately equal the order percentage. For Stage 2, the project members have identified six company level activities and they are suppliers, purchasing, production, QA/QC, sales and customer support. From these company level activities, the related process activities were then identified as well as the initial resource map developed based on the resource category of physical, financial, human, technological, organisational, and reputation. In Stage 3, the project members have identified the significant activities as purchasing, CAD/CAM, machining, CMM and manual check, planning, processing and sales. Critical resources identified include shop floor & plant, payments to suppliers, investment for machines, tools, building and plants, programming and designing skills and experiences, know-how in Oil & Gas industry, QA/QC experiences, skills in precision engineering, network within & outside of firm, and products quality.

In Stage 4, the current competitive strategy was assessed to be Operational Excellence and so was their desired competitive. According to the competitive

gaps analysis, the company matched the customer requirement in the area of Operational Excellence and exceeded the competitors in product availability, product price, and quality conformance. However, the company is lagging behind the customer requirement in the area of customer Intimacy, such as product customisation and after sales support. For Stage 5, the project members have identified the significant activities of purchasing, CAD/CAM, machining, processing, planning and CMM & manual check and their related critical resources as supporting Operational Excellence. The other significant activity of sales and critical resources were supporting Customer Intimacy. The current competitive gaps between the company and customers and competitors performance were critical and improvement were needed in the area of Operational Excellence. Further improvement in Customer Intimacy would also be needed.

For the final Stage 6, the project members brainstormed and proposed the actions to be carried out for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps. Summarising the results, Case 6 found that most of the critical resources are from the machining department, which means that they have better ability in machining to produce good quality products. They also have robust programs for CNC machining in CAD/CAM for their main clients so that lead time is reduced noticeably. Case 6 has strong financial resources as compared to their competitors and they can invest in new projects which are risky, costly and doubtful of success, but they are being carried out for the good of the clients. As a result, strong relationship with customers are developed and long term partnership created, which is very difficult for their competitors to imitate.

Case 7 is a machine tool maker with a regional support network. The 2 manufacturing facilities in Singapore and China manufacture CNC turning machines with high performance that meet the high standards of machine quality. By producing machines close to the market, case 7 understands the

needs of the customers and can provide the best after sales services and support in the region. However, due to the dynamic nature of the market and changing demands from the customers, the company is facing keen competitions in the areas of R&D of new machines and providing customer satisfaction.

In Stage 1 the project members have identified the CNC turning machine business area to apply the methodology. For the over-riding challenge, the project members have identified that the company is firstly facing customer related problems in which the company is unable to fully fulfill and support the customer requirements. Secondly, the R&D centre is located in Singapore and in order to access a wider market region as well as to gain the trust of customers, the R&D should move closer to the customers in order to gain a better and deeper understanding of the needs of the customers. For Stage 2, the project members have identified four company level activities and they are warehousing & delivery, engineering, production, and sales. From these company level activities, the related process activities were then identified as well as the initial resource map developed based on the resource category of physical, financial, human, technological, organisational, and reputation. In Stage 3, the project members have identified the significant activities as ASRS, customise software, turning & milling, machine assembly, fabrication, negotiation and order processing, maintenance and turnkey handling. Critical resources identified include AS 400 system, simulation and control software system, advanced turning/milling/ robotic technology, satellite order processing system, customer database system, experienced employee, real-time satellite maintenance software system, processing machines, and training oriented environment.

In Stage 4, the current competitive strategy was assessed to be Operational Excellence In the future, Case 7 would like to tackle some of the customer related problems such as the inability to fully fulfil and support the customer requirements and the need to upgrade the manufacturing and sales resources to

increase market share and make higher profit. Clearly the desired competitive strategy of the company is Operational Excellence, supported closely by Customer Intimacy. According to the competitive gaps analysis, the company currently exceeded the customer requirement and competitors in product availability and quality conformance. However, the company is lagging behind the customer requirement and competitors in product price, service customisation and after sales support. For Stage 5, the project members have identified the significant activities of ASRS, customise software, turning & milling, machine assembly, fabrication and their related critical resources as supporting Operational Excellence. The other significant activities of negotiation and order processing, maintenance and turnkey handling and critical resources were supporting Customer Intimacy. The current competitive gaps between the company and customers and competitors performance were critical and improvement were needed in the area of Operational Excellence and Customer Intimacy.

For the final Stage 6, actions were proposed to be carried out for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps. Summarising the results, Case 7 found that most of the critical resources are from the production, sales, warehouse and engineering departments, and the activities and resources in these departments need to be strengthened and to grow. Case 7 has the challenge of product price and fully fulfilling and supporting the customer requirements in terms of service customisation and after-sales support. To overcome these challenges, Case 7 needs to keep, strengthen, and grow significant activities like turning, milling, machine assembly, fabrication, sales negotiation, maintenance and turnkey handling. Similarly they also need to invest and upgrade these related critical resources. As a result, customers' requirements can then be met, strong relationship with customers and long term partnership created, and product price can also be reduced, making Case 7 very competitive and difficult for their competitors to imitate.

Case 8 is a local SME company that provides third-party semiconductor and burn-in testing services, and also manufactures burn-in testing equipment used in the testing of wafers, devices and other electrical components. These testing services will enable semiconductor devices and other electronic components to meet the requirements of aerospace, industrial and commercial applications. Case 8 has 2 subsidiaries located in Singapore and China. Case 8's strong commitment to research and development has enabled the company to advance as one of the regional burn-in system manufacturers with very impressive results. It also provides high quality products and services that fulfill the price and quality requirements of the customers.

The application of the methodology began with Stage 1 where the project members have selected the burn-In board driver product as the business area for review since it is one of the main products which generates high profit margin for the company. For the over-riding challenge faced by Case 6, the business is currently facing the problem of losing customers as there are many competitors arising in the semiconductor industry. With the opening of new markets in China, India and other South East Asian countries with lower labour cost, there are many competitors arising and the company is losing customers due to their higher product and service costs. For Stage 2, the project members have identified six company level activities and they comprise of logistics, finance, manufacturing, quality assurance, testing operations, and sales & marketing. From these company level activities, the related process activities were then identified as well as the initial resource map developed based on the resource category of physical, financial, human, technological, organisational, and reputation. In Stage 3, the project members have identified the significant activities as purchasing, delivery, designing & price calculation, board assembly, and engineering test operations. Critical resources identified include skilful engineers and technicians, low cost and flexible recruitments of contract operators, accurate way of testing, and reputation for quality assurance and reliable product delivery.

In Stage 4, the current competitive strategy was assessed to be Operational Excellence as the company currently offers high quality product at the best price. In the future the company would like to focus on tackling the problem of losing customers due to their higher product and service costs, and inability to provide and meet 100% support services for customers. Clearly the desired competitive strategy of the company was assessed to be also Operational Excellence, supported by closely by Customer Intimacy. According to the competitive gaps analysis, Case 8 was found to currently match and exceed the customer requirement and competitors in operational excellence on product availability and quality conformance, and in customer intimacy on service and product customisation. However, the company is lagging behind the customer requirement and competitors in product price and after sales support. For Stage 5, the project members have identified all the significant activities of purchasing, delivery, designing & price calculation, board assembly, and engineering test operations and their related critical resources as supporting Operational Excellence. The current competitive gaps between the company and customers and competitors performance were critical and improvements were needed in the area of Operational Excellence and Customer Intimacy.

For the final Stage 6, the project members brainstormed and proposed the actions to be carried out for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps. Summarising the results, Case 8 found that most of the critical resources are from the logistics, manufacturing and test operations departments, and the activities and resources in these departments need to be strengthened and need to grow. It can be seen that Case 8 has the challenge of product price and fully fulfilling and supporting the customer requirements in terms of after-sales support. To overcome these challenges, Case 8 needs to keep, strengthen, and grow these significant activities like purchasing, delivery, designing & price calculation, board assembly, and engineering test operations. Similarly they also need to invest and upgrade these related critical resources.

Having given an overview of the applications, the analyses of the cases are presented.

8.4 RESULTS OF METHODOLOGY APPLICATION

This section presents the results of testing the methodology to the four cases based on the post completion questionnaire and facilitator observation addressing the evaluation criteria of feasibility, usability, and usefulness. Following the completion of the test case, both quantitative and qualitative analysis were carried out. The 5-point scale rating of the quantitative questions followed that of Section 6.5. A detailed post assessment result of the quantitative analysis for the facilitator and participants for each case study is set out in Appendix G. These results are now discussed in the following sections.

8.4.1 Feasibility of applying the methodology

The feasibility criteria were intended to establish that the methodology can be followed. The four companies followed the methodology and the scores made by the participants regarding the feasibility test during the post completion questionnaire are summarised in Table 8.2. From the table, it demonstrates that the methodology is feasible as the average of the scores from the four cases is 81.4%.

From Appendix G, the facilitators' perceptions of the methodology were very good in Cases 5 and 6 while good in Cases 7 and 8. For participants, most of them felt that the overall structure of the methodology proved feasible and did work for their companies. This can be seen clearly as two participants in Case 5 responded to the four questions on feasibility and rated the methodology as 82.5%, four participants in Case 6 scored 80.0%, five participants in Case 7 rated 82.0% and three participants in Case 8 scored 81.7%.

8.4.2 Usability of applying the methodology

The usability criterion was intended to prove how easily the methodology could be applied and followed. The measure of usability was also tested post completion at this phase and both quantitative and description statements from both facilitators and participants are sought.

From Appendix G, the facilitators' perceptions of the methodology were good in Cases 5 and 7 while average in Cases 6 and 8. For the participants, their scores made regarding the usability test during the post completion questionnaire were summarised as shown in Table 8.3. Based on the nine quantitative questions, participants rated the usability of the methodology as 64.4% in Case 5, 63.9% in Case 6, 65.3% in Case 7, 59.3% in Case 8. The average scores of the four companies for usability of the methodology was rated as 63.2%. Most participants felt that stages 2 and 3 of the methodology were too time consuming in identifying the different activities and resources as well as in the evaluation of significant activities and critical resources of the company.

8.4.3 Usefulness of applying the methodology

The usefulness criterion was intended to prove that the methodology can provide a useful output that meet expections. From Appendix G, all indications from the facilitators for measure of usefulness of the methodology pointed that the methodology was perceived to be good in all the cases. From the participants' perspective, the overall feedback from the post questionnaire on the usefulness of the methodology was 81.0% as shown in Table 8.4. For the six questions asked, two participants scored 85% in Case 5, four participants rated it 80.8% in Case 6, five participants answered 79.3% in Case 7, three participants rated it 78.9% in Case 8. Many of the participants have indicated that the overall process has been very successful and well worth doing, contributing to their

Table 8.2: Feasibility results of applying the pilot SSCP methodology

	FEASIBILITY			
	Case 5	**Case 6**	**Case 7**	**Case 8**
R: Respondents	Average of 2R	Average of 4R	Average Of 5R	Average of 3R
Q.1 Completeness	4.5	4.5	4.2	4.3
Q.2 Consistency	4.0	4.0	4.2	3.7
Q.3 Applicability	4.5	3.8	4.2	4.7
Q.4 Contingency	3.5	3.8	3.8	3.7
RESULTS	82.5%	80.0%	82%	81.7%
	81.4%			

Table 8.3: Usability results of applying the pilot SSCP methodology

	USABILITY			
	Case 5	**Case 6**	**Case 7**	**Case 8**
R: Respondents	Average of 2R	Average of 4R	Average of 5R	Average of 3R
Q.6 Time	2.0	2.0	2.0	2.0
Q.7 Ease of Use	2.0	2.0	2.2	2.0
Q.8 Understanding	2.5	2.5	2.4	2.3
Q.9 Robustness	4.0	2.5	3.0	2.7
Q.10 Issues	3.0	3.5	3.2	2.7
Q.11 Preparation	3.0	3.8	4.2	3.7
Q.12 Participation	4.0	4.0	4.2	4.0
Q.13 Case study	4.0	4.3	4.2	3.7
Q.14 Consultation	4.5	4.3	4.0	3.7
RESULTS	64.4%	63.9%	65.3%	59.3%
	63.2%			

Table 8.4: Usefulness results of applying the pilot SSCP methodology

	USEFULNESS			
	Case 5	**Case 6**	**Case 7**	**Case 8**
R: Respondents	Average of 2R	Average of 4R	Average of 5R	Average of 3R
Q.23 Successful	5.0	4.8	4.2	4.3
Q.24 Effectiveness	5.0	4.3	4.4	3.7
Q.25 Contribution	3.5	3.8	3.6	3.7
Q.26 Influence	3.5	3.8	3.6	3.7
Q.27 Efficiency	3.5	3.8	4.0	3.7
Q.28 Usefulness	5.0	4.0	4.0	4.7
RESULTS	85.0%	80.8%	79.3%	78.9%
	81.0%			

strategic positioning and providing a new strategic direction for the long-term plan of the organisation.

8.5 ANALYSIS AND DISCUSSION OF RESULTS

The objective of this section is to use the results from testing of the methodology to analyse the strengths and weaknesses of the methodology, and to find opportunities for further refinement.

8.5.1 Strengths of the methodology

From the results of the four case studies, it was observed that there are quite a number of strengths in the decision process of the methodology. First, as a whole, the methodology is very comprehensive and systematic comprising of six stages which can be followed in its entirely in applying to the case studies. The sequence of the stages is uniquely consistent and makes sense in delivering the final result. The methodology is well suited for small and medium enterprises (SMEs) and many of the participants have indicated that the overall process has been very successful and well worth doing. It contributes to their strategic positioning, pointing out both the strengths - significant activities and critical resources, and weaknesses of the company. The result also provides a new strategic direction for the long-term plan of the organisation to achieve sustainable competitive advantage by focusing on the firm's internal core activities and resources. The methodology provides a window to enable management to see the different views of the company from their own internal view of activities and resources, to the external market view of current and desired strategy, which are not available in most other methodologies. Finally the methodology is able to conclude the actions to be taken, based on the significant activities and critical resources of the company, to identify its competitive space to respond to the gaps and opportunities in the market.

Secondly, each of the stages also has their own unique strength, namely:

- **Stage 1** provides a useful guide to understand the current situation of the company, to identify the products and services to be analysed so as to set the boundary for the project, and to highlight some over-riding issues and challenges for strategic positioning.
- **Stage 2** provides a generic and visual approach in identifying the activities of the company from the four interfaces of the company with the supply chain. It also provides a table of resource classification with six categories of resources - physical, financial, human, technological, organisational and reputation resources, to guide in identifying the resources underpinning the activities.
- **Stage 3** provides the decision criteria for the evaluation and identification of significant activities and critical resources. In the evaluation of critical resources, a table with five criteria – superiority, imitability, durability, substitutability, appropriability, is provided together with description and measurement scale to help guide in evaluating which resources are critical to the company.
- **Stage 4** provides a useful set of key criteria in the form of worksheets to help companies identify their competitive strategy, be it operational excellence, product leadership or customer intimacy. It also provides a table to identify the competitive gaps with customers and competitors.
- **Stage 5** provides the alignment checks for significant activities/critical resources and strategy, and competitive gaps and strategy. This is to guide in checking the alignment of the current and desired strategy, significant activities, critical resources, and competitive gaps. It can then be observed whether the company's critical resources and significant activities can be used to enhance the competitive strategy to gain sustainable competitive advantage for the company.
- **Stage 6** provides a useful method to combine all the decisions agreed upon and produce an output of summary of proposed actions based on

the significant activities and critical resources of the company to identify a competitive space to achieve the desired strategy and minimise the competitive gaps.

8.5.2 Weaknesses of the methodology

In the previous section, the strengths of the methodology were discussed. This section discusses the weaknesses of the methodology. First, on the overall, the methodology was time consuming, especially during stages 2 and 3, in identifying the activities and the different categories of resources underpinning each of the activities as well as in the evaluation of significant activities and critical resources of the company. Most participants commented that the steps for these stages should be automated, especially regarding the task of repeating the resources identified from stage 2 to stage 3 for evaluation, which was very tedious and time consuming.

Besides the weaknesses of the methodology as a whole, some other weaknesses occurred at the various stages within the methodology itself, namely:

Stage 2:

For stage 2, the feedbacks obtained from participants have indicated that understanding and identifying the different resource types - physical, financial, human, technological, organisational and reputation resources, for each process activity was initially difficult and needed close guidance by the facilitators, especially in identifying intangible resources. As a result of this, filling the worksheet for the different resources underpinning each process activity became time consuming and tedious.

Stage 3:

For stage 3, the feedbacks obtained have suggested that most participants found this stage to be the most time consuming part of the methodology. This was due to the fact that this is the stage that evaluates and identifies the significant activities and critical resources of the company. To start the process of evaluation of significant activities and critical resources, most participants felt that it was tedious and very time consuming to have to repeat the activities and resources identified in stage 2 into this stage 3. They would prefer this task to be automated.

Secondly, for resource evaluation, participants initially found it difficult to understand the meaning of the five criteria of superiority, imitability, durability, substitutability, appropriability, and again needed close guidance by the facilitators. This was especially so for appropriability, which most participants found difficult to understand and apply practically.

Stage 6:

For stage 6, the main weakness found by most participants was on the action analysis for both the significant activities and critical resources. The current method of action analysis was simple and did not consider the competitive gaps for customers and competitors together. Actions were formulated based on these independent comparisons of competitive gaps, which resulted in very different actions recommended. Furthermore, the current action statements for activity (e.g. grow, strengthen and etc) and resource (e.g. upgrade, invest, and etc) were simple and generic. Most participants suggested that a more detail action analysis to consider a combination of both these competitive gaps is needed in order to have a clearer vision to formulate the actions to be taken. The current method also did not consider the actions to be taken for activities and resources which are not significant and critical.

Secondly, some participants found that the current method for action analysis focused only on the existing industry that the company was doing business in. They suggested that a method to guide company to leverage on their current resources and change, shift, or expand to other segments or different industries should be introduced.

8.5.3 Summary of opportunities for refinement

The opportunities to improve the methodology can be derived from the analysis of the strengths and weaknesses outlined in the above sub-sections. The opportunities to improve the methodology further basically fall into two categories, namely:

1. *Overall structure of the methodology* – On the overall, the methodology can be improved by automating it as a computerised software tool. This is necessary to remove the tedious and time consuming process of having to repeat the various activities and resources identified in stage 2 to the other stages for evaluation of significant activities and critical resources.

2. *Individual stages* - For the individual stages, as discussed earlier, stages 2, 3 and 6 require further improvement. For stage 2, improvement can be made to the table of resource classification to better guide participants in understanding and identifying resources. For stage 3, a computerised software tool as suggested earlier would eliminate the need of repeating the activities and resources from stage 2. In addition, improvement can be made to the table of evaluation criteria for critical resources to simplify the criteria and remove those not necessary. For stage 6, the action analysis for both the significant activities and critical resources need to be improved to consider a combination of the two competitive gaps, as well as activities and resources which are not significant and critical. Further improvement is also needed to consider leveraging on

current resources and change, shift, or expand to other segments or different industries.

8.6 CHAPTER SUMMARY

This chapter has addressed the fourth objective of the research programme, namely, to evaluate the pilot SSCP methodology in case studies from the industry. This is to gain an in-depth understanding of how well the methodology works, and to determine whether the methodology is generic and robust to be used by SMEs in Singapore. The results gained have indicated a number of improvements necessary to the pilot SSCP methodology, and these form the basis of the work in the following chapter.

- include automating the methodology as a computerised software tool to remove the tedious and time consuming task of repeating the activities and resources (Section 8.5.3); 2. Individual stages – include improvement on the table of resource classification in stage 2, computerising the repeat of activities and resources and improving the table of evaluation criteria in stage 3, and for stage 6, to improve on the, the action analysis for both the significant activities and critical resources as well as further improvement to cater for expansion to different segments and industries (Section 8.5.3).

Having outlined the refinements needed, the following sections are to determine the structure of the methodology (Section 9.2), determine the content of the methodology (Section 9.3), and finally to describe an overview of the final SSCP methodology (Section 9.4). This approach is graphically illustrated in Figure 9.1 and this chapter sets out to execute this approach in the following sections.

9.2 DETERMINE THE STRUCTURE OF THE FINAL SSCP METHODOLOGY

This section sets out to establish the structure of the final SSCP methodology. Phase 4 (Section 8.5.3) has established that the structure of the methodology can be improved by automating it as a computerised software tool. This is necessary to remove the repeat of activities and resources from one stage to another. The current pilot SSCP methodology is a manual process and therefore considerable effort was needed to repeat the activities and resources from one stage to another, thus making the process of applying the methodology very tedious and time consuming.

The structure of the final SSCP methodology is still based on the six stages as before. The suggested improvement to automate the final SSCP methodology into a computerised software tool was made to link the six stages together. The next section determines the content of the final SSCP methodology.

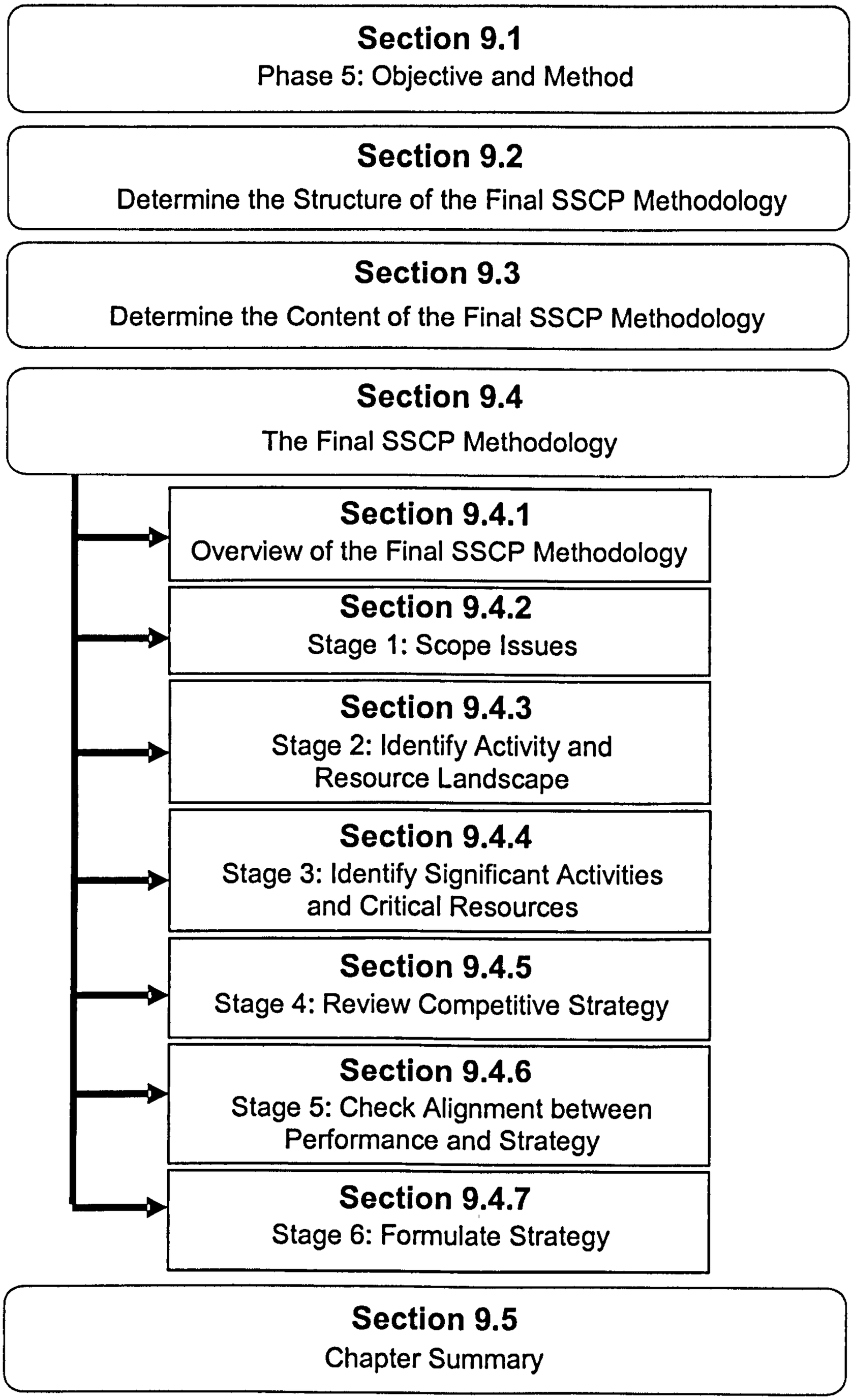


Figure 9.1: Development of the final SSCP Methodology

9.3 DETERMINE THE CONTENT OF THE FINAL SSCP METHODOLOGY

The purpose of this section is to determine the content of the various stages in the final SSCP methodology. Phase 4 (Section 8.5.3) has established that individual stages 2, 3 and 6 of the pilot methodology require further improvement. For stage 2, improvement can be made to the table of resource classification to better guide participants in understanding and identifying resources. For stage 3, a computerised software tool as suggested earlier would eliminate the need of repeating the activities and resources from stage 2. In addition, improvement can be made to the table of evaluation criteria for critical resources to simplify the criteria and remove those not necessary. For stage 6, the action analysis for both the significant activities and critical resources need to be improved to consider a combination of the two competitive gaps, as well as activities and resources which are not significant and critical. Further improvement is also needed to consider leveraging on current resources and change, shift, or expand to other segments or different industries.

These improvement changes were made and together they were incorporated into the content of stages 1 to 6 of the final SSCP methodology. These changes made are summarised and shown in Table 9.1. For stage 2, a new table of resource classifications was created with a new column giving examples of the various types of resources under each resource category as shown in Table 9.2. For stage 3, a new table of evaluation criteria for critical resources was created with four simplified criteria as shown in Table 9.3. For stage 6, a new table (shown in Table 9.4), a competitive gaps impact matrix (shown in Figure 9.2) and two worksheets were created to propose action for both the significant activities and critical resources to consider a combination of the two competitive gaps, as well as activities and resources which are not significant and critical. In addition, a new industry/segment opportunity matrix (shown in Figure 9.3) was created to

Table 9.1: Main changes to content of the methodology

Stages of the Methodology	Changes made
Stage 1 - Scope issues	• No changes
Stage 2 – Identify activity and resource landscape	• A new table of resource classifications was created with a new column giving examples of the various types of resources under each resource category
Stage 3 – Identify significant activities and critical resources	• A new table of evaluation criteria for critical resources was created with four simplified criteria
Stage 4 – Review competitive strategy	• No changes
Stage 5 - Check alignment between performance and strategy	• No changes
Stage 6 - Formulate strategy	• A new table, a competitive gap matrix and two worksheets were created for the action analysis for both the significant activities and critical resources to consider a combination of the two competitive gaps, as well as activities and resources which are not significant and critical. • A new industry/segment matrix was created to provide leveraging on current resources and change, shift, or expand to other segments or different industries.

Table 9.2: A new table of resource classifications

Resources	Description	Examples
Physical resources	All the firm's assets with the physical form	Building, plant, machine, equipment, land, stocks,
Financial resources	The firm's borrowing capacity and its internal funds generation determine its resilience and capacity for investment	Finance for research, plant, sales and promotion, management development and etc.
Human resources	Human available, expertise, skills and know-how which are capable by firm.	Educational, technical, professional qualifications, skills, knowledge, know-how and experiences of employees, unskilled and skilled staffs.
Technological resources	Technology that are advanced and may be high-tech so that competitors can not utilise easily	Contracts, licenses, patents, trade marks, copyright, technologies,
Organisational resources	Skills of groups as well as the organisational routines and interactions through co-ordinations	Organisational culture, values, preferred behaviors and climate, system and procedure and management system. Internal relationships, interest groups within the company, networks with suppliers and customers
Reputation	the opinion that customers have about the company, or how much value or recognise, based on past events	Brand recognition, Brand equity (brand value) Percent of repeat buying, Objective measures of comparative, product performance, Surveys of corporate reputation

Table 9.3: A new table of evaluation criteria of critical resources

Evaluation Criteria	Description	Scale
Valuable	Evaluates if and to what extent the resource contributes to differentiating the company from its competitors	1 (Low value) <> 5 (High value)
Inimitable	Analyses actual and potential competitors' difficulty in imitating the resource, e.g., its physical uniqueness, path dependency, casual ambiguity or economic deterrence	1 (Easy to acquire) <> 5 (Difficult to acquire)
Durable	Measures if the resource's benefits will also be generated in the long term	1 (Short life span) <> 5 (Long life span)
Non-substitutable	Assesses how difficult it is for competitors to replace the resource with an alternative that gives the same advantages	1 (Easy to replace) <> 5 (Difficult to replace)

Table 9.4: A new table of competitive gaps impact

Customer Requirement Gap	Competitor Performance Gap	Impacts of Competitive Gaps
Lag	Lag	High threat
Exceed	Lag	Not good for long term
Lag	Exceed	Good opportunity
Exceed	Exceed	Best condition

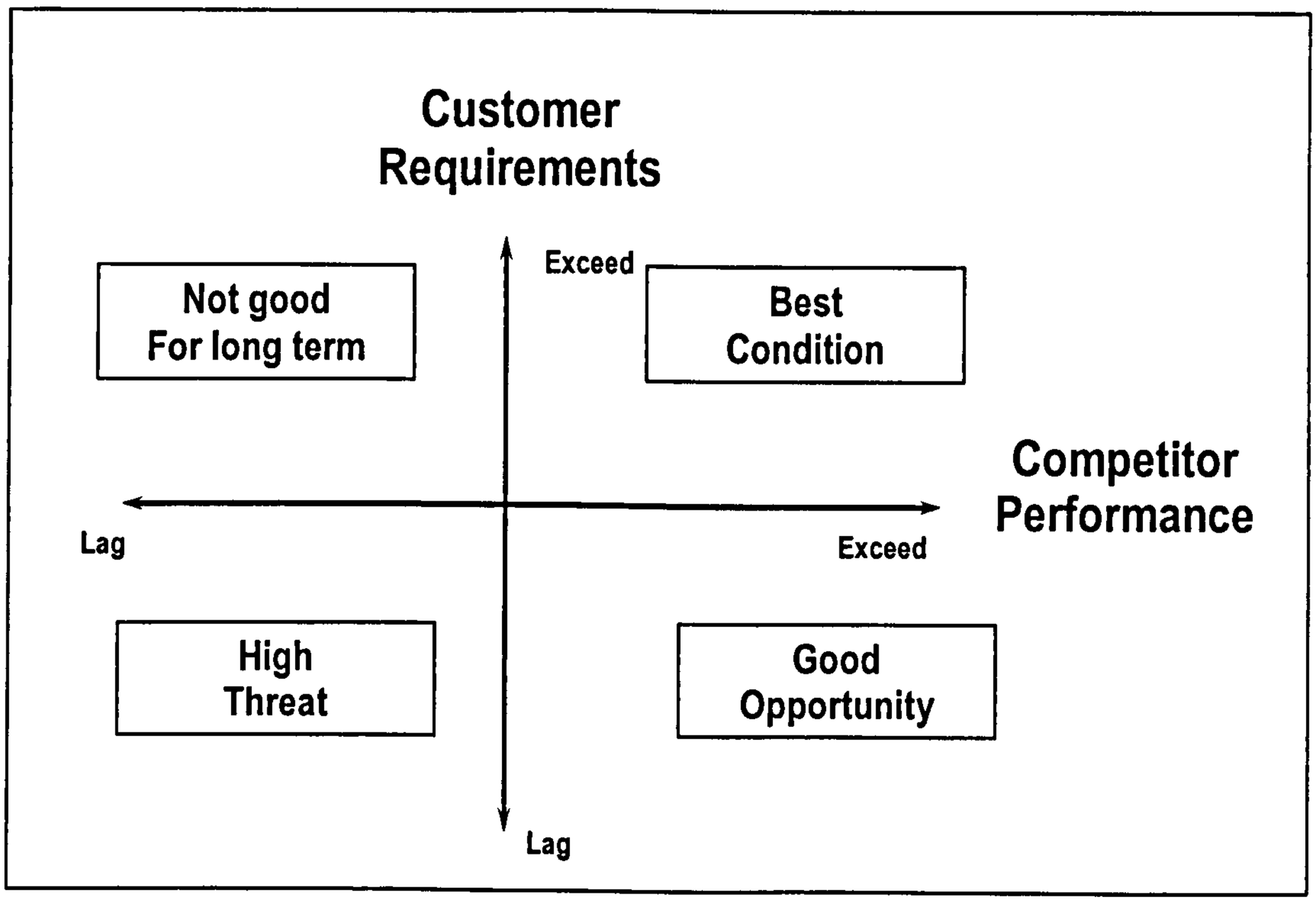


Figure 9.2: Competitive gaps impact matrix

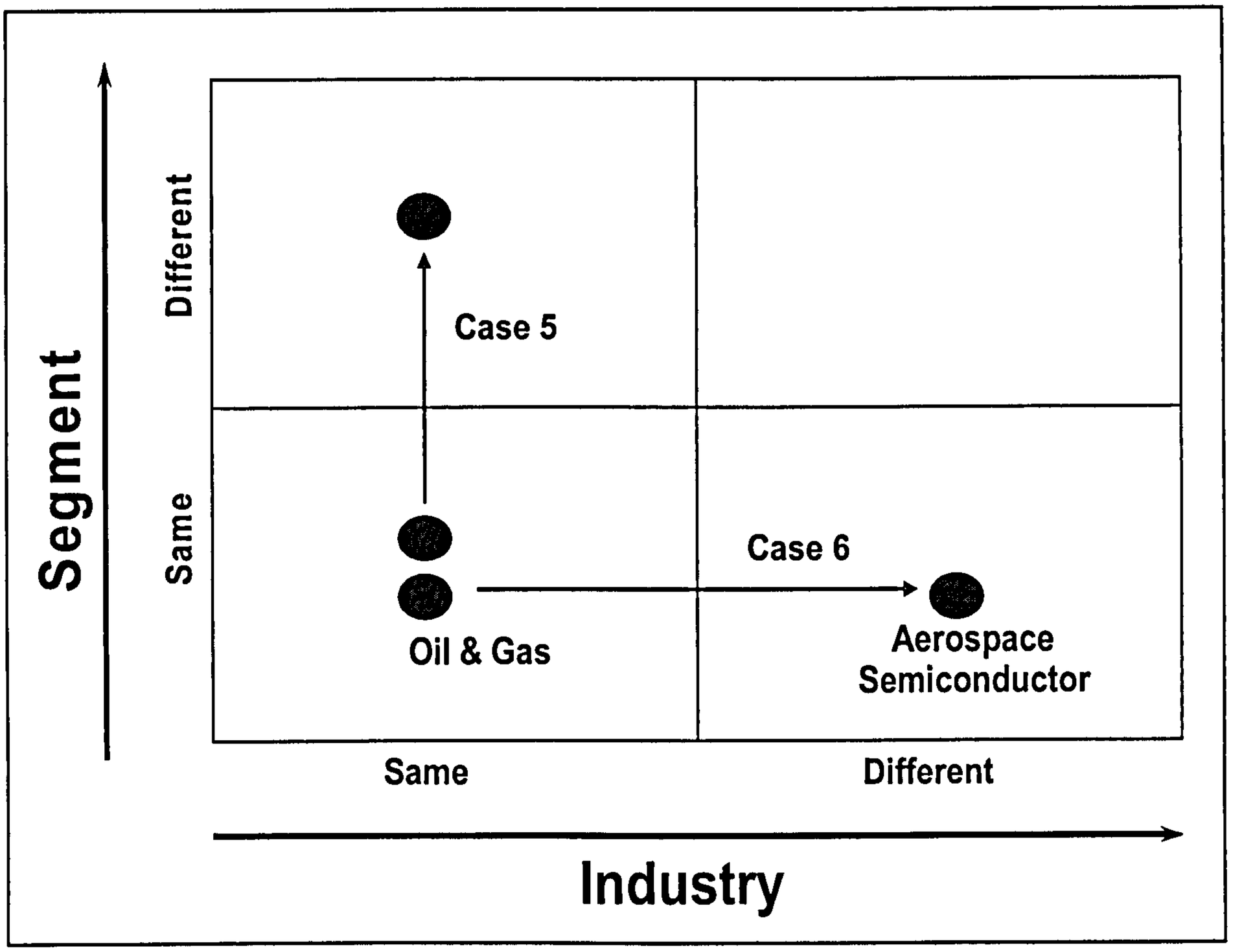


Figure 9.3: Industry/segment opportunity matrix

leverage on current resources to generate business opportunity and change, shift, or expand to other segments or different industries.

Having established the structure and content of the final SSCP methodology, the next section provides a detail description of the final SSCP methodology.

9.4 THE FINAL SSCP METHODOLOGY

A description of the final SSCP methodology is provided here to illustrate the overview structure, the content of the stages and associated steps, and their use when following the methodology. Details of the user interfaces for each of the stages and steps of the final SSCP methodology in the form of a computerised software tool are also shown.

9.4.1 Overview of the final SSCP methodology

This section gives an overview of the final SSCP methodology, the structure and its stages. As Figure 9.4 shows, the final SSCP methodology comprises of the following six stages that guides the actions and decisions of a SSCP team.

- Stage 1: Scope issues
- Stage 2: Identify activity and resource landscape
- Stage 3: Identify significant activities and critical resources
- Stage 4: Review competitive strategy
- Stage 5: Check alignment between performance and strategy
- Stage 6: Formulate strategy

The methodology starts from stage 1 on the scope issue to understand the current situation of the organisation and to identify the boundary of the organisation to be analysed. Stage 2 follows on the identification of the activity

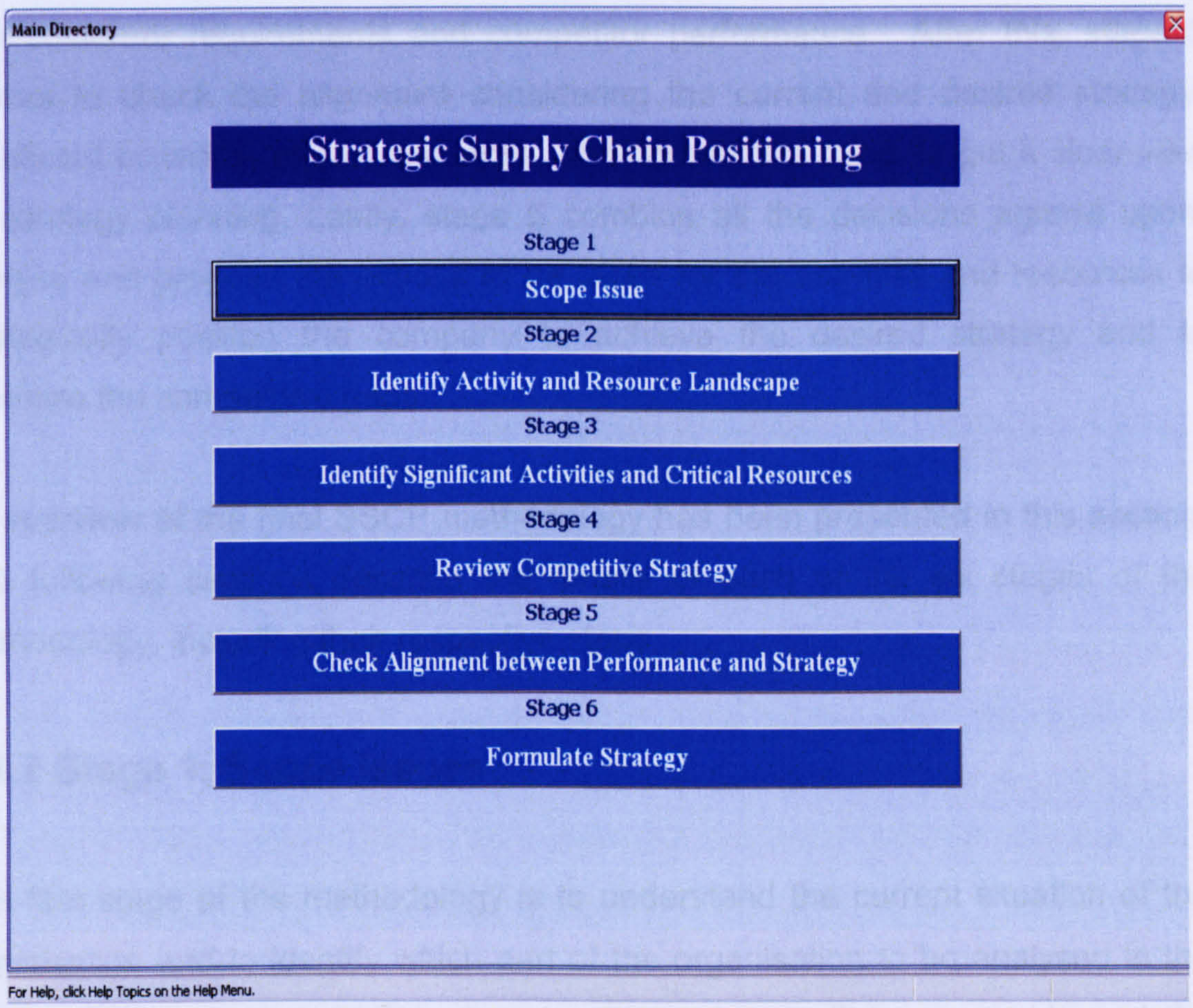


Figure 9.4: Final SSCP methodology

and resource landscape by mapping both the initial activity and resource maps. After mapping, stage 3 continues with the identification of significant activities and critical resources by evaluating the initial activity and resource maps. Next is stage 4 to understand and confirm the company's current strategy, desired strategy, and to assess the current performance of the company as compared with customer requirements and competitor performance. After this, stage 5 follows to check the alignment considering the current and desired strategy, significant activities, critical resources, and competitive gaps, to get a clear view for strategy planning. Lastly, stage 6 combine all the decisions agreed upon, analyse and propose the actions to be taken for the activities and resources to strategically position the company to achieve the desired strategy and to minimise the competitive gaps.

An overview of the final SSCP methodology has been presented in this section. The following sections describe the details of each of the six stages of the methodology, including their respective steps.

9.4.2 Stage 1: Scope Issues

The first stage of the methodology is to understand the current situation of the organisation and to identify which part of the organisation to be analysed in the project. This is necessary for otherwise the process will be very wide and the result will be general if it is applied to the entire company as there will be many departments, activities and resources to view at the same time. In addition, although the company size may be small enough to apply the methodology, the management team may sometime wants to focus on only certain concern particular activities or departments.

This stage requires the project team and senior management from the various departments that interact with the four interfaces of the supply chain, namely: suppliers, customers, infrastructure, and product range, to participate in the

project. Senior management should define the types of products and services to be analysed so that a clear business area can be identified. Moreover they should highlight some over-riding issues and challenges. The output of this first stage is to produce an issues statement that states which areas of the organisation to be analysed and some over-riding issues and challenges to be tackled in the project. Figure 9.5 shows the screenshots of the user interfaces for stage 1 from activating to recording the issues statement that specifies which part of the organisation is being considered and what are the over-riding challenges.

9.4.3 Stage 2: Identify Activity and Resource Landscape

After identifying and describing the scope issues, this stage 2 is to produce an unfiltered landscape of all related activities and resources of the company that are involved in delivering the products and services identified. Activity landscape is mapped according to the organisational processes which have the 4 interfaces to the supply chain such as suppliers, customers, product range and infrastructure. Resource landscape is then mapped according to the activity landscape. The outputs from this stage are the initial activity and resource landscape maps of the company. The user interfaces for stage 2 are shown in Figure 9.6. To realise this stage 2 of the methodology, the following two steps are carried out:

Step 2.1: Identify Initial Activity Map **-** The objective of step 2.1 is to identify all the related activities within the company which have the 4 interfaces with the supply chain, namely: suppliers, customers, infrastructure and product range. Mapping all activities is crucial and no filtering should be carried out. When considering or identifying activities, it is important that they are considered and identified at the appropriate level which are neither broad nor narrow. Therefore, a worksheet using the swim-lane and process activity block approach is provided to guide the project members to visually map out all the activities in blocks, which

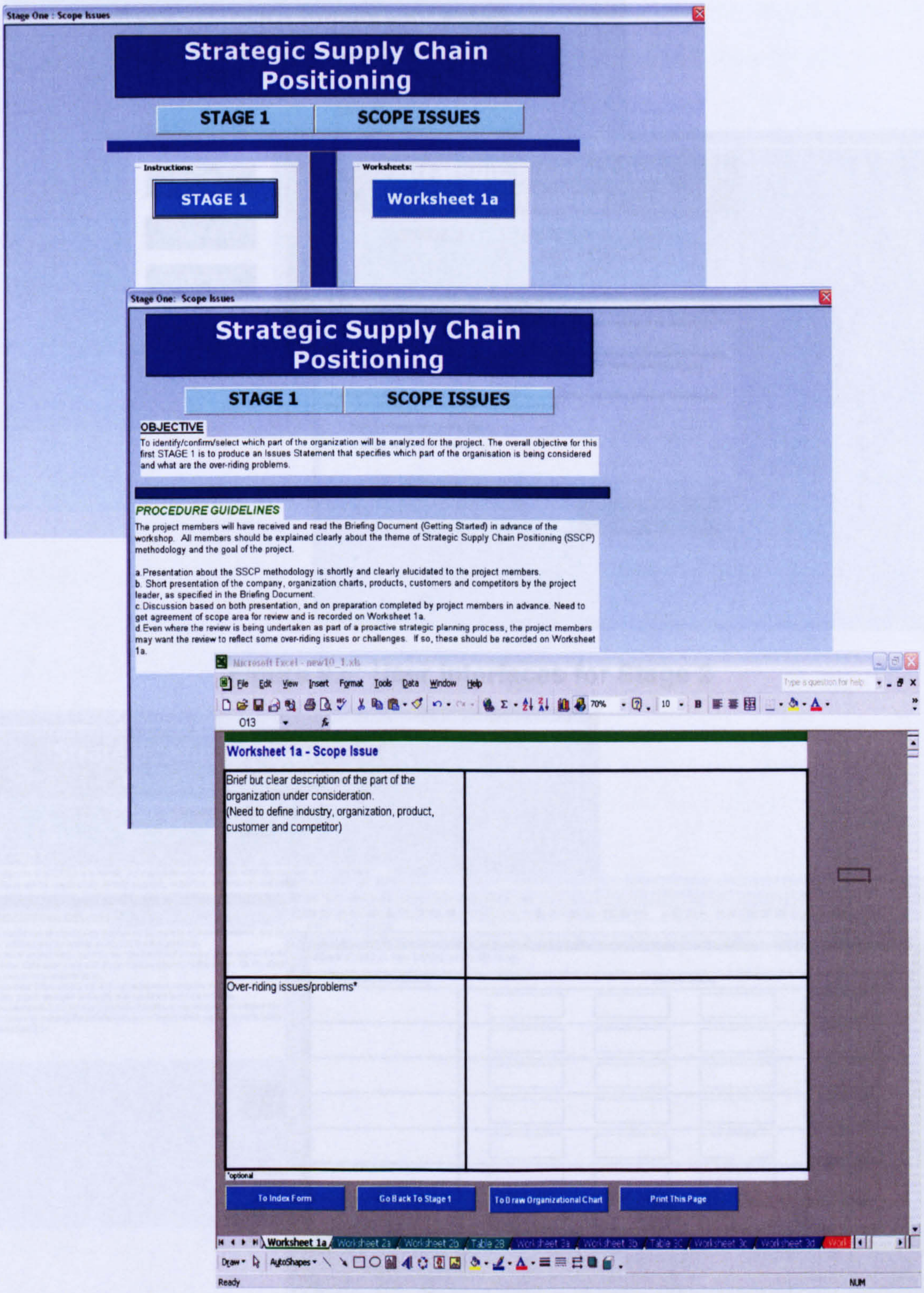


Figure 9.5: User interfaces for Stage 1

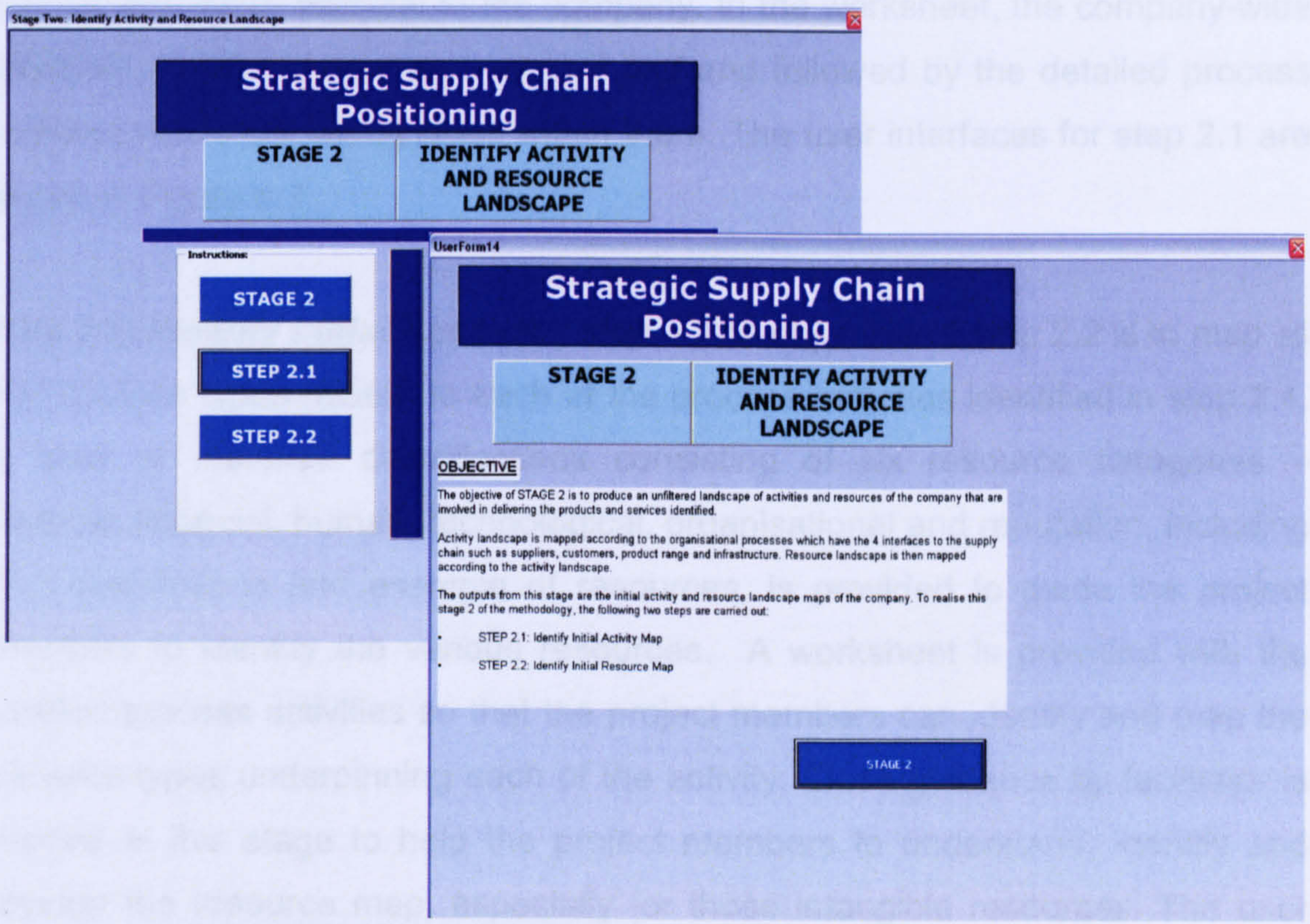


Figure 9.6: User interfaces for Stage 2

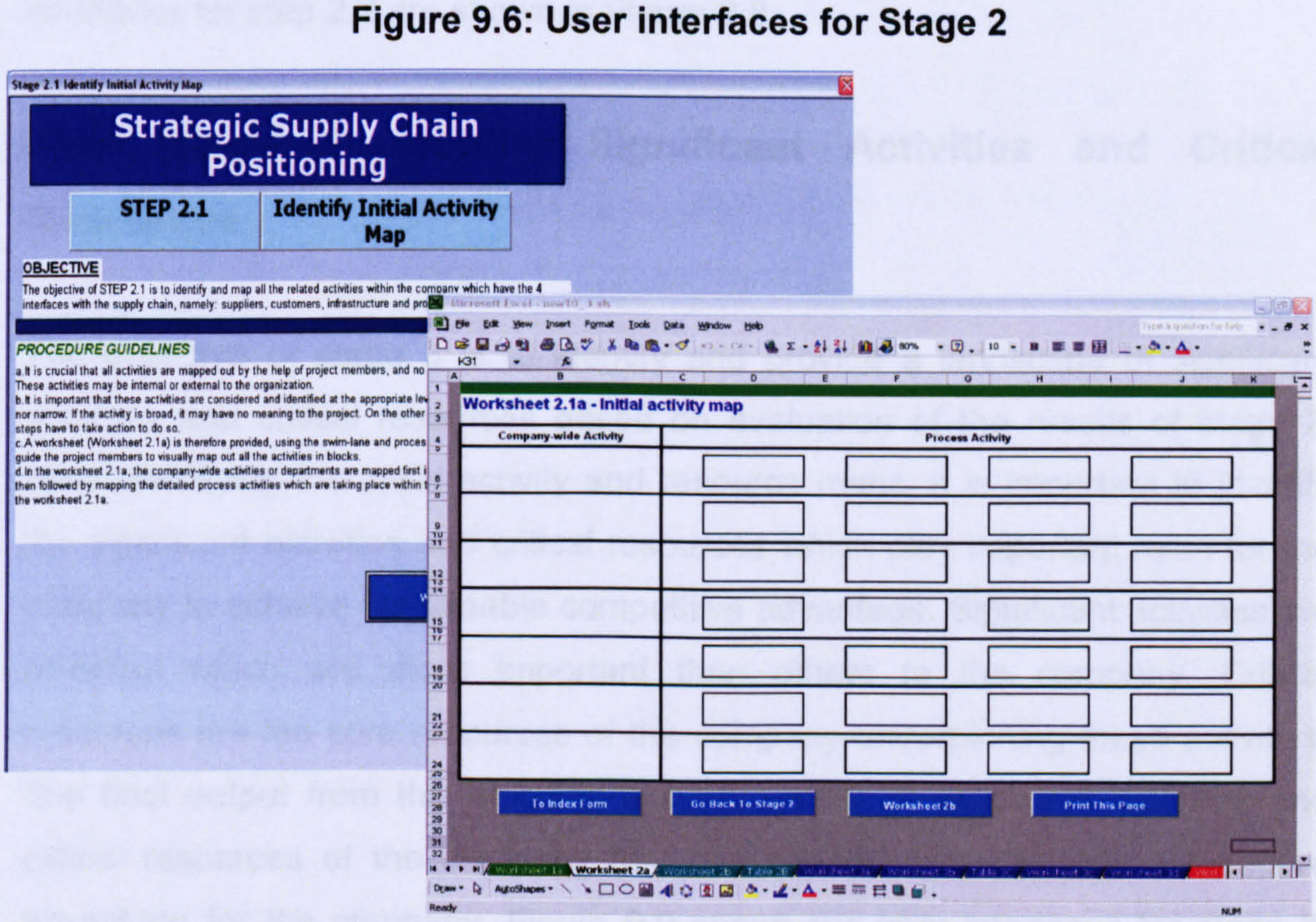


Figure 9.7: User interfaces for Step 2.1

may be internal or external to the company. In the worksheet, the company-wide activities or departments are mapped first and followed by the detailed process activities which are taking place within them. The user interfaces for step 2.1 are shown in Figure 9.7.

Step 2.2: Identify Initial Resource Map – The objective of step 2.2 is to map all the resource types related to each of the process activities identified in step 2.1. A table of resource classifications consisting of six resource categories – physical, financial, human, technological, organisational and reputation, including their descriptions and example of resources, is provided to guide the project members to identify the various resources. A worksheet is provided with the detailed process activities so that the project members can identify and map the resource types underpinning each of the activity. Close guidance by facilitator is needed at this stage to help the project members to understand, identify and develop the resource map, especially for those intangible resources. The user interfaces for step 2.2 are shown in Figure 9.8.

9.4.4 Stage 3: Identify Significant Activities and Critical Resources

The objective of stage 3 is to identify and provide a landscape of significant activities and critical resources based on evaluation of the results of stage 2. After identifying the initial activity and resource maps, it is important to identify the significant activities and critical resources which play important roles for the company to achieve sustainable competitive advantage. Significant activities are activities which are more important then others to the company. Critical resources are the core resources of the company underpinning these activities. The final output from this stage is a summary list of significant activities and critical resources of the company that can provide a sustainable competitive advantage for the company. Figure 9.9 shows the user interfaces for stage 3. This stage 3 of the methodology is executed in the following 2 steps:

Stage 2.2 Identify Initial Resource Map

Strategic Supply Chain Positioning

STEP 2.2 | **Identify Initial Resource Map**

OBJECTIVE

The objective of STEP 2.2 is to identify and map all the resources that are related to each of the activities within the company that have been mapped in STEP 2.1.

PROCEDURE GUIDELINES

a.A table of resource classifications (Table 2.2a) consisting of six resource categories – physical, financial, human, technological, organisational and reputation, including their descriptions and example of resources, is provided to guide the project members to identify the various resources.
b.It is important to clearly explain the descriptions of these resource categories to all project members. Care must be taken in explaining intangible resources which are difficult to clarify.
c.A worksheet (Worksheet 2.2a) is provided for the project members to record the detailed process activities identified in STEP 2.1 and map the related resource types underpinning each of these activities.
d.Close guidance by facilitator is needed at this stage to help the project members to understand, identify and develop the resource map, especially for those intangible resources.

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Table 2.2a - Resources Classification

Resources	Description	Examples
Physical resources	It constrains the firm's set of production possibilities and impacts its cost position.	Building, plant, machine, equipment, land, stocks, more or less anything with a physical form
Financial resources	The firm's borrowing capacity and its internal funds generation determine its resilience and capacity for investment	$ for research, plant, sales and promotion, management development and etc.
Human resources	Education, training and experiences of employees determine the skills available to the firm. The adaptability of employees contributes to the strategic flexibility of the firm. The social and collaborative skills of employees determine the capacity of the firm to transform human resources into organizational capabilities. The commitment and loyalty of employees deter mine the capacity of the firm to attain and maintain competitive advantage	Educational , technical, professional qualifications, skills, knowledge, know-how and experiences of employees.
Technological resources	IP: patent portfolio, copyright, trade secrets Resources for innovation: research facilities, technical and scientific	Number and significance of patents Revenue from licensing patents and copyrights R & D staff as a percent of total employment Number and location of research facilities Contracts, licenses, patents, trade marks, copyright
Organizational resources	System and procedural – a wide range of documented resources from recruitment and selection systems to performance measurement and reward systems, order process systems etc.	Organizational culture, values, preferred behaviours and climate, system and procedure and management system. Internal relationships, interest groups within the company, networks with suppliers and customers.
Reputation	Reputation with customers through the ownership of brands and Established relationships with customers; The reputation of the firm's products and services for quality and The reputation with suppliers (including component suppliers, banks and financiers, employees and government agencies, and with the	Brand recognition Brand equity (brand value) Percent of repeat buying Objective measures of comparative product performance Surveys of corporate reputation

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Worksheet 2.2a - Initial resource mapping

	Resources					
Process Activity	Physical	Financial	Human	Technological	Organizational	Reputation

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Table 2B
Print This Page

	Resources					
Process Activity	Physical	Financial	Human	Technological	Organizational	Reputation

Opportunity Matrix | Competitive gaps | Organizational Chart | Worksheet 2a | Worksheet 2b | Table 2B

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Figure 9.8: User interfaces for Step 2.2

Step 3.1: **Identify Significant Activities -** The objective of step 3.1 is to identify the significant activities from the initial activity map identified in step 2.1. A worksheet with all the initial activities identified earlier is provided for the project members to brainstorm, evaluate, and identify the significant activities, based on their current and future importance to the company. This stage has proposed to limit the maximum number of significant activities identified to 10. The user interfaces for step 3.1 are shown in Figure 9.10.

Step 3.2: Identify Critical Resources – The objective of step 3.2 is to identify the critical resources from the initial resource map identified in step 2.2. A table of evaluation criteria for critical resources consisting of four criteria – valuable, inimitable, durable, and non substitutable, including their descriptions and measurement scales, is provided to guide the project members to evaluate and identify critical resources. A worksheet with the detailed resource types identified earlier is provided for the project members to brainstorm, evaluate, and identify the critical resources, based on the four evaluation criteria. Similar to step 3.1, close guidance by facilitator is needed at this stage to help the project members to understand the evaluation criteria and measurement scale, so as to identify critical resources. The user interfaces for step 3.2 are shown in Figure 9.11.

9.4.5 Stage 4: Review Competitive Strategy

The objective of stage 4 is to firstly understand and confirm the company's current strategy and subsequently the desired strategy for the future. By analysing current and desired strategy, project members can have clear ideas of the required actions to be taken to meet the strategy. Secondly, this stage also assesses the competitive gaps between the company performance and customer requirements and competitor performance. The outputs of this stage are the current and desired competitive strategy as well as the competitive gap



Figure 9.9: User interfaces for Stage 3



Figure 9.10: User interfaces for Step 3.1

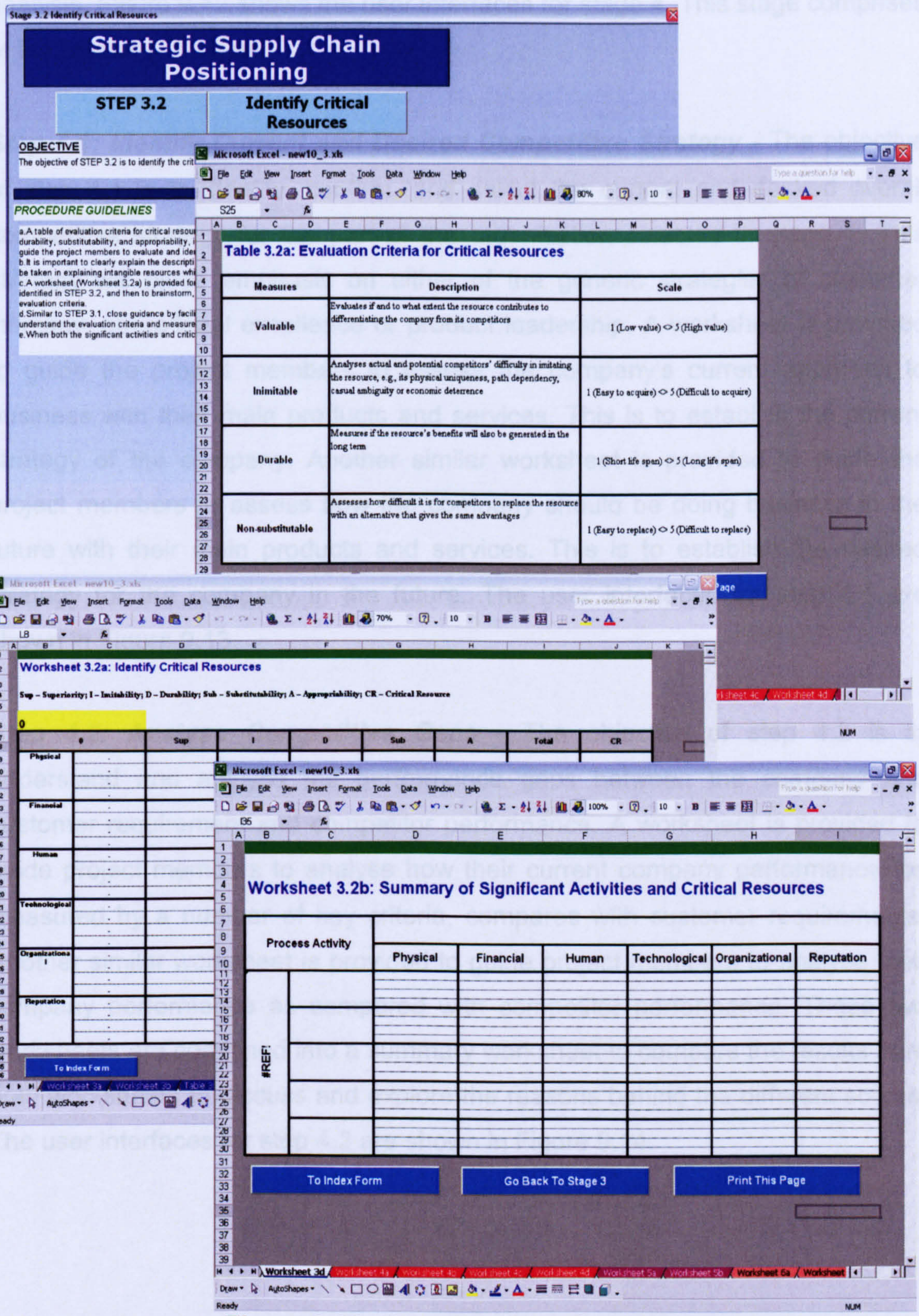


Figure 9.11: User interfaces for Step 3.2

analysis. Figure 9.12 shows the user interfaces for stage 4. This stage comprises of the following 2 steps:

Step 4.1: Identify Current and Desired Competitive Strategy **-** The objective of step 4.1 is to identify, confirm, and select the current and desired overall competitive strategy for the part of the organisation selected in stage 1. This strategy will place emphasis on either of the generic strategies of customer intimacy, operational excellence or product leadership. A worksheet is provided to guide the project members to assess the company's current approach to business with their main products and services. This is to establish the current strategy of the company. Another similar worksheet is provided to guide the project members to assess how the company should be doing business in the future with their main products and services. This is to establish the desired strategy for the company in the future. The user interfaces for step 4.1 are shown in Figure 9.13.

Step 4.2: Analyse Competitive Gaps **-** The objective of step 4.2 is to understand and analyse the performance gaps between the company and customer requirement and competitor performance. A worksheet is provided to guide project members to analyse how their current company performance, as measured by a number of key criteria, compares with customer requirements. Another similar worksheet is provided to guide project members to analyse their company performance as compared with competitor performance. These two worksheets are combined into a summary worksheet to compare the results from both worksheets to discuss and explore the reasons behind the different scores. The user interfaces for step 4.2 are shown in Figure 9.14.

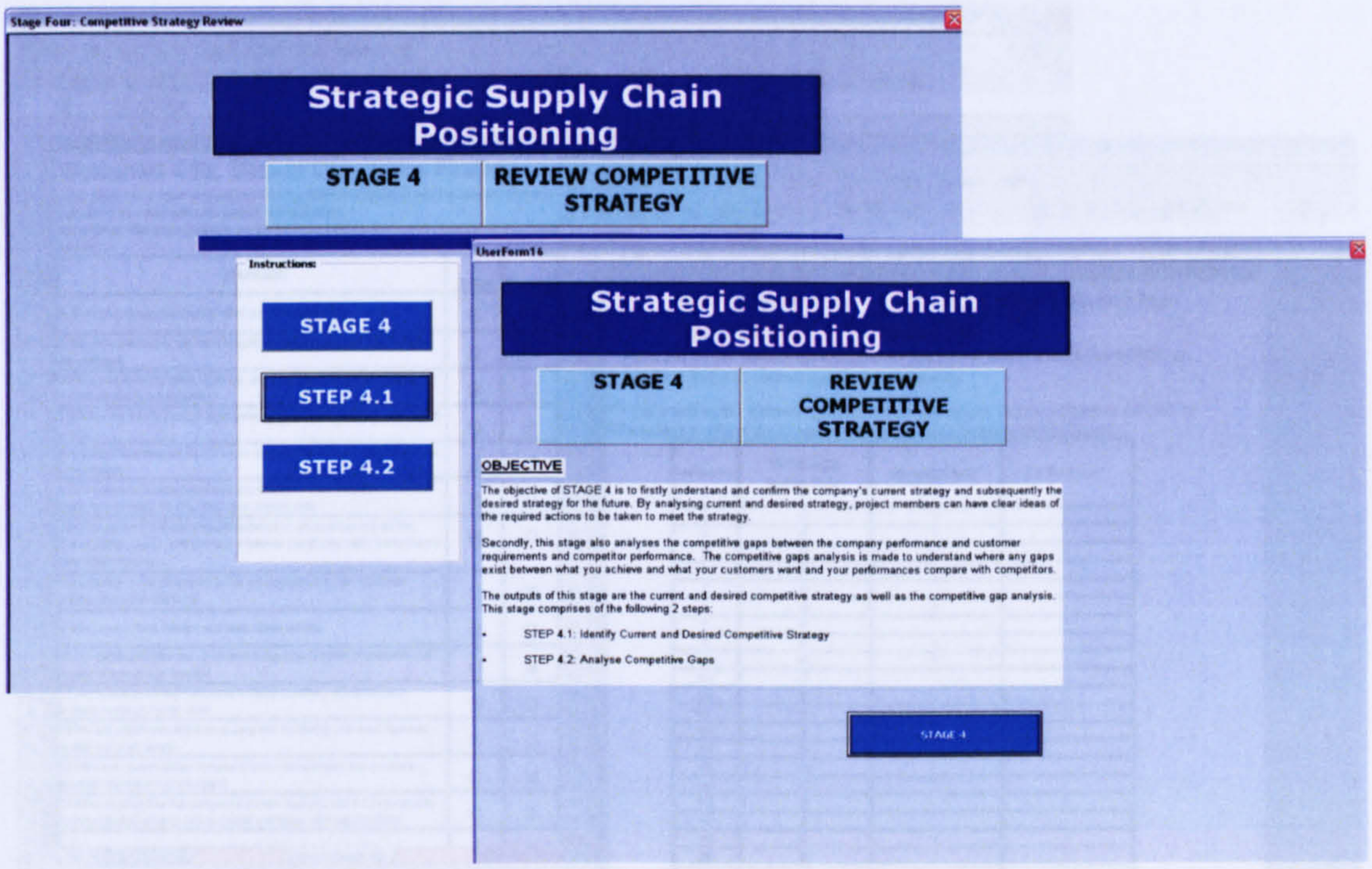


Figure 9.12: User interfaces for Stage 4



Figure 9.13: User interfaces for Step 4.1

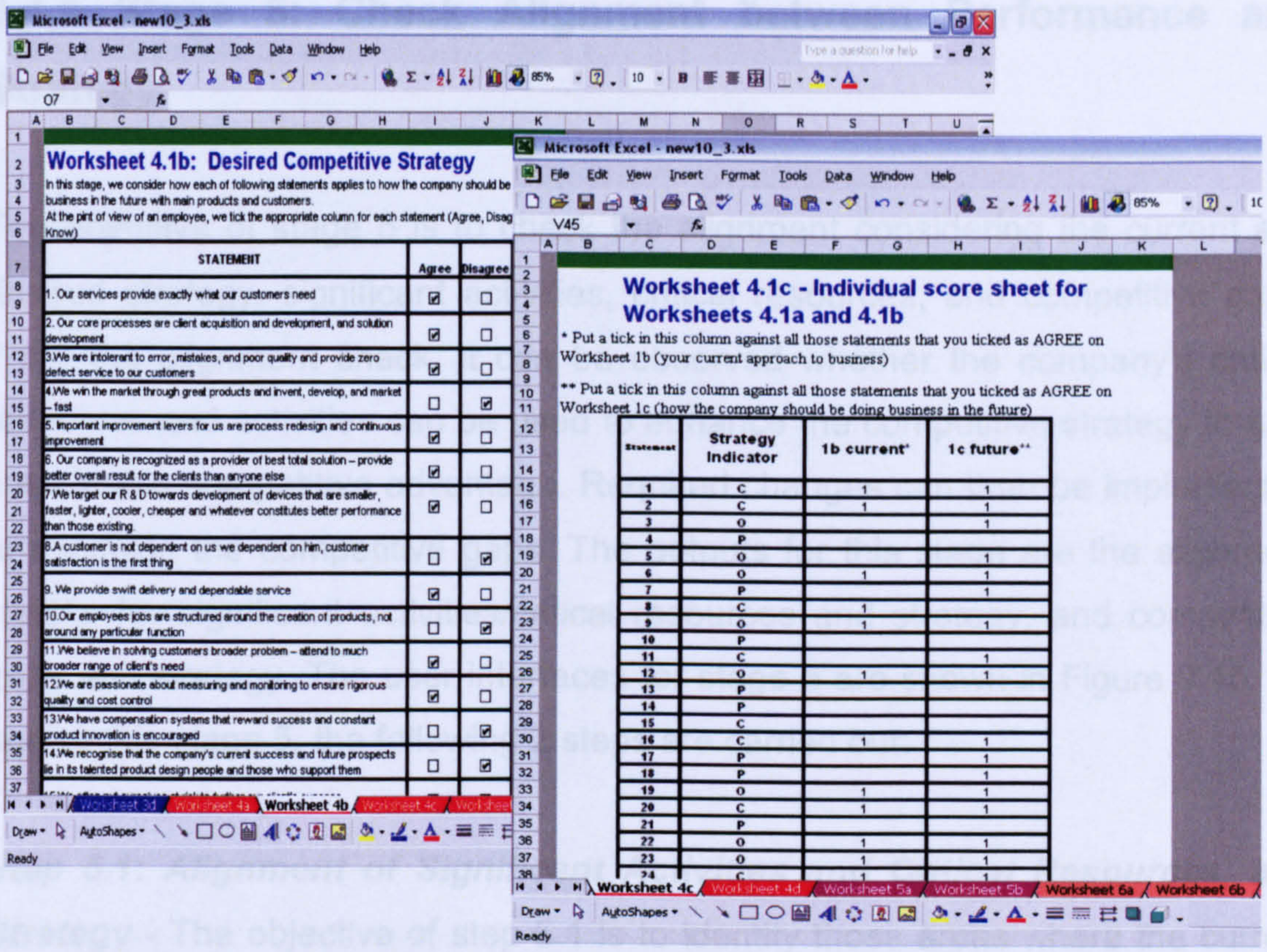


Figure 9.13: User interfaces for Step 4.1(cont.)

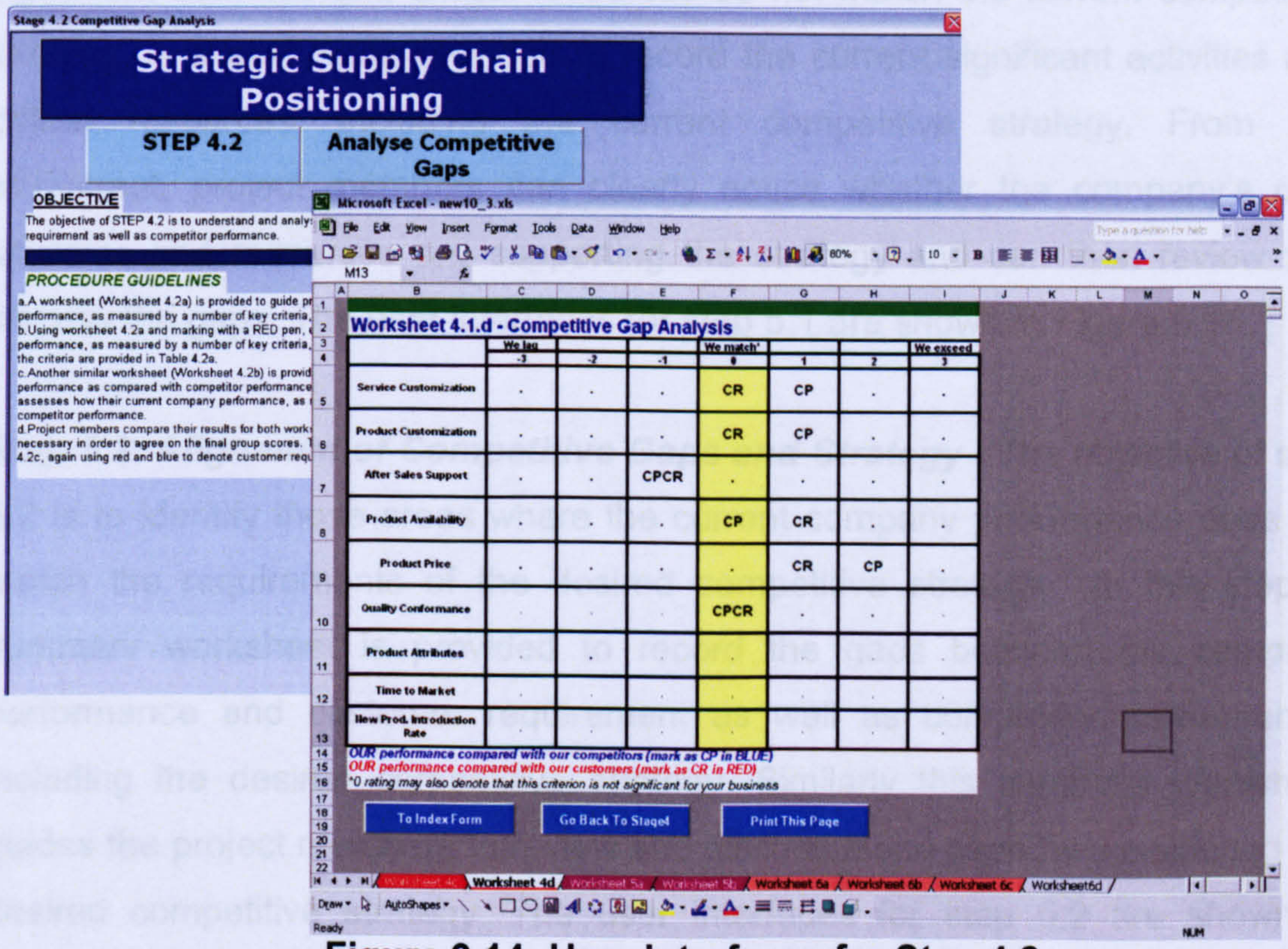


Figure 9.14: User interfaces for Step 4.2

9.4.6 Stage 5: Check Alignment between Performance and Strategy

The objective of stage 5 is to check the alignment considering the current and desired strategy, significant activities, critical resources, and competitive gaps. From the alignment check, it can be observed whether the company's critical resources and activities can be used to enhance the competitive strategy to gain sustainable competitive advantage. Required changes can then be implemented to minimise the competitive gaps. The outputs for this stage are the alignment checks for significant activities/critical resources and strategy, and competitive gaps and strategy. The user interfaces for stage 5 are shown in Figure 9.15. To realise this stage 5, the following 2 steps are carried out:

Step 5.1: Alignment of Significant Activities and Critical Resources, and Strategy **-** The objective of step 5.1 is to identify those areas where the current significant activities and critical resources do not match the current competitive strategy. A worksheet is provided to record the current significant activities and critical resources, including the current competitive strategy. From this worksheet, project members can clearly notice whether the company's core activities and resources are supporting the strategy and can then review and discuss the gaps. The user interfaces for step 5.1 are shown in Figure 9.16.

Step 5.2: Alignment of Competitive Gaps and Strategy **-** The objective of step 5.2 is to identify those areas where the current company performance does not match the requirements of the desired competitive strategy. In this step, a summary worksheet is provided to record the gaps between the company performance and customer requirement as well as competitor performance, including the desired competitive strategy. Similarly this summary worksheet guides the project members to review and discuss these gaps by considering the desired competitive strategy. The user interfaces for step 5.2 are shown in Figure 9.17.



Figure 9.15: User interfaces for Stage 5

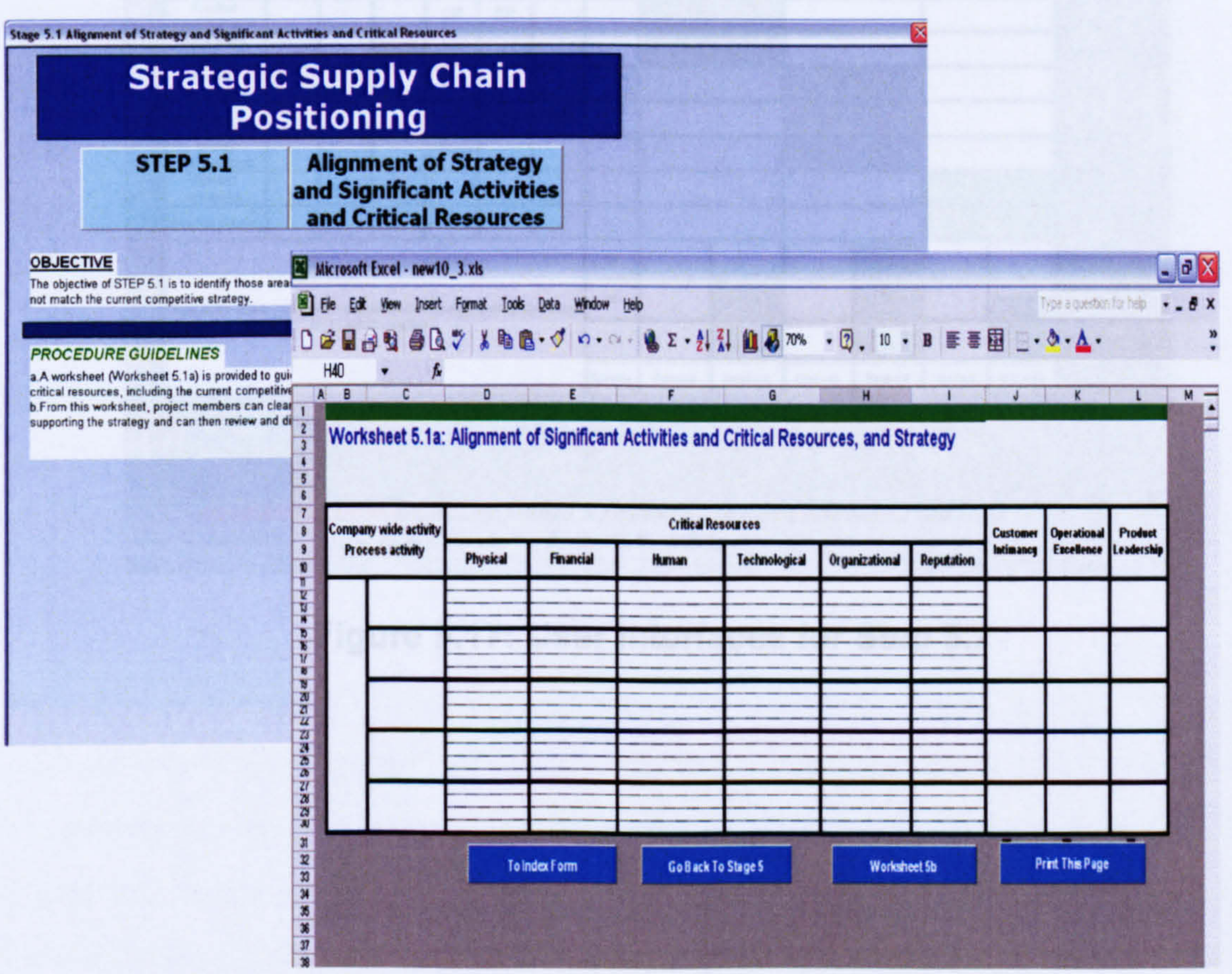


Figure 9.16: User interfaces for Step 5.1

Stage 5.2 Alignment of Competitive Gaps and Strategy

Strategic Supply Chain Positioning

STEP 5.2	Alignment Of Competitive Gaps and Strategy

OBJECTIVE

The objective of STEP 5.2 is to identify those areas where the current company performance does not match the requirements of the desired competitive strategy.

PROCEDURE GUIDELINES

a.In this step, a worksheet (Worksheet 5.2a) is provided to guide project members to record the gaps between the company performance and customer requirement as well as competitor performance, including the desired competitive strategy.
b.Similarly this summary worksheet guides the project members to review and discuss these gaps by considering the desired competitive strategy.

Worksheet 5b

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Worksheet 5.2a: Alignment of Competitive Gaps and Strategy

Summary of Competitive Gaps								Customer Intimacy	Operational Excellence	Product Leadership
	Lag			Match	Exceed					
	-3	-2	-1	0	1	2	3			
Service Customization	.	.	.	CR	CP	.	.			
Product Customization	.	.	.	CR	CP	.	.			
After Sales Support	.	.	CPCR	.	.	.	.			
Product Availability	.	.	.	CP	CR	.	.			
Product Price	.	.	.	.	CR	CP	.			
Quality Conformance	.	.	.	CPCR	.	.	.			
Product Attributes	.	.	.	.	.	.	.			
Time to Market	.	.	.	.	.	.	.			
Aggregate scores for current and desired competitive strategies from three panel members							30			
							20			
							10			
							Scores	Current / Desired	Current / Desired	Current / Desired

To Index Form | Go Back To Stage 5 | Print This Page

Worksheet 4c | Worksheet 4d | Worksheet 5a | Worksheet 5b | Worksheet 6a | Worksheet 6b | Worksheet 6c | Worksheet6d

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Figure 9.17: User interfaces for Step 5.2

9.4.7 Stage 6: Formulate Strategy

In the previous 5 stages, all the analyses have already been carried out and the project members have clear idea regarding the necessary actions to be taken for the activities and resources. This final stage 6 of the methodology is to combine all the decisions agreed upon, and to analyse and propose the actions to be taken for the activities and resources to achieve the desired strategy and to minimise the competitive gaps. In performing this stage, it is important to remember that new decisions and issues from previous stages may have arisen which may not have been noted. This stage provides a basis for validation and formulation of the implementation plan. The final output from this stage is the summary of proposed actions. The user interfaces for stage 6 are shown in Figure 9.18. There are 4 steps associated with stage 6 and these are:

Step 6.1: Propose Actions for Activities - The objective of step 6.1 is to propose the actions to be carried out for the related activities (including both significant and not significant activities) to achieve the desired strategy and to minimise the competitive gaps. A table and matrix on competitive gaps impact is provided to highlight to project members on the four possible impacts, namely: good opportunity, best condition, high threat, and not good for long term. A worksheet with all the competitive gaps and impact is then provided for the project members to brainstorm and identify the related activities, and to propose the actions to be taken. The user interfaces for step 6.1 are shown in Figure 9.19.

Step 6.2: Propose Actions for Resources – The objective of step 6.2 is to propose the actions to be carried out for the related resources (including both critical and not critical resources) underpinning those related activities identified in step 6.1, to achieve the desired strategy and to minimise the competitive gaps. A similar worksheet with all the competitive gaps and impact is then provided for the project members to brainstorm and identify the related resources, and then



Figure 9.18: User interfaces for Stage 6

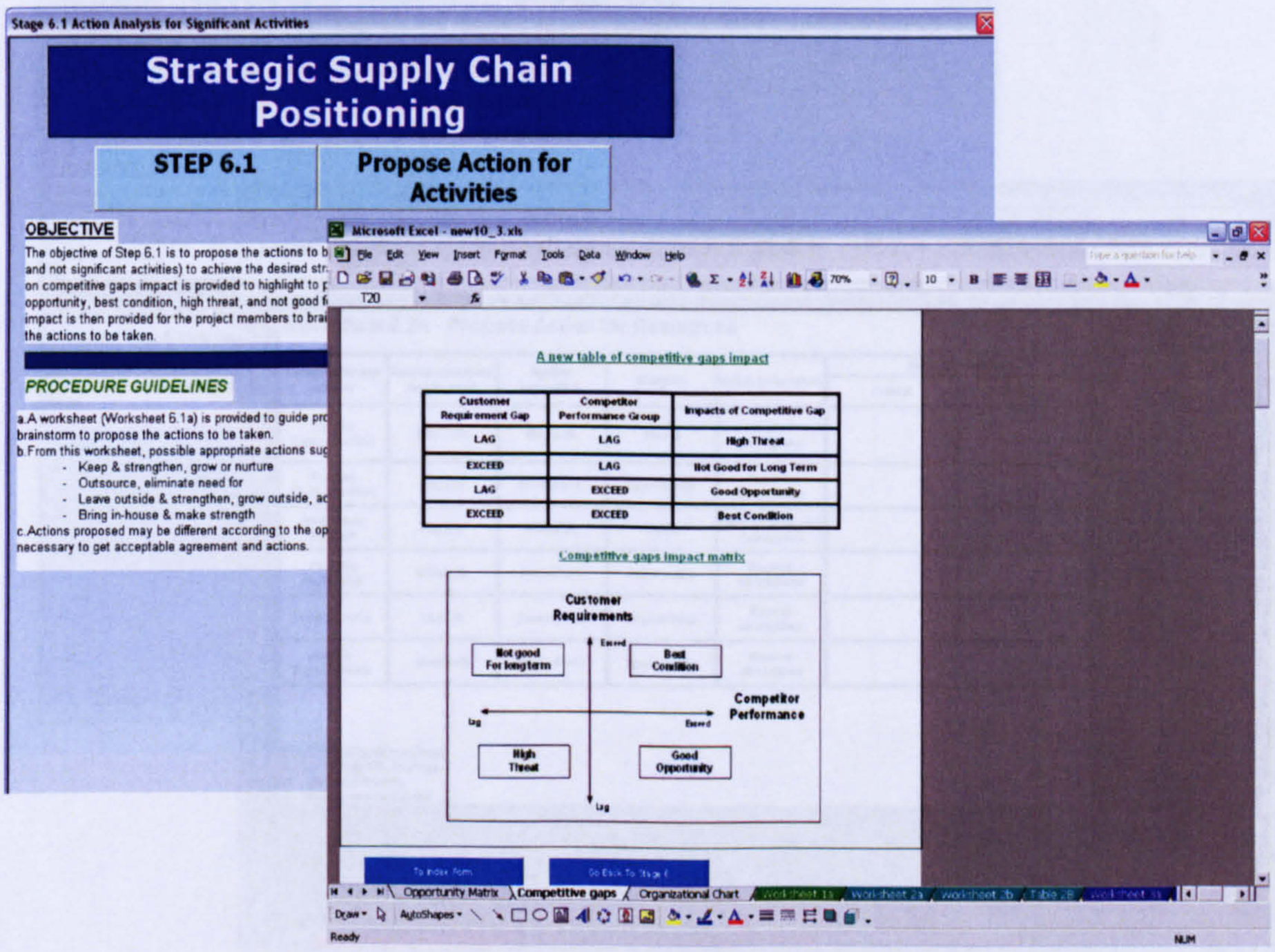


Figure 9.19: User interfaces for Step 6.1

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Worksheet 6a - Propose Actions for Activities

Competitive gap criteria	Against customer requirement	Against competitor	Analysis	Action to be taken	Related Activities	
					Significant	Non-significant
Service Customization	Match (0)	Match (0)	Threat	Need to grow and strengthen		
Product Customization	Lag (-1)	Exceed (+1)	Opportunity	Need to strengthen		
After Sales Support	Lag (-1)	Match (0)	Threat	Need to grow and strengthen		
Product Availability	Match (0)	Exceed (+1)	Opportunity	Need to strengthen		
Product Price	Lag (-1)	Exceed (+1)	Opportunity	Need to strengthen		
Quality Conformance	Match (0)	Exceed (+2)	Opportunity	Need to strengthen		
Product Attributes	Lag (-1)	Exceed (+1)	Opportunity	Need to strengthen		
Time to Market						

Possible appropriate actions:
S - Keep, grow or nurture
W - Keep & strengthen, outsource, eliminate
O - Leave outside, bring in-house & make a
T - Leave outside, leave outside and strengthen

To Index Form | Go Back To Stage 6 | Competitive gap | Worksheet 6b | Print This Page

Worksheet 4c | Worksheet 4d | Worksheet 5a | Worksheet 5b | Worksheet 6a | Worksheet 6b | Worksheet 6c | Worksheet6d

Draw AutoShapes

Ready NUM

Figure 9.19: User interfaces for Step 6.1 (cont.)

Stage 6.2 Action Analysis for Critical Resources

Strategic Supply Chain Positioning

STEP 6.2 | **Propose Action for Resources**

OBJECTIVE

The objective of Step 6.2 is to pro
and not critical resources) underp
strategy and to minimise the com
then provided for the project mem
actions to be taken.

PROCEDURE GUIDELINE

The objective of Step 6.2 is to prop
and not critical resources) underpir
and to minimize the competitive ga
for the project members to brainsto
taken.

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Worksheet 6.2a - Propose Action for Resources

Competitive gap criteria	Against customer requirement	Against competitor	Analysis	Action to be taken	Related Activities	
					Critical	Non-critical
Service Customization	Match (0)	Match (0)	Threat	Need to grow and strengthen		
Product Customization	Lag (-1)	Exceed (+1)	Opportunity	Need to strengthen		
After Sales Support	Lag (-1)	Match (0)	Threat	Need to grow and strengthen		
Product Availability	Match (0)	Exceed (+1)	Opportunity	Need to strengthen		
Product Price	Lag (-1)	Exceed (+1)	Opportunity	Need to strengthen		
Quality Conformance	Match (0)	Exceed (+1)	Opportunity	Need to strengthen		

Possible appropriate actions:
S - Invest, upgrade, leverage,
W – Retire, retrench,
O - Develop new resources

To Index Form | Competitive gap | Go Back To Stage 6 | Worksheet 6c | Print This Page

Worksheet 4c | Worksheet 4d | Worksheet 5a | Worksheet 5b | Worksheet 6a | Worksheet 6b | Worksheet 6c | Worksheet6d

Draw AutoShapes

Ready NUM

Figure 9.20: User interfaces for Step 6.2

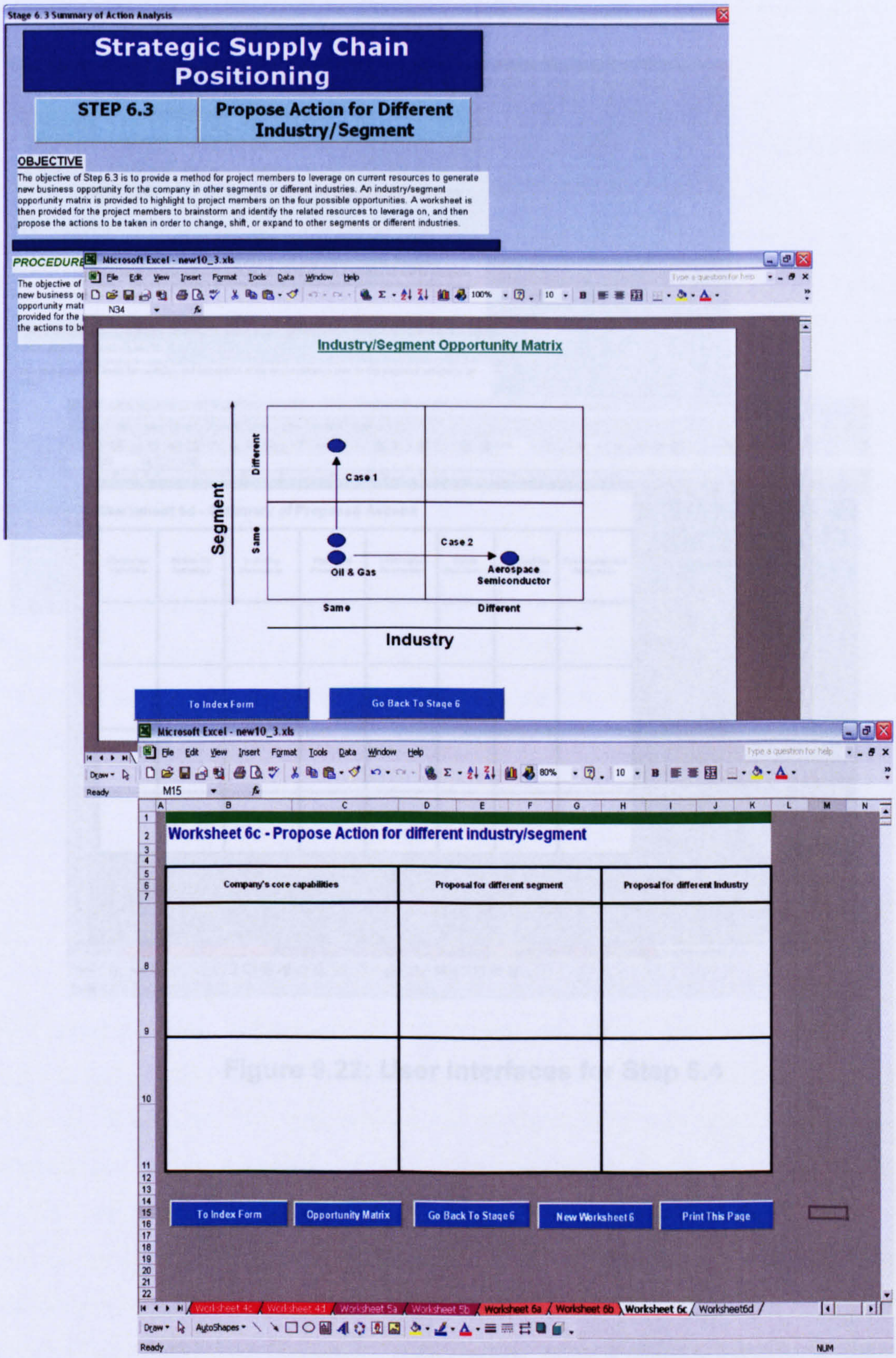


Figure 9.21: User interfaces for Step 6.3

to propose the actions to be taken. The user interfaces for step 6.2 are shown in Figure 9.20.

Step 6.3: Propose Actions for different Industry/Segment - The objective of step 6.3 is to provide a method for project members to leverage on current resources to generate new business opportunity for the company in other segments or different industries. An industry/segment opportunity matrix is provided to highlight to project members on the four possible opportunities. A worksheet is then provided for the project members to brainstorm and identify the related resources to leverage on, and then propose the actions to be taken in order to change, shift, or expand to other segments or different industries. The user interfaces for step 6.3 are shown in Figure 9.21.

Step 6.4: Summary of Proposed Actions **-** The objective of step 6.4 is to provide a summary of all the proposed actions recommended. A summary worksheet is provided to list all the proposed actions recommended for all related activities as well as resources from steps 6.1, 6.2 to 6.3. This step provides a basis for validation and formulation of the implementation plan for the proposed actions to be taken. The user interfaces for step 6.4 are shown in Figure 9.22.

9.5 CHAPTER SUMMARY

This chapter has explained the process of developing the final SSCP methodology, which is in the form of a computerised software tool, suitable for SMEs in Singapore. An overview of the methodology was presented, including detailed description of the six stages, their respective steps, and user interfaces of the computerized software tool shown. The methodology is structured, procedural and descriptive, and focuses on how to carry out the various stages and steps of the methodology effectively from the start to the end. The next chapter concludes the research programme, makes contribution to knowledge and recommends further research in the field.

CHAPTER 10: CONCLUSIONS

This research sets out to create a methodology that would guide SMEs in Singapore in the successful and rigorous implementation of strategic supply chain positioning. This chapter summarises the research contributions in Section 10.2. The limitations of the research are discussed in Section 10.3, and the directions for future work suggested in Section 10.4. Finally, the concluding remarks are given in Section 10.5.

10.1 OVERVIEW OF RESEARCH AIM, OBJECTIVES AND PROGRAMME

This section provides an overview of the research aim, objectives and programme. The research aim of this work was as follow:

> *"To develop a strategic supply chain positioning methodology to support the strategic decision making process in SMEs in Singapore and evaluate its effectiveness in practical implementation"*

The research aim was achieved by completing the following 5 research objectives:

1. Selection of most promising methodology.
2. Evaluation of most promising methodology.
3. Formation of pilot methodology tailored to SMEs in Singapore.
4. Evaluation of pilot methodology.
5. Refinement and illustration of final methodology.

A five phase structured research programme has been executed to achieve the research aim and objectives, and has resulted in the development of a strategic supply chain positioning (SSCP) methodology for SMEs in Singapore. In phase 1, existing methodologies related to SSCP from literature were critically reviewed to select the most promising methodology (Chapter 5). Phase 2 then evaluated the effectiveness of the selected methodology with 4 practical case studies in real industry settings, to demonstrate the feasibility, usability and usefulness of the methodology, and to establish future research needed to refine the methodology (Chapter 6). Based on the feedback data gathered, phase 3 refined and improved the selected methodology to form the pilot SSCP methodology tailored to SMEs in Singapore (Chapter 7). The research then proceeded with phase 4, where the pilot SSCP methodology was further evaluated and tested with another 4 case studies to identify particular characteristics to refine and improve (Chapter 8). Finally, all the suggested changes from the case studies were collated and refined in phase 5, and a fully documented final SSCP methodology was developed in the form of a computerised software tool for SMEs in Singapore (Chapter 9).

This section has provided an overview of the research aim, objectives and programme. The aim and objectives of the research have been met. The major contributions of this thesis are now presented in the next section.

10.2 SUMMARY OF RESEARCH CONTRIBUTIONS

The research presented in this thesis has provided two main contributions to knowledge regarding the subject of strategic supply chain positioning for SMEs in Singapore. This is discussed in Section 10.2.1. In addition a number of secondary contributions have emerged that can also be considered as important contributions to existing knowledge and these are discussed in Section 10.2.2.

10.2.1 Main research contributions

The two main contributions to knowledge that this research has provided are as follows. Firstly, an in-depth understanding has been gained regarding the supply chain positioning, core operational resources and activities, and their link to competitive strategy of SMEs in Singapore. Secondly, a practical and procedural strategic supply chain positioning (SSCP) methodology for SMEs in Singapore has been created, assessed and refined. The purpose of the methodology developed in this thesis is to guide practitioners from SMEs in Singapore through a series of well-defined structured stages and steps necessary to make informed, consistent and efficient improvements to their strategic supply chain positioning. It brings together a series of tools and techniques, and provides a holistic approach to analyse, improve, implement, evaluate and review processes. This structured and procedural methodology for strategic supply chain positioning for SMEs in Singapore forms the main research contribution of this thesis. The initial aim of the research has been achieved.

10.2.2 Secondary research contributions

In the process of executing the research programme, a number of secondary contributions to new knowledge have arisen. These are presented in this section. Firstly no formalised process for strategic supply chain positioning was discovered amongst all the SME organisations studied. Whilst some of the SME organisations had documents associated with some kinds of strategic plan, these were not combined to form a structured process, even though the management were aware of the importance of a structured process for the company.

Secondly, through the evaluation and testing of the selected most promising methodology in Chapter 6, review of literature on resource-based view (RBV) theory and the development of the pilot SSCP methodology incorporating RBV methods in Chapter 7, and further evaluation and testing of the pilot

methodology in Chapter 8, it was discovered that RBV methods are suitable for SMEs.

Thirdly, this research resulted in the identification of those tasks and activities that must be done well for SMEs in Singapore in order to succeed in the implementation of strategic supply chain positioning. The major contributions of this research have been discussed. The following section now considers some limitations of the research described in this thesis.

10.3 LIMITATIONS OF THE RESEARCH

Although the research has achieved the provision of a strategic supply chain positioning methodology for SMEs in Singapore, there are a number of limitations that need presenting. Therefore, this section discusses limitations found within the research programme as well as observations of the research.

10.3.1 Limitations of the research programme

The research programme adopted in developing the SSCP methodology by selecting a most promising methodology from literature, testing in industry case studies, refining, re-testing, and further refining to ensure its applicability is believed to be novel for research in the field of strategic supply chain positioning. This type of research, to the knowledge of the researcher, is still under studied. There are therefore a number of limitations about the manner in which this research has been conducted.

First, for a four-year engineering doctorate programme, the scope of research was board as it required the acquisition of knowledge in a number of subject areas. Significant effort was also spent in obtaining the 8 good industry test cases for industrial testing. In addition, a pilot SSCP methodology based on RBV methods as well as the final SSCP methodology in the form of a computerised

software tool needed to be designed and developed for ease of use by the SMEs. All these efforts imposed a substantial workload over a relatively short time. The shortcomings were that, because of the breadth of the work and the number of industrial tests, the methodology could not be researched and developed in depth.

Second, as mentioned in the above paragraphs, the research programme adopted began with a review of the literature to select a most promising methodology, which was then used directly for testing in industry case studies. Hence, there could be a bias towards focusing too much on one methodology for subsequent refining, re-testing and further refining based on this one methodology selected. Fortunately, the methodology selected was sufficiently thorough in its development and subsequent testing has justified that the selected methodology proved feasible, usable and useful, and was a good methodology to be based on for future work.

10.3.2 Limitations of research findings

This section identifies limitations that have arisen about the findings gained from executing the research programme.

First, it was difficult to achieve full control of the environments because testing was conducted inside the companies. In some cases, due to the company's organisational changes, which resulted in unforeseeable circumstances, the testing process was delayed. In general, whilst the use of the methodology would give a detailed evaluation, the results from the testing may have been influenced by some bias of interpretation. There could have been bias due to the researcher's familiarity with the structure of the methodology. To overcome this weakness, the researcher has appointed different facilitators to conduct the last 4 industry case studies, with the researchers acting as an observer.

Second, the type of cases selected was based on general industry which covered different segments of the supply chain ranging from machining shop, contract manufacturing, equipment manufacturing, to distribution. This was not based on a particular industry, and therefore detailed conclusions about any one particular industry could not be made. However, the diversity of companies involved has provided useful learning in this research.

This section has highlighted some of the limitations of the current research as related to the research programme and research observations. The next section considers possible future research work.

10.4 DIRECTIONS FOR FURTHER RESEARCH

As discussed in the previous section, this section identifies the direction that future work should take to support the progress of research in this area.

First, during the selection of the type of cases in Section 6.2, it covered the different segments of the supply chain ranging from machining shop, contract manufacturing, equipment manufacturing, to distribution. This was based on general industry and not based on a particular industry, for example electronics, precision engineering, chemical, biomedical, or transport and logistics. This was the same with Section 8.2. However the supply chain characteristics many differ from industry to industry, and therefore, the strategic positioning issues may also be different for different industries. Future work should focus on the supply chain positioning of a particular industry, so as to enable an in-depth understanding of the success factors, pitfalls and limitations of supply chain positioning for each particular industry.

Second, it was observed that output of stage 6 of the current SSCP methodology was a summary of proposed actions (Section 9.4.7). The current SSCP methodology did not go further to consider strategic positioning in the global

supply chain. Since globalisation has opened up many markets and companies now have manufacturing networks which are globally dispersed, strategic decision in positioning in global networks has become an important issue. Future research work should focus on helping companies to position themselves strategically in the global supply chain to enable them to be more efficient, more responsive, and achieve better coordination of the supply chain.

Third, from conducting the industry case studies in Chapter 6 and 8 it was realised that performance measurement is an important area that can help companies to measure the effectiveness of their strategic positioning as they move from their current to desired competitive strategic position. Future work should therefore develop such a performance measurement system for strategic positioning in the supply chain, which should include both quantitative as well as qualitative metrics.

Fourth, Section 3.1.1 has defined that strategic supply chain positioning of a company takes place between the business strategy level and the functional strategy level. Whilst developing the methodology, it became apparent that the formal linking between business strategy and strategic supply chain positioning is strong, as compared with the linking between strategic supply chain positioning and functional strategy. Future work should extend the outputs from strategic supply chain positioning to other functional strategies such as manufacturing strategy, supplier selection strategy, outsourcing strategy, and etc.

10.5 CONCLUDING REMARKS

This concluding chapter has summarised the principal research findings against the research aim, and discussed major contributions to knowledge. The limitations of the research have been identified and finally recommendations for future work suggested. It is hoped that the main contributions that this thesis has made to the body of knowledge will be relevant in theory and practice.

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APPENDICES

APPENDIX A: REVIEW AND RESULTS OF ANALYSIS OF EXISTING SSCP METHODOLOGIES

Table A.1: Review of existing SSCP related methodologies

No.	Researchers	Contributions to Research	Study/ Review	Model	Framework	Approach	Methodology
1	Jauch & Wilson (1979)	Develop a framework of strategic planning in make or buy decision and explain strategic considerations in make/buy issues			Y		
2	Welch & Nayak (1992)	Develop a conceptual framework known as strategic sourcing model (SSM) for approaching the make or buy decision			Y		
3	Probert (1996)	Develop and use a systematic methodology to formulate a make or buy strategy					Y
4	McIvor et al. (1997)	Develop a strategic model for the formulation of effective make or buy decision		Y			
5	Padillo & Diaby (1999)	Develop a multiple-criteria decision methodology for the evaluation of make-or-buy strategies					Y
6	Humphreys et al. (2002)	Develop a make or buy model with knowledge-based system (KBS) to help companies in the make or buy decision		Y			
7	Platts et al. (2002).	Develop a make-or-buy methodology incorporating multi-attribute decision-making					Y
8	Quinn and Hilmer (1995)	Discuss core competencies, strategic outsourcing, degree of sourcing control, benefits and risks, new management approaches	Y				
9	Tayles and Drury (2001)	Develop a strategic sourcing model and apply in a large manufacturing company		Y			
10	Jennings (2002)	Develop a model considering the contextual factors to structure the outsourcing decision		Y			

Cont. Table A.1: Review of existing SSCP related methodologies

No.	Researchers	Research	Study/ Review	Model	Framework	Approach	Methodology
11	Barragan et al. (2003)	Develop a decision making framework for sourcing product development services			Y		
12	Freytag and Kirk (2003)	Develop a continuous strategic sourcing framework to achieve optimal performance for strategic in and outsourcing			Y		
13	Jin, B (2004)	Study to find the ideal point, at which the optimal amount of global and domestic sourcing can be formulated considering the total cost and delivery time simultaneously	Y				
14	Talluri and Narasimhan (2004)	Develop an objective framework for effective supplier sourcing			Y		
15	Narasimhan and Carter (1990)	Study the various organisational structures used to carry out international sourcing and materials management functions.	Y				
16	Cavusgil et al. (1993)	Develop a comprehensive decision-making framework for global sourcing			Y		
17	Fraering and Prasad (1999)	Develop a model addressing the linkages between the type of product, organisational, and country characteristics, and the sourcing and logistics strategies		Y			
18	Nellore et al. (2001)	Explore the interconnection between global purchasing and the conditions of lean supply.	Y				
19	Kotabe and Murray (2004)	Explore the potential limitations and negative consequences of outsourcing strategy on a global scale	Y				
20	Narasimhan and Das (2000)	Study the role of sourcing practices in achieving manufacturing flexibilities	Y				

Cont. Table A.1: Review of existing SSCP related methodologies

No.	Researchers	Research	Study/ Review	Model	Framework	Approach	Methodology
21	Baines and Kay (2002)	Survey of 3,500 UK companies and report on manufacturing sourcing practices and decision making processes	Y				
22	Nydick and Hill (1992)	Use the Analytic Hierarchy Process method to structure the supplier selection process				Y	
23	Weber and Ellram (1993)	Develop a multi-objective programming (MOP) model for JIT supplier selection		Y			
24	Chao et al. (1993)	An assessment of different factors employed in supplier selection by Chinese purchasing managers in China	Y				
25	Masella and Rangone (2000)	Propose four different vendor selection systems (VSSs) using analytic hierarchy process method and resource-based approach				Y	
26	Sarkis and Talluri (2002)	Develop an ANP model for evaluation and strategic selection of suppliers which considers multiple factors		Y			
27	Barla (2003)	Develop a multi-attribute selection model (MSM) for supplier selection and evaluation on the basis of lean philosophy		Y			
28	Dulmin and Mininno (2003)	Develop a multi-criteria decision aid (MCDA) model for supplier selection		Y			
29	Humphreys et al. (2003)	Develop a knowledge-based decision support system for selecting suppliers based on environmental factors				Y	
30	Jeffries (1974)	Discuss important causes of difficulties in implementing total distribution management and present some principles to follow to avoid pitfalls	Y				

Cont. Table A.1: Review of existing SSCP related methodologies

No.	Researchers	Research	Study/ Review	Model	Framework	Approach	Methodology
31	Bowersox (1969)	Review of past development, current status, and future research topics in physical distribution	Y				
32	Stock and Lambert (1983)	Examine the issues to consider in physical distribution management for international market	Y				
33	Gill and Allerheiligen (1996)	Identify various economic bases for channel co-operation in physical distributions	Y				
34	Baines et al (1999)	Develop a methodology to help practicing managers to form technology sourcing policies					Y
35	Chiesa and Manzini (2000)	Propose a framework to aid in decision-making process of selecting organisational mode for acquisition of technology			Y		
36	Durrani et al. (1998)	Develop a model and staged process which provides a formalised approach to technology acquisition. The model is realised in a software package.		Y			
37	Li et al. (2003)	Develop a multi-stage stochastic programming model to aid manufacturing firms in making strategic decisions in technology acquisition		Y			
38	Tracey et al. (1999)	Survey and study of the relationships between advanced manufacturing technology and strategy formulation to competitive capabilities of firm	Y				
39	Moller et al. (2003)	Develop a framework to guide companies in developing and handling competence-based relationships with technology suppliers			Y		
40	Swamidass (1987)	Develop a new approach for manufacturing technology planning based on monitoring the deterioration of technology over time				Y	

Cont. Table A.1: Review of existing SSCP related methodologies

No.	Researchers	Research	Study/ Review	Model	Framework	Approach	Methodology
41	Jones et al. (2000)	Study the management of technology in mature firm	Y				
42	Probert et al.(2000)	Develop a methodology for technology management assessment in manufacturing firms					Y
43	Baines (2004)	Develop an integrated process for forming manufacturing technology acquisition decisions					Y
44	Vallespir and Kleinhans (2001)	Develop a fuzzy logic model to support the decision-making process of a company, positioned in a supply chain, to decide and modify the scope of its activity on the chain		Y			
45	Johansen and Riis (2005)	Develop a framework for the strategic positioning of an industrial company			Y		
46	Baines et al. (2005)	A formal and rational process that guides manufacturers through the strategic positioning decision					Y

Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Document ations	Participat ion	Project Management
1	Jauch & Wilson (1979)	Develop a framework of strategic planning in make or buy decision and explain strategic considerations in make/buy issues	Y		Y				
2	Welch & Nayak (1992)	Develop a conceptual framework known as strategic sourcing model (SSM) for approaching the make or buy decision	Y		Y	Y			
3	Probert (1996)	Develop and use a systematic methodology to formulate a make or buy strategy	Y	Y	Y	Y	Y	Y	Y
4	McIvor et al. (1997)	Develop a strategic model for the formulation of effective make or buy decision	Y	Y	Y	Y			
5	Padillo & Diaby (1999)	Develop a multiple-criteria decision methodology for the evaluation of make-or-buy strategies	Y	Y	Y	Y			
6	Humphreys et al. (2002)	Develop a make or buy model with knowledge-based system (KBS) to help companies in the make or buy decision	Y	Y	Y	Y			
7	Platts et al. (2002).	Develop a make-or-buy methodology incorporating multi-attribute decision-making	Y	Y	Y	Y	Y	Y	Y

Cont. Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Documentations	Participation	Project Management
8	Quinn and Hilmer (1995)	Discuss core competencies, strategic outsourcing, degree of sourcing control, benefits and risks, new management approaches			Y				
9	Tayles and Drury (2001)	Develop a strategic sourcing model and apply in a large manufacturing company	Y	Y	Y	Y			
10	Jennings (2002)	Develop a model considering the contextual factors to structure the outsourcing decision	Y		Y				
11	Barragan et al. (2003)	Develop a decision making framework for sourcing product development services	Y	Y	Y	Y			
12	Freytag and Kirk (2003)	Develop a continuous strategic sourcing framework to achieve optimal performance for strategic in and outsourcing	Y		Y				
13	Jin, B (2004)	Study to find the ideal point, at which the optimal amount of global and domestic sourcing can be formulated considering the total cost and delivery time simultaneously			Y				
14	Talluri and Narasimhan (2004)	Develop an objective framework for effective supplier sourcing	Y	Y	Y	Y			

Cont. Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Documentations	Participation	Project Management
15	Narasimhan and Carter (1990)	Study the various organisational structures used to carry out international sourcing and materials management functions.			Y				
16	Cavusgil et al. (1993)	Develop a comprehensive decision-making framework for global sourcing	Y	Y	Y	Y			
17	Fraering and Prasad (1999)	Develop a model addressing the linkages between the type of product, organisational, and country characteristics, and the sourcing and logistics strategies	Y		Y				
18	Nellore et al. (2001)	Explore the interconnection between global purchasing and the conditions of lean supply.			Y				
19	Kotabe and Murray (2004)	Explore the potential limitations and negative consequences of outsourcing strategy on a global scale			Y				
20	Narasimhan and Das (2000)	Study the role of sourcing practices in achieving manufacturing flexibilities			Y				
21	Baines and Kay (2002)	Survey of 3,500 UK companies and report on manufacturing sourcing practices and decision making processes			Y				

Cont. Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Document ations	Participat ion	Project Management
22	Nydick and Hill (1992)	Use the Analytic Hierarchy Process method to structure the supplier selection process	Y		Y				
23	Weber and Ellram (1993)	Develop a multi-objective programming (MOP) model for JIT supplier selection	Y		Y				
24	Chao et al. (1993)	An assessment of different factors employed in supplier selection by Chinese purchasing managers in China			Y				
25	Masella and Rangone (2000)	Propose four different vendor selection systems (VSSs) using analytic hierarchy process method and resource-based approach	Y		Y				
26	Sarkis and Talluri (2002)	Develop an ANP model for evaluation and strategic selection of suppliers which considers multiple factors	Y	Y	Y	Y			
27	Barla (2003)	Develop a multi-attribute selection model (MSM) for supplier selection and evaluation on the basis of lean philosophy	Y	Y	Y	Y			
28	Dulmin and Mininno (2003)	Develop a multi-criteria decision aid (MCDA) model for supplier selection	Y	Y	Y	Y			
29	Humphreys et al. (2003)	Develop a knowledge-based decision support system for selecting suppliers based on environmental factors	Y	Y	Y	Y			

Cont. Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Document ations	Participat ion	Project Management
30	Jeffries (1974)	Discuss important causes of difficulties in implementing total distribution management and present some principles to follow to avoid pitfalls			Y				
31	Bowersox (1969)	Review of past development, current status, and future research topics in physical distribution			Y				
32	Stock and Lambert (1983)	Examine the issues to consider in physical distribution management for international market			Y				
33	Gill and Allerheiligen (1996)	Identify various economic bases for channel co-operation in physical distributions			Y				
34	Baines et al (1999)	Develop a methodology to help practicing managers to form technology sourcing policies	Y	Y	Y	Y	Y	Y	Y
35	Chiesa and Manzini (2000)	Propose a framework to aid in decision-making process of selecting organisational mode for acquisition of technology	Y		Y				
36	Durrani et al. (1998)	Develop a model and staged process which provides a formalised approach to technology acquisition. The model is realised in a software package.	Y	Y	Y	Y			

Cont. Table A.2: Results of analysis of SSCP methodologies against requirements

No.	Researchers	Research	Clear Objective & Outcome	Structure	Simple Tools and Techniques	Outputs	Document ations	Participat ion	Project Management
44	Vallespir and Kleinhans (2001)	Develop a fuzzy logic model to support the decision-making process of a company, positioned in a supply chain, to decide and modify the scope of its activity on the chain	Y		Y				
45	Johansen and Riis (2005)	Develop a framework for the strategic positioning of an industrial company	Y		Y				
46	Baines et al. (2005)	A formal and rational process that guides manufacturers through the strategic positioning decision	Y	Y	Y	Y	Y	Y	Y

APPENDIX B: POST ASSESSMENT QUESTIONNAIRE

STRATEGIC SUPPLY CHAIN POSITIONING METHODOLOGY

POST ASSESSMENT QUESTIONNAIRE

FEASIBILITY (F): *COULD THE METHODOLOGY BE FOLLOWED?*

The purpose of this section is to discover if the methodology could be followed. Please tick the answer(s) which correspond to your opinion. Please add comments as necessary.

1. **Completeness: Was all the stages in the methodology completed?**

   No/Not at all ☐ Partly☐ Don't know☐ Mostly☐ Yes☐

   If the methodology lacks in completeness, please indicate where you feel there are omissions or where additional stages should be added.

   .....

   .....

2. **Consistency: Did you feel that the sequence of the stages was consistent?**

   No/Not at all☐ Partly☐ Don't know☐ Quite☐ Yes☐

3. **Applicability: Did you find that methodology can be applied satisfactorily?**

   No/Not at all☐ Partly☐ Don't know☐ Mostly☐ Completely☐

   Comments: .....

4. **Contingency: If the project encountered problems, did the methodology provide an alternative solution?**

   No/Not at all☐ Partly☐ Don't know☐ Mostly☐ Completely☐

USABILITY (USAB): *HOW EASILY COULD THE METHODOLOGY BE FOLLOWED?*

The purpose of this session is to discover how you structured and followed the methodology. Please tick the answer(s) which correspond to your opinion. Please add comments as necessary.

5. **How long did the methodology application take? Elapsed time**

   Calendar months.....

   Man-days effort.....

6. **How well did the timing of the methodology and stages to the project fit into your other duties?**

   No/Not at all☐ Not very well ☐ Don't know ☐ Quite well ☐ Very well ☐

7. **Did you find the tools and techniques at each stage reasonably easy to follow and explain?**

   No/Not at all☐ Not very easy☐ Don't know☐ Quite Easy☐ Very Easy☐

   Comments.....

8. **Were the aims and actions of the methodology clear at each stage?**

   No/Not at al☐ Partly Clear☐ Don't know☐ Quite Clear☐ Very Clea☐

   Comments.....

9. **Did you find the methodology and stages robust?**

   No/Not at all☐ Partly☐ Don't know☐ Quite☐ Very/Yes☐

   Comments.....

10. **Was there sufficient time to discuss the important issues during the project?**

    No/Not at all☐ Not always ☐ Don't know☐ Nearly always ☐ Very/Yes ☐

11. Did you have sufficient preparation prior to each stage of the methodology application and assessment?

No/ Not at all	Little Sufficient	Don't know	Quite Sufficient	Very Sufficient
☐	☐	☐	☐	☐

12. Did you have sufficient chance in the project team to participate and be involved and contribute at each stage of the methodology?

No/ Not at all	Little Sufficient	Don't know	Quite Sufficient	Very Sufficient
☐	☐	☐	☐	☐

13. Would it help if case study examples were to be provided in the methodology?

No/Not at all☐ Of Little use☐ Don't know☐ Usefu☐ Very Usefu☐

14. If you were to carry out a strategic supply chain positioning task in the future, would you consult the methodology?

No/Not at all☐ Not very likely☐ Don't know☐ Very Likely☐ Yes, Definitely☐

Comments.....

15. Please detail below any significant deviations you made from the methodology specified. Please say why these were made.

.....

16. Please state what you consider to be the major strengths and weaknesses of the overall methodology?

.....

17. Please state what you consider to be the major strengths and weaknesses of the overall methodology?

.....

.....

18. What changes would you make if you were to repeat the overall methodology?

.....

.....

19. Which of the stages would you like to modify or combine? Please add comments

Comments:.....

.....

20. What else in the methodology structure would you like the stages to define?

.....

.....

21. Which of the methodology stages and steps were most useful and why? Please provide examples.

.....

.....

22. Which of the methodology stages and steps were least useful and why? Please provide examples.

.....

.....

23. Is there anything in the stages, steps, and related tools and techniques that you would like to change to make it more workable?

.....

.....

USEFULNESS (USF): *DID THE METHODOLOGY PROVIDE A USEFUL OUTPUT THAT MET EXPECTIONS?*

The aim of this section is to discover how useful the methodology was and what type of results were produced. Please tick the answer(s) which corresponds to your opinion.

24. Was the methodology successful in your organisation?

Most unsuccessful ☐ Not successful ☐ Don't know ☐ Was successful ☐ Very successful ☐

Comments: .....

25. Did the methodology result in a successful output for the organisation?

Most unsuccessful ☐ Not successful ☐ Don't know ☐ Was successful ☐ Very successful ☐

26. Please tick the answer(s) which correspond to your opinion.

The methodology resulted in a new strategic direction (Long Terms Plans) for the business. ☐

The methodology resulted in radical changes to the existing processes. ☐

The methodology resulted in a few changes to the existing processes. ☐

The methodology confirmed the existing processes. ☐

The methodology did not produce a result. ☐

If the methodology did not produce a result, please say why not.

.....

.....

27. How much influence do you think the methodology had on achieving the result?

None ☐ Very Small ☐ Don't Know ☐ Average ☐ Large ☐

28. Did the methodology consume excessive resources of time and people?

No/Not at all☐ Partly☐ Don't Know☐ Quite☐ Very/Yes☐

29. Will you find the methodology and its stages and steps useful in your work?

No/Not at all☐ Partly☐ Don't Know☐ Quite☐ Very/Yes☐

30. Would you use the methodology again in your organisation and why?

θ Yes .....

.....

θ No.....

.....

31. Can you envisage the methodology being adopted in your organisation?

θ Yes .....

.....

θ No.....

.....

APPENDIX C: CASE STUDY APPLICATIONS OF SELECTED METHODOLOGY

APPENDIX C: CASE STUDY APPLICATIONS OF SELECTED METHODOLOGY

This appendix describes the application of the selected most promising methodology in the four different case studies by the participating companies identified in Section 6.2. The application of the methodology in the four participating companies is to observe the methodology in practice in real industry setting and to establish future research needed. The following sections describe each individual company as well as the application of the five-stage methodology within each company.

1. CASE 1: APPLICATION OF THE SELECTED METHODOLOGY

Case 1 is a leading distributor of quality fasteners, electronic hardware, sleevings, tubings and other electro-mechanical parts. Case 1 has established an enviable reputation in its inventory programme, which includes ship-to-stock, hub, two-bin system, amongst others. Excellent customer service and good quality control are key factors in the way they do business and their biggest advantage over the competitors is the wide product range case 1 handles. This means that they are capable of handling all types of customers with a one-stop shop solution, be they big or small. Case 1's on-time delivery, competitive pricing and proactive approach have set industry standards that their repeat customers have become accustomed to. Case 1's quality and delivery performances are rated 99% but what matters most is the 100% satisfaction and assurance of the customers.

The crucial goal of Case 1 is to become a regional leader in the distribution of quality assured fasteners, electronic hardware, sleevings, tubings and other electro-mechanical parts. In order to achieve this, the company will continue to ensure that they provide high quality products, on-time delivery, competitive

pricing and prompt active approach, to exceed the expectations of their customers.

Stage 1: Scope Issues

The need for the review of competitive position of the company was proactive.

1.1 Identify Business Area for Review

This stage has identified that the product or business area selected for the purpose of review of competitive position needed to cover the whole company. The over-riding challenge for Case 1 was to be the leader in the regional distribution of quality assured fasters, electronic hardware, sleevings, tubings and other electro-mechanical parts. Case 1 also wanted to sustain their market share by product price advantage.

1.2 Competitive Strategy Review

The project members were asked to assess the 30 statements in relation to the company's current and desired competitive strategy. The results of the assessment were as follow:

Current Competitive Strategy: From the assessment, Case 1's current competitive strategy was assessed to be Customer Intimacy. As a distributor, Case 1 has always been trying to fulfill the needs and expectations of the customers. Case 1 is not only able to carry out the company's core processes well, acquire and develop new clients, but they are also able to maintain their existing customers.

Desired Competitive Strategy: From the assessment, the desired competitive strategy was also assessed as Customer Intimacy. The first priority for a distributor like Case 1 is customer satisfaction. From the start, Case 1's mission

has always been to satisfy the clients. They want to build strong relationship with their clients and are willing to put themselves at risk to further their client's success.

1.3 Competitive Gap Analysis

Based on criteria of the three competitive strategies, the project members analysed the current gap between:

a) Company and its customers and
b) Company and its competitors

The summary of competitive gaps showed that the company exceeded both their customers and competitors in Customer Intimacy and Operational Excellence. Since Case 1 is a distributor, they did not consider the need to analyse the gaps for Product Leadership.

1.4 Alignment check between performance and strategy

According to the aggregate scores for the current and desired strategies, Customer Intimacy was identified as the desired competitive strategy of the company. Hence, they needed to focus on improving in the areas of Customer Intimacy and Operational Excellence.

Stage 2: Identify Key Decision Criteria

2.1 Selection of FACTS Criteria

The company's project members proposed a number of criteria for each of the FACTS through the brainstorming session and they were asked to vote the criteria which were the most important in assessing the project initiatives.

For the Financial Issues, getting the profit margin was crucial to a project followed by payback period. The next issue was Attitude/Acceptability and the

management support/commitment and workforce co-operation were the two highest importance facts under this issue. The third issue was Capability/Competence, here, the impact on customer required 'activities' and resource capacities were vital. For the fourth issue on Technological Issue, there were the key facts such as technology importance to business and technology strength. Last but not least was Strategic Issue and fit with customer requirements, relationship impact and impact on competitiveness were essential.

2.2 Weighting of FACTS Criteria

After summarising FACTS, profit margin was at the top of the priority list, followed by management support. The rest in order of importance were impact on customer required 'activities', technology importance to business, and impact on competitiveness.

2.3 Consistency Check on FACTS Criteria

The FACTS criteria need to be consistent with the company's criteria for the purpose of assessing initiatives and new projects. Case 1 considered profit margin as the most important criteria in selecting projects. The final product quality must meet customer's requirement and standard. At the same time it was important to consider the impact of existing product quality and reliability. The impact on workforce would directly influence on the production capacity and innovativeness. Finally, the company's core activities needed to be aligned and consistence with the desired competitive strategy. Therefore the key decision criteria selected were consistent with the company's scope issues identified in stage 1.

Stage 3: Identify Activity Landscape

The initial external and internal activity landscape was mapped out. After this, the Significant Activities (SA) were identified and listed. These significant activities

identified included business development, processing order, follow up delivery dates, ensure on-time delivery, check order conformance dates, receipt of goods ordered, ensure accuracy of items ordered, quality control such as inspection of incoming goods and rejected parts replacement and payment to supplier. The Related Activities (RA) identified included sales and marketing department, operation and quality control.

Stage 4: Assess Impact

4.1 Condition Analysis and 4.2 Action Analysis

At this stage, from the condition and action analysis, the strengths of the company were identified and decision made to keep these activities and continue to grow them in order to fulfill the company's future plan. These activities included processing order, ensure on-time delivery, payment to supplier and ensure accuracy of items ordered. Weaknesses were also identified such as check order conformance dates, quality control in inspection of incoming goods ordered and rejected parts replacement. Decision was made to outsource these activities.

4.3 Gross SA Impact Analysis

From the gross impact score of this analysis, Significant Activities (SA) such as processing order, ensure on-time delivery and ensure accuracy of items ordered have considerable positive impact on the key decision criteria.

4.4 Gross RA Impact Analysis

According to the gross impact score on RA impact analysis, Related Activities (RA) such as sales and marketing department, operation and quality control were vital on the key decision criteria.

4.5 Net Impact and Ranking Analysis

Based on the difference between Gross SA impact score and Gross RA impact score, the Net impact score was obtained and ranked accordingly. The top three rankings were processing order, ensure on-time delivery and ensure accuracy of items. Therefore, the ranking were also consistent with the company's scope issues identified in stage 1.

Stage 5: Consolidate Outcomes

The final stage of the process was used to reflect on the key outcomes from earlier stages. This stage provided an opportunity for the company to combine all the decisions agreed upon during the process and then provided a basis for validation and implementation.

5.1 From Issues Statement

Case 1 wanted to be a leader in the regional distribution of quality assured fasteners, electronic hardware, sleevings, tubings and other electro-mechanical parts. Case 1 also wanted to sustain their market share by product price advantage.

5.2 From Key Decision Criteria (From FACTS)

The profit margin was at the top of the priority list and followed by management support. The rest in order of importance were impact on customer required 'activities', technology importance to business, and impact on competitiveness.

5.3 From Significant Activities and proposed actions

This stage highlighted the Significant Activities (SA) and the proposed actions taken by the company, which is shown in Table C.1.

Table C.1: Significant activities and proposed actions (Case 1)

Significant Activities Considered (*taken from STAGE 2)*	Proposed Actions (*taken from STAGE 4*)
Business Development	Keep & grow
Order Processing	Keep & grow
Follow up Delivery dates	Keep & grow
On-time Delivery	Keep & grow
Check Order conformance dates	Outsource
Receipt of goods ordered	Keep & grow
Accuracy of items ordered	Keep & grow
Inspection of incoming goods	Outsource
Rejected parts replacement	Outsource
Payment to supplier	Grow

Table C.2: Related activities and net impact score (Case 1)

Significant Activities Considered (taken from STAGE 2)	Proposed Actions (taken from STAGE 4)	Related Activities Considered (taken from STAGE 3)	RA Impact Form (taken from STAGE 4)	Net Impact Score (Rank) (taken from STAGE 4)
Business Development	Keep & grow	-	-	3
Order Processing	Keep & grow	Sales & Marketing dept	Customer Satisfaction	10
Follow up Delivery dates	Keep & grow	-	-	2
On-time Delivery	Keep & grow	Sales & Marketing dept	Reduce Time to market	9
Check Order conformance dates	Outsource	-	-	7
Receipt of goods ordered	Keep & grow	-	-	1
Accuracy of items ordered	Keep & grow	Sales & Marketing dept	Will improve reliability	8
Inspection of incoming goods	Outsource	*	-	6
Rejected parts replacement	Outsource	-	-	5
Payment to supplier	Grow	-	-	4

Table C.3: Allocate future actions, responsibilities and timescale (Case 1)

Significant Activities Considered (*taken from STAGE 2)*	Net Impact Score (Rank) (*taken from STAGE 4*)	Future Actions	Responsibilities	Time scale
Business Development	3	Keep & grow	Sales & Marketing dept	6 mths
Order Processing	10	Keep & grow	Sales & Marketing dept	1 mth
Follow up Delivery dates	2	Keep & grow	Sales & Marketing dept	
On-time Delivery	9	Keep & grow	Sales & Marketing dept	2 mths
Check Order conformance dates	7	Outsource	Materials dept	3 mths
Receipt of goods ordered	1	Keep & grow	Operation dept	
Accuracy of items ordered	8	Keep & grow	Operation dept	2 mths
Inspection of incoming goods	6	Outsource	Quality dept	6 mths
Rejected parts replacement	5	Outsource	Quality dept	6 mths
Payment to supplier	4	Grow	Finance dept	

5.4 From Related Activities, RA impact form and net impact score

This stage highlighted the Related Activities (SA), the RA impact form and the net impact score as shown in Table C.2.

5.5 Allocate future actions, responsibilities and timescale

Besides identifying the significant activities, future actions were allocated, individual responsibilities assigned and the timescale were also determined for executing these actions. This is shown in Table C.3.

2. CASE 2: APPLICATION OF THE SELECTED METHODOLOGY

Case 2 is one of Singapore's leading vertically integrated contract manufacturer serving the wireless telecommunications, consumer electronics and computing and automotive industries. Case 2 provides a wide range of products and services which includes industrial and product design, manufacture, assembly mold design and fabrication, injection molding, class 100k clean room molding, related secondary processes and component assembly. Case 2 has the ability to generate customer patronage and loyalty by consistently offering quality products and services at competitive prices and reliable delivery time. Continuous success is dependent to a significant extent on company's ability to retain the services of the key management and efficient operation. Most of the Case 2's customers have multi-site manufacturing locations in the countries in which Case 2 operates, supporting its vision of becoming a regional contract manufacturer.

Stage 1: Scope Issues

The need for the review of competitive position of the company was proactive.

1.1 Identify Business Area for Review

In this stage, Case 2 has identified the data storage business area for the purpose of review of competitive position. Case 2 manufactures small precision components for the data storage market and they anticipated a higher growth of the personal computers as well as wider applications of hard-disk drives. The over-riding challenge for Case 2 was to globalise and add value to customers through quality and technology. Case 2 wanted to focus on strengthening its timely product/process design and development.

1.2 Competitive Strategy Review

The project members were asked to assess the 30 statements in relation to the company's current and desired competitive strategy. The results of the assessment were as follow:

Current Competitive Strategy: From the assessment, Case 2's current competitive strategy was assessed to be Operational Excellence. Case 2's strength is the ability to generate customer patronage and loyalty by consistently offering quality products and services at competitive prices and reliable delivery time. Continuous success is dependent to a significant extent on the company's ability to retain the services of key management and to excel in its operations.

Desired Competitive Strategy: From the assessment, the desired competitive strategy was also assessed as Operational Excellence. Case 2 aims to expand its operations in Asia, to uphold quality and service reliability, and to maintain the price competitiveness through improved cost efficiency. In the future the company would focus on best quality product at the best price.

1.3 Competitive Gap Analysis

The summary of competitive gaps showed that the company matched the customer requirements in terms of Customer Intimacy and Operational

Excellence. However, the company lagged behind their competitors in product availability and product price for Operational Excellence, and after-sales support for Customer Intimacy.

1.4 Alignment check between performance and strategy

Stage 1.2 has established that both the current and desired strategies of the company were Operational Excellence. Hence, the current competitive gaps between the company and competitors performance were critical and improvement were needed in the areas of Customer Intimacy and Operational Excellence.

Stage 2: Identify Key Decision Criteria

2.1 Selection of FACTS Criteria

The company's project members proposed a number of criteria for each of the FACTS through the brainstorming session and they were asked to vote the criteria which were the most important in assessing the project initiatives.

For the Financial Issues, profit margin was identified as important followed by manufacturing cost and cost of development effort. For Attitude/Acceptability, the members considered attitude towards decision making, re-organisation and the management capability to implement as important issues. For the third issue on Capability/Competence, important criteria identified were impact on customer required activities, the resource capacity, degree of change in core competence requirement and ability to retain required competence. For the fourth issue on Technological Issue, key facts such as technology strength and capability, technology importance to business, process life cycle and process maturity were identified. Finally for Strategic Issue, important facts identified included impact on competitiveness and overall strategic fit.

2.2 Weighting of FACTS Criteria

After summarising FACTS, profit margin was at the top of the priority list, followed by technology strength, attitude towards decision making, ability to retain required competency and impact of competitiveness.

2.3 Consistency Check on FACTS Criteria

Case 2 considered profit margin obtained from any project as the most important criteria. Attitude towards decision marking and ability to retain required competency was also important since the company wanted to decrease the subcontractor's ratio and to build everything in-house. In addition, the company needed to buy more machines and develop high level technologies, and as such they should have very strong technology strength. Finally, Case 2 lagged behind the competitors and therefore they needed to concentrate more on the impact of competitiveness. All these key decision criteria were consistent with the company's scope issues identified in stage 1.

Stage 3: Identify Activity Landscape

At this stage the initial activity map was drawn. After this, Significant Activities (SA) were identified and they included tool and die mold part design, plan and schedule inhouse/sub-out operations, grinding/milling/ wire-cut, Inspect inhouse/sub-out, precision plastic injection molding, NC programming, new product development, mold assembly and testing, customer service and marketing.

Stage 4: Assess Impact

4.1 Condition Analysis and 4.2 Action Analysis

At this stage, the strengths of the company were discovered so that they could be kept and grew further to fulfill the company's future plan. The strengths

identified included internal activities such as design, production planning and control, tooling, and customer service. For the weaknesses identified, to overcome them, the company needed to adopt new technologies, in-source those sub-contracted operations to achieve higher quality and shorter time to market, reduce product price, acquire new technologies, increase manpower and high-tech machines. For the opportunities identified, raw material purchasing should be improved to avoid delay so as to reduce risk of claims, deductions and cancellations.

4.3 Gross SA Impact Analysis

From the gross impact score of this analysis, Significant Activities (SA) such as technology development, raw material purchase, product price and customisation have considerably positive impact on the key decision criteria.

4.4 Gross RA Impact Analysis

According to the gross impact score on RA impact analysis, Related Activities (RA) such as production department and purchasing department were vital to the key decision criteria.

4.5 Net Impact and Ranking Analysis

Based on the Net impact score, the top three rankings were grinding/milling/ wire-cut, Inspect inhouse/sub-out, and new product development. Therefore, the ranking were also consistent with the company's scope issues identified in Stage 1.

Stage 5: Consolidate Outcomes

This final stage combined all the decisions agreed upon during the process and then provided a basis for validation and implementation.

5.1 From Issues Statement

Case 2 aimed at becoming global and adding value to customers through quality and technology. Case 2 also wanted to focus on strengthening its timely product/process design and development.

5.2 From Key Decision Criteria (From FACTS)

The profit margin was at the top of the priority list, followed by technology strength, attitude towards decision making, ability to retain required competency and impact of competitiveness.

5.3 From Significant Activities and proposed actions

This stage highlighted the Significant Activities (SA) and the proposed actions taken by the company, which is shown in Table C.4.

5.4 From Related Activities, RA impact form and net impact score

This stage highlighted the Related Activities (SA), the RA impact form and the net impact score as shown in Table C.5.

5.5 Allocate future actions, responsibilities and timescale

Besides identifying the significant activities, future actions were allocated, individual responsibilities assigned and the timescale were also determined for executing these actions. This is shown in Table C.6.

Table C.4: Significant activities and proposed actions (Case 2)

Significant Activities Considered (*taken from STAGE 2)*	Proposed Actions (*taken from STAGE 4*)
Tool and die mold part design	Keep & grow
Plan and schedule inhouse/sub-out operations	Keep & grow
Grinding/milling/wire-cut	Bring-in-house
Inspect inhouse/sub-out	Bring-in-house
Precision plastic injection molding	Keep & grow
NC programming	Keep & grow
New product development	Keep & grow
Mold assembly and testing	Keep & grow
Customer service	Keep & grow
Marketing	Grow

Table C.5: Related activities and net impact score (Case 2)

Significant Activities Considered (taken from STAGE 2)	Proposed Actions (taken from STAGE 4)	Related Activities Considered (taken from STAGE 3)	RA Impact Form (taken from STAGE 4)	Net Impact Score (Rank) (taken from STAGE 4)
Tool and die mold part design	Keep & grow	Design dept	-	5
Plan and schedule inhouse/sub-out operations	Keep & grow	Production planning & Control dept	Will reduce time and labor cost	3
Grinding/milling/wire-cut	Bring-in-house	Tooling dept	Will reduce time and labor cost	10
Inspect inhouse/sub-out	Bring-in-house	QC dept	Will reduce time and labor cost	9
Precision plastic injection molding	Keep & grow	Molding dept	-	7
NC programming	Keep & grow	CAM dept	-	6
New product development	Keep & grow	Design dept	-	8
Mold assembly and testing	Keep & grow	Assembly dept	-	4
Customer service	Keep & grow	Sales dept	-	2
Marketing	Grow	Sales dept		1

Table C.6: Allocate future actions, responsibilities and timescale (Case 2)

Significant Activities Considered (*taken from STAGE 2)*	Net Impact Score (Rank) (*taken from STAGE 4*)	Future Actions	Responsibilities	Time scale
Tool and die mold part design	5	Keep & grow	Design dept	
Plan and schedule inhouse/sub-out operations	3	Keep & grow	Production planning & Control dept	
Grinding/milling/wire-cut	10	Bring-in-house	Tooling dept	9 mths
Inspect inhouse/sub-out	9	Bring-in-house	QC dept	9 mths
Precision plastic injection molding	7	Keep & grow	Molding dept	6 mths
NC programming	6	Keep & grow	CAM dept	6 mths
New product development	8	Keep & grow	Design dept	9 mths
Mold assembly and testing	4	Keep & grow	Assembly dept	
Customer service	2	Keep & grow	Sales dept	
Marketing	1	Grow	Sales dept	

3. CASE 3: APPLICATION OF THE SELECTED METHODOLOGY

Case 3 is a contract manufacturer engaged mainly in the manufacture of equipment and automated assembly lines. Case 3 has been formed by the strategic alliance between two Singapore companies A and B. Company A was a supplier of assembly and test equipment services to manufacturers in the hard-disk drive industry. Company B was a supplier of precision machining components and equipment modules for both the front-end and back-end semiconductor equipment manufacturers. The strategic alliance was formed to meet the global demands from many customers to design and develop a variety of challenging complex products. These precision components and equipment are mainly for the hard disk drive manufacturers, semiconductor equipment manufacturers and other industries in the electronic, machine tools, and etc. Case 3 has been able to gain the confidence of its customers through its commitment to quality, reliability, on time delivery and competitive prices.

Case 3's vision is to be a regional supplier of parts and components for testing equipments and semiconductor equipments, and services through vertically integrated contract manufacturing solutions. The mission of Case 3 is to delight the customers by providing industrial leading quality at a competitive price while exceeding on-time delivery expectations.

Stage 1: Scope Issues

The need for the review of competitive position of the company was proactive.

1.1 Identify Business Area for Review

In this stage, Case 3 has identified the semiconductor and testing equipment business area for the purpose of review of competitive position. Case 3 manufactures parts and components for testing equipments and semiconductor equipments, and provides services through vertically integrated contract

manufacturing solutions. The over-riding challenge for Case 3 was to reduce costs in manufacturing of testing equipment for the hard-disk drive and front-end semiconductor equipment business. They also wanted to reduce costs, improve quality, flexibility, dependability in their manufacturing operation for the back-end semiconductor equipment business.

1.2 Competitive Strategy Review

The project members were asked to assess the 30 statements in relation to the company's current and desired competitive strategy. The results of the assessment were as follow:

Current Competitive Strategy: From the assessment, Case 3's current competitive strategy was assessed to be Operational Excellence. Case 3 currently tries to achieve best quality product and provides the best total cost and delivery on time. The core processes include end-to-end product delivery and customer service. Case 3 also emphasises on process redesign and continuous improvement and actively pursues lean manufacturing.

Desired Competitive Strategy: From the assessment, the desired competitive strategy was also assessed as Operational Excellence. In the future the Case 3 would also focus on best quality product and provides the best total cost and delivery on time.

1.3 Competitive Gap Analysis

The summary of competitive gaps showed that in the area of operational excellence the company currently matched with the customer requirement and competitor performance, and exceeded in quality conformance. Hence the company was not only able to fulfill customer requirement satisfactorily but also outdo the competitors. However, the company lagged behind the competitors in after sales support.

1.4 Alignment check between performance and strategy

Stage 1.2 has established that both the current and desired strategies of the company were Operational Excellence. Hence, the current competitive gaps between the company and competitors performance were critical and improvement were needed in the areas of Customer Intimacy and Operational Excellence.

Stage 2: Identify Key Decision Criteria

2.1 Selection of FACTS Criteria

The company's project members proposed a number of criteria for each of the FACTS through the brainstorming session and they were asked to vote the criteria which were the most important in assessing the project initiatives.

For the Financial Issues, profit margin was identified as important followed by manufacturing cost and cost of development effort. For Attitude/Acceptability, the members considered corporate support, workforce co-operation and the management capability to implement as important issues. For the third issue on Capability/Competence, important criteria identified were impact on customer required activities, the resource capacity and impact on core activity. For the fourth issue on Technological Issue, key facts such as technology capability, impact on existing products, process life cycle and process maturity were identified. Finally for Strategic Issue, important facts identified included fit with customer requirement, impact on competitiveness and overall strategic fit were essential.

2.2 Weighting of FACTS Criteria

After summarising FACTS, profit margin was at the top of the priority list and followed by resource capacity, fit with customer requirement, corporate support and technology capability.

2.3 Consistency Check on FACTS Criteria

The profit margin from any project was considered the most important criteria in the selection of project. In addition, there must be sufficient resource capacity to implement the project. At the same time, it was important for Case 3 to fit with customer requirement, corporate support and technology capacity. Therefore, the key decision criteria were consistent with the company's scope issues.

Stage 3: Identify Activity Landscape

Once the initial activity map was drawn, the Significant Activities (SA) were identified and they included design, product definition and schedule, product transfer, production capacity, purchasing, customer service, standard parts purchase, quality control, new technology and market diversification The corresponding Related Activities (RA) identified were production department and sales department.

Stage 4: Assess Impact

4.1 Condition Analysis and 4.2 Action Analysis

At this stage, the strengths of the company were identified as product definition and schedule, product transfer and customer service, which needed to be kept and continue to grow. To overcome the weaknesses, the company needed to adopt new technologies, in-source standard parts purchase, reduce product price by increasing production capacity. The opportunity such as market diversification was considered necessary to bring in-house.

4.3 Gross SA Impact Analysis

From the gross impact score of this analysis, Significant Activities (SA) such as machine setup, product definition and schedule, market diversification have considerably positive impact on the key decision criteria.

4.4 Gross RA Impact Analysis

According to the gross impact score on RA impact analysis, Related Activities (RA) such as production and sales department were vital to the key decision criteria.

4.5 Net Impact and Ranking Analysis

Based on the Net impact score, the top three rankings were product definition and schedule, production capacity and customer service. Therefore, the ranking were also consistent with the company's scope issues identified in Stage 1.

Stage 5: Consolidate Outcomes

This final stage combined all the decisions agreed upon during the process and then provided a basis for validation and implementation.

5.1 From Issues Statement

Case 3 aimed to reduce costs in manufacturing of testing equipment for the hard-disk drive and front-end semiconductor equipment business. They also wanted to reduce costs, improve quality, flexibility, dependability in their manufacturing operation for the back-end semiconductor equipment business.

5.2 From Key Decision Criteria (From FACTS)

The profit margin was at the top of the priority list and followed by resource capacity, fit with customer requirement, corporate support and technology capability.

5.3 From Significant Activities and proposed actions

This stage highlighted the Significant Activities (SA) and the proposed actions taken by the company, which is shown in Table C.7.

Table C.7: Significant activities and proposed actions (Case 3)

Significant Activities Considered (*taken from STAGE 2)*	Proposed Actions (*taken from STAGE 4*)
Design	Keep & grow
Product definition and schedule	Keep & grow
Product transfer	Keep & grow
Production capacity	Keep & grow
Purchasing	Keep & grow
Standard parts purchase	In-source
Quality control	Keep & grow
Customer service	Keep & grow
New Technology	Outsource
Market Diversification	Bring In house

Table C.8: Related activities and net impact score (Case 3)

Significant Activities Considered (taken from STAGE 2)	Proposed Actions (taken from STAGE 4)	Related Activities Considered (taken from STAGE 3)	RA Impact Form (taken from STAGE 4)	Net Impact Score (Rank) (taken from STAGE 4)
Design	Keep & grow	Design dept	-	4
Product definition and schedule	Keep & grow	Production dept	Will enhance product quality	5
Product transfer	Keep & grow	Production dept	Will enhance product quality	10
Production capacity	Keep & grow	Production dept	-	9
Purchasing	Keep & grow	Purchasing dept	-	3
Standard parts purchase	In-source	Purchasing dept	-	1
Quality control	Keep & grow	QC dept	-	6
Customer service	Keep & grow	Sales & Marketing dept	Will improve after sales support	7
New Technology	Outsource	Production dept	Will increase market share	8
Market Diversification	Bring In house	Sales & Marketing dept		2

Table C.9: Allocate future actions, responsibilities and timescale (Case 3)

Significant Activities Considered (*taken from STAGE 2)*	Net Impact Score (Rank) (*taken from STAGE 4*)	Future Actions	Responsibilities	Time scale
Design	4	Keep & grow	Design dept	
Product definition and schedule	5	Keep & grow	Production dept	
Product transfer	10	Keep & grow	Production dept	
Production capacity	9	Keep & grow	Production dept	9 mths
Purchasing	3	Keep & grow	Purchasing dept	6 mths
Standard parts purchase	1	In-source	Purchasing dept	
Quality control	6	Keep & grow	QC dept	6 mths
Customer service	7	Keep & grow	Sales & Marketing dept	
New Technology	8	Outsource	Production dept	
Market Diversification	2	Bring In house	Sales & Marketing dept	6 mths

5.4 From Related Activities, RA impact form and net impact score

This stage highlighted the Related Activities (SA), the RA impact form and the net impact score as shown in Table C.8.

5.5 Allocate future actions, responsibilities and timescale

Besides identifying the significant activities, future actions were allocated, individual responsibilities assigned and the timescale were also determined for executing these actions. This is shown in Table C.9.

4. CASE 4: APPLICATION OF THE SELECTED METHODOLOGY

Case 4 is a Singapore company that designs, manufactures and markets Computer Numerical Control (CNC) machining centers regionally. Case 4 has subsidiaries strategically located in Singapore and China. The company planned to focus strongly on research and development to enable the company to become a leading regional machine tools builder. Through its subsidiary companies, Case 4 offers many types of services including major overhauling and retrofitting on all types of CNC equipment, factory automation and robotics. Their main customers include industries in automobile parts machining, die/mold machining (plastic injection) and aerospace components machining. The major competitors of Case 4 are very well established brand names in the machine tool industry. The German and Japanese are the leaders in developing new technologies in machine design.

Case 4's vision is to become the regional leader in machine tool by 2008 and plans to increase the production output, and shorten the lead-time and delivery time to customers.

Stage 1: Scope Issues

The need for the review of competitive position of the company was proactive.

1.1 Identify Business Area for Review

In this stage, Case 4 has identified the milling machine business area for the purpose of review of competitive position. Case 4 designs, manufactures and markets Computer Numerical Control (CNC) machining centers regionally. The over-riding challenge for Case 4 was to become the regional leader in machine tool by 2008 and to increase the production output, and shorten the lead-time and delivery time to customers. They also wanted to sustain the customer orders, stay competitive in the market, introduce new technologies, strengthen R&D to design and build value-added intelligent machines.

1.2 Competitive Strategy Review

The project members were asked to assess the 30 statements in relation to the company's current and desired competitive strategy. The results of the assessment were as follow:

Current Competitive Strategy: From the assessment, Case 3's current competitive strategy was assessed to be Operational Excellence. The company currently offers the best quality product at the best total cost to customers. To do so, it has standardised and efficient operating procedures, quick delivery, dependable services and low cost product and service support.

Desired Competitive Strategy: From the assessment, the desired competitive strategy was also assessed as Product Leadership. In the future, the company plans to focus on invention, commercialisation and market exploitation, by frequently reviewing its product portfolio. They plan to focus on product technology, reduce R&D cycle time and time to market, so that they can be the provider of leading products to be offered at premium prices.

1.3 Competitive Gap Analysis

The summary of competitive gaps showed that in the area of operational excellence the company currently matched with the customer requirement, but lagged the competitor performance in product availability. In terms of product leadership, the company lagged behind the competitors in product attributes, time to market and especially in new product introduction rate.

1.4 Alignment check between performance and strategy

Stage 1.2 has established that the current and desired strategies of the company were Operational Excellence and Product Leadership respectively. Hence, the current competitive gaps between the company and competitors performance were critical and improvement were needed in the areas of Operational Excellence and Product Leadership.

Stage 2: Identify Key Decision Criteria

2.1 Selection of FACTS Criteria

The company's project members proposed a number of criteria for each of the FACTS through the brainstorming session and they were asked to vote the criteria which were the most important in assessing the project initiatives.

For the Financial Issues, profit margin was identified as important followed by capital employed, manufacturing cost, and cost of development effort. For Attitude/Acceptability, the members considered that the management capability to implement was the highest importance fact. For the third issue on Capability/Competence, the degree of change in core competence requirement and ability to retain required competence were vital. For the fourth issue on Technological Issue, key facts such as new product leadership in market place and process maturity were identified. Finally for Strategic Issue, important facts

identified included overall strategic fit, relationship impact and fit with customer requirements were essential.

2.2 Weighting of FACTS Criteria

After summarising FACTS, profit margin was at the top of the priority list and followed by management capability to implement, fit with customer requirement, process maturity and degree of change in core competence requirement.

2.3 Consistency Check on FACTS Criteria

The profit margin from any project was considered the most important criteria in the selection of project. In addition management must have sufficient means to implement the project. At the same time it was important for the company's strategy to fit with customer requirements. Therefore, the key decision criteria were consistent with the company's scope issues.

Stage 3: Identify Activity Landscape

Once the initial activity map was drawn, the Significant Activities (SA) were identified and they included rough/fine machining of raw casting, optional features sub-assembly, final sub-assemblies for spindle sub-assembly, bed/column/table sub-assembly and coolant tank sub-assembly, product transfer, design and prototyping, standard parts purchase, design definition and specification, customer service, new product development and market diversification. Related Activities (RA) identified were production department and market survey.

Stage 4: Assess Impact

4.1 Condition Analysis and 4.2 Action Analysis

At this stage, the strengths of the company were identified which included design

and prototyping, design definition and specification for turnkey applications, customer service, new product development, standard parts purchase (bought from local market) and product transfer. Weaknesses identified included rough/fine machining of raw castings, optional features sub-assembly, and final sub-assemblies which were required to be outsourced. The opportunity such as market diversification was considered necessary to bring in-house.

4.3 Gross SA Impact Analysis

From the gross impact score of this analysis, Significant Activities (SA) such as raw casting machining, product transfer and standard parts supply have considerably positive impact on the key decision criteria.

4.4 Gross RA Impact Analysis

According to the gross impact score on RA impact analysis, Related Activities (RA) such as design and prototyping and market diversification were vital to the key decision criteria.

4.5 Net Impact and Ranking Analysis

Based on the Net impact score, the top three rankings are design and prototyping, design definition and specification and new product development Therefore, the ranking were also consistent with the company's scope issues identified in Stage 1.

Stage 5: Consolidate Outcomes

This final stage combined all the decisions agreed upon during the process and then provided a basis for validation and implementation.

5.1 From Issues Statement

Case 4 aimed to become the regional leader in machine tool by 2008 and to increase the production output, and shorten the lead-time and delivery time to customers. They also wanted to sustain the customer orders, stay competitive in the market, introduce new technologies, strengthen R&D to design and build value-added intelligent machines.

5.2 From Key Decision Criteria (From FACTS)

The profit margin was at the top of the priority list and followed by management capability to implement, fit with customer requirement, process maturity and degree of change in core competence requirement.

5.3 From Significant Activities and proposed actions

This stage highlighted the Significant Activities (SA) and the proposed actions taken by the company, which is shown in Table C.10.

5.4 From Related Activities, RA impact form and net impact score

This stage highlighted the Related Activities (SA), the RA impact form and the net impact score as shown in Table C.11.

5.5 Allocate future actions, responsibilities and timescale

Besides identifying the significant activities, future actions were allocated, individual responsibilities assigned and the timescale were also determined for executing these actions. This is shown in Table C.12.

Table C.10: Significant activities and proposed actions (Case 4)

Significant Activities Considered (*taken from STAGE 2)*	Proposed Actions (*taken from STAGE 4*)
Raw casting machining	Outsource
Optional features sub assembly	Outsource
Final sub assembly	Outsource
Product transfer	Bring-in-house
Design & prototyping	Keep & grow
Standard parts supply	Bring-in-house
Design definition & specification	Keep & grow
Customer service	Keep & grow
New product development	Keep & grow
Market diversification	Bring-in-house

Table C.11: Related activities and net impact score (Case 4)

Significant Activities Considered (taken from STAGE 2)	Proposed Actions (taken from STAGE 4)	Related Activities Considered (taken from STAGE 3)	RA Impact Form (taken from STAGE 4)	Net Impact Score (Rank) (taken from STAGE 4)
Raw casting machining	Outsource	Production dept	-	4
Optional features sub assembly	Outsource	Production dept	Will reduce time and labor cost	5
Final sub assembly	Outsource	Production dept	Will reduce time and labor cost	3
Product transfer	Bring-in-house	R&D dept	-	1
Design & prototyping	Keep & grow	R&D dept	Will reduce time and labor cost	10
Standard parts supply	Bring-in-house	Supplier	-	6
Design definition & specification	Keep & grow	Turnkey Application dept	-	9
Customer service	Keep & grow	Customer Service dept	-	7
New product development	Keep & grow	R&D dept	-	8
Market diversification	Bring-in-house	Market survey	Will make new products available to right market segment	2

Table C.12: Allocate future actions, responsibilities and timescale (Case 4)

Significant Activities Considered (*taken from STAGE 2)*	Net Impact Score (Rank) (*taken from STAGE 4*)	Future Actions	Responsibilities	Time scale
Raw casting machining	4	Outsource	Production dept	
Optional features sub assembly	5	Outsource	Production dept	
Final sub assembly	3	Outsource	Production dept	
Product transfer	1	Bring in-house	R&D dept	
Design & prototyping	10	Keep & grow	R&D dept	6 mths
Standard parts supply	6	Bring in-house	Supplier	6 mths
Design definition & specification	9	Keep & grow	Turnkey Application dept	6 mths
Customer service	7	Keep & grow	Customer Service dept	6 mths
New product development	8	Keep & grow	R&D dept	6 mths
Market diversification	2	Bring in-house	Market survey	

APPENDIX D: POST ASSESSMENT RESULTS OF CASE STUDY APPLICATIONS OF SELECTED METHODOLOGY

CASE 1: POST ASSESSMENT RESULTS

1. CASE 1 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**			
Respondents	R1	R2	R3	Average
Q.1 Completeness	4	4	4	4.0
Q.2 Consistency	5	4	5	4.7
Q.3 Applicability	4	5	4	4.3
Q.4Contingency	2	4	5	3.67
Total Average				16.67
On a scale of 1 to 5 = 4 X 5 = 20	Total			83.35%

USABILITY

Criteria	**Usability**			
Respondents	R1	R2	R3	Average
Q.6 Time	4	4	2	3.3
Q.7 Ease of Use	4	4	4	4.0
Q.8 Understanding	4	4	4	4.0
Q.9 Robustness	4	4	4	4.0
Q.10 Issues	4	4	2	3.3
Q.11 Preparation	2	2	4	2.7
Q.12 Participation	4	2	4	3.3
Q.13 Case Study	4	4	5	4.3
Q.14 Consultation	1	2	5	2.7
Total Average				31.6
On a scale of 1 to 5 = 9 X 5 = 45	Total			70.22%

USEFULNESS

Criteria	**Usefulness**			
Respondents	R1	R2	R3	Average
Q.23 Successful	4	5	4	4.33
Q.24 Effectiveness	4	5	5	4.67
Q.25 Contribution	4	3	4	3.67
Q.26 Influence	5	4	3	4
Q.27 Efficiency	4	2	4	3.3
Q.28 Usefulness	4	4	5	4.3
Total Average				24.3
On a scale of 1 to 5 = 6 X 5 = 30	Total			81%

CASE 2: POST ASSESSMENT RESULTS

1. CASE 2 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**				
Respondents	R1	R2	R3	R4	Average
Q.1 Completeness	2	3	2	4	2.75
Q.2 Consistency	2	4	4	2	3
Q.3 Applicability	2	3	4	3	3
Q.4Contingency	2	2	2	4	2.5
Total Average					11.25
On a scale of 1 to 5 = 4 X 5 =20	Total				56.25%

USABILITY

Criteria	**Usability**				
Respondents	R1	R2	R3	R4	Average
Q.6 Time	2	3	4	4	3.25
Q.7 Ease of Use	2	2	4	3	2.75
Q.8 Understanding	2	1	4	5	3
Q.9 Robustness	2	2	2	3	2.25
Q.10 Issues	2	2	4	4	3
Q.11 Preparation	2	1	4	2	2.25
Q.12 Participation	2	2	4	4	3
Q.13 Case Study	2	2	4	4	3
Q.14 Consultation	3	3	4	4	3.5
Total Average					26
On a scale of 1 to 5 = 9 X 5 = 45	Total				57.8%

USEFULNESS

Criteria	**Usefulness**				
Respondents	R1	R2	R3	R4	Average
Q.23 Successful	3	2	4	4	3.25
Q.24 Effectiveness	3	2	3	4	3
Q.25 Contribution	3	2	4	5	3.5
Q.26 Influence	2	3	4	4	3.25
Q.27 Efficiency	1	2	4	3	2.5
Q.28 Usefulness	2	3	4	4	3.25
Total Average					18.75
On a scale of 1 to 5 = 6 X 5 = 30	Total				62.5%

CASE 3: POST ASSESSMENT RESULTS

1. CASE 3 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**						
Respondents	R1	R2	R3	R4	R5	R6	Average
Q.1 Completeness	4	2	5	4	4	5	4
Q.2 Consistency	2	1	2	5	4	4	3
Q.3 Applicability	3	4	3	4	4	4	3.67
Q.4 Contingency	0	3	4	4	5	4	3.33
Total Average							12.5
On a scale of 1 to 5 = 4 X 5 = 20	Total						70%

USABILITY

Criteria	**Usability**						
Respondents	R1	R2	R3	R4	R5	R6	Average
Q.6 Time	2	2	4	5	3	2	3
Q.7 Ease of Use	2	2	2	4	4	4	3.0
Q.8 Understanding	4	4	2	5	4	2	3.5
Q.9 Robustness	3	4	4	5	5	2	3.83
Q.10 Issues	4	4	2	2	4	4	3.33
Q.11 Preparation	2	2	4	5	4	1	3.0
Q.12 Participation	4	4	4	5	4	4	4.17
Q.13 Case Study	2	4	4	5	4	2	3.5
Q.14 Consultation	2	2	4	4	4	3	3.17
Total Average							30.5
On a scale of 1 to 5 = 8 X 5 = 40	Total						67.78%

USEFULNESS

Criteria	**Usefulness**						
Respondents	R1	R2	R3	R4	R5	R6	Average
Q.23 Successful	2	2	4	4	4	3	3.17
Q.24 Effectiveness	3	3	5	4	5	2	3.67
Q.25 Contribution	3	2	5	4	4	3	3.5
Q.26 Influence	3	2	4	4	4	3	3.33
Q.27 Efficiency	1	3	5	4	4	2	3.17
Q.28 Usefulness	2	2	2	3	4	1	2.33
Total Average							19.17
On a scale of 1 to 5 = 6 X 5 = 30	Total						63.9%

CASE 4: POST ASSESSMENT RESULTS

1. CASE 4 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**					
Respondents	R1	R2	R3	R4	R5	Average
Q.1 Completeness	4	4	4	5	4	4.2
Q.2 Consistency	4	4	2	5	4	3.8
Q.3 Applicability	5	4	3	4	3	3.8
Q.4 Contingency	4	2	1	4	2	2.6
Total Average						14.4
On a scale of 1 to 5 = 4 X 5 = 20	Total					72%

USABILITY

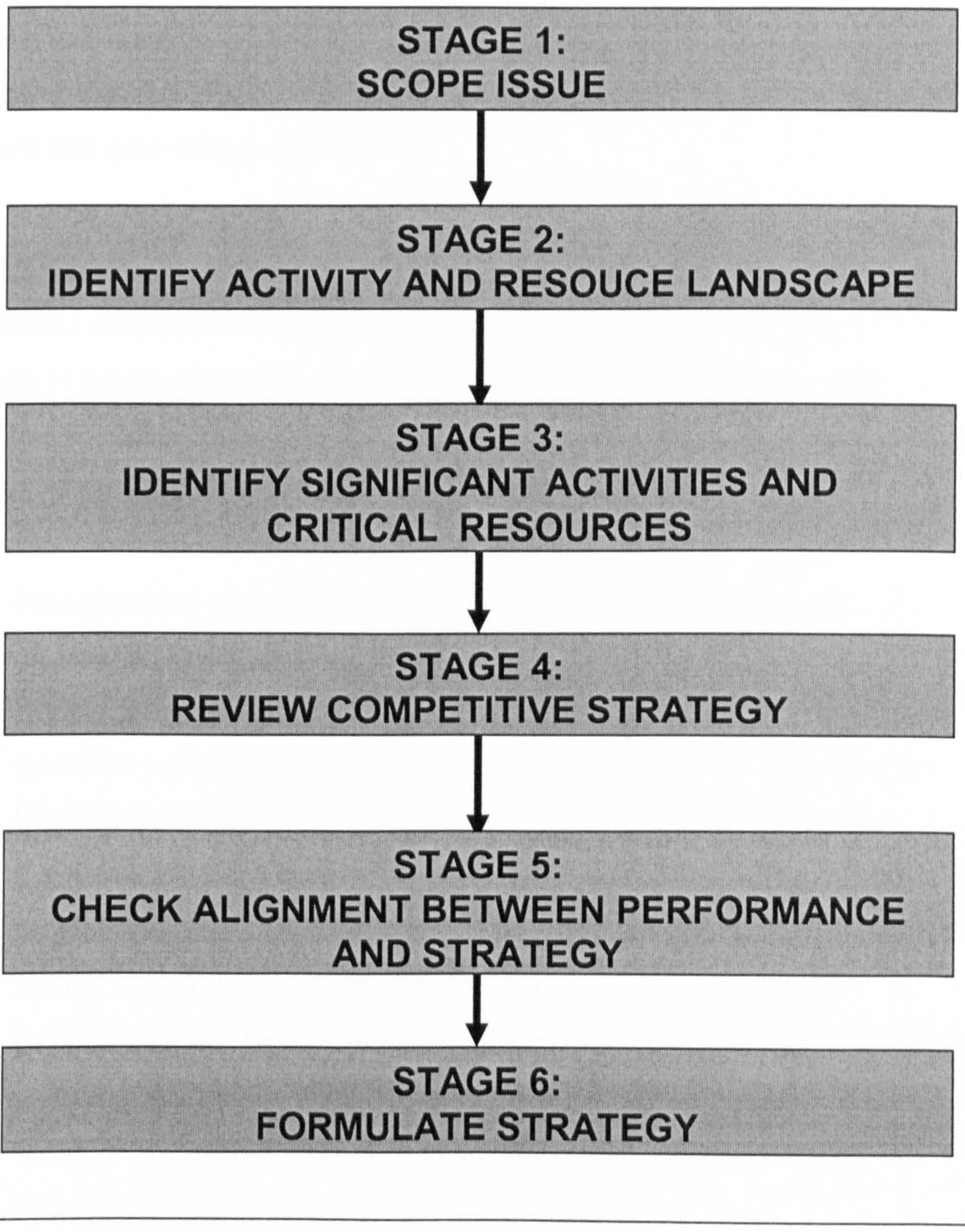
Criteria	**Usability**					
Respondents	R1	R2	R3	R4	R5	Average
Q.6 Time	4	5	2	4	3	3.6
Q.7 Ease of Use	4	2	1	5	2	3.2
Q.8 Understanding	4	2	1	4	4	3
Q.9 Robustness	4	4	2	5	4	3.8
Q.10 Issues	4	4	2	4	2	3.2
Q.11 Preparation	3	2	2	4	2	2.6
Q.12 Participation	4	2	2	4	4	3.2
Q.13 Case Study	4	4	3	4	3	3.6
Q.14 Consultation	4	4	2	4	2	3.2
Total Average						26.2
On a scale of 1 to 5 = 9 X 5 = 45	Total					65.3%

USEFULNESS

Criteria	**Usefulness**					
Respondents	R1	R2	R3	R4	R5	Average
Q.23 Successful	5	5	2	4	2	3.6
Q.24 Effectiveness	4	5	3	4	3	3.8
Q.25 Contribution	4	4	3	4	2	3.4
Q.26 Influence	4	5	3	4	3	3.8
Q.27 Efficiency	5	5	2	5	2	3.8
Q.28 Usefulness	5	5	3	5	2	4
Total Average						22.4
On a scale of 1 to 5 = 6 X 5 = 30	Total					74.67%

APPENDIX E: PILOT SSCP METHODOLOGY

STRATEGIC SUPPLY CHAIN POSITIONING METHODOLOGY



STAGE 1	SCOPE ISSUES

Objective

To identify/confirm/select which part of the organisation will be analysed for the project. The overall objective for this first STAGE 1 is to produce an Issues Statement that specifies which part of the organisation is being considered and what are the over-riding problems.

Procedure

The project members will have received and read the Briefing Document (Getting Started) in advance of the workshop. All members should be explained clearly about the theme of Strategic Supply Chain Positioning (SSCP) methodology and the goal of the project.

a. Presentation about the SSCP methodology is shortly and clearly elucidated to the project members.
b. Short presentation of the company, organisation charts, products, customers and competitors by the project leader, as specified in the Briefing Document.
c. Discussion based on both presentation, and on preparation completed by project members in advance. Need to get agreement of scope area for review and is recorded on Worksheet 1a.
d. Even where the review is being undertaken as part of a proactive strategic planning process, the project members may want the review to reflect some over-riding issues or challenges. If so, these should be recorded on Worksheet 1a.

Worksheet 1a: Scope Issue

Brief but clear description of the part of the organisation under consideration. (Need to define industry, organisation, product, customer and competitor)	
Over-riding issues/problems *	

*Optional

STAGE 2	IDENTIFY ACTIVITY AND RESOURCE LANDSCAPE

Objective

The objective of STAGE 2 is to produce an unfiltered landscape of activities and resources of the company that are involved in delivering the products and services identified.

Activity landscape is mapped according to the organisational processes which have the 4 interfaces to the supply chain such as suppliers, customers, product range and infrastructure. Resource landscape is then mapped according to the activity landscape.

The outputs from this stage are the initial activity and resource landscape maps of the company. To realise this stage 2 of the methodology, the following two steps are carried out:

- STEP 2.1: Identify Initial Activity Map

- STEP 2.2: Identify Initial Resource Map

STEP 2.1	IDENTIFY INITIAL ACTIVITY MAP

Objective

The objective of STEP 2.1 is to identify and map all the related activities within the company which have the 4 interfaces with the supply chain, namely: suppliers, customers, infrastructure and product range.

Procedure

a. It is crucial that all activities are mapped out by the help of project members, and no filtering should be carried out. These activities may be internal or external to the organisation.

b. It is important that these activities are considered and identified at the appropriate level, which are neither broad nor narrow. If the activity is broad, it may have no meaning to the project. On the other hand, if it is narrow, several steps have to take action to do so.

c. A worksheet (Worksheet 2.1a) is therefore provided, using the swim-lane and process activity block approach, to guide the project members to visually map out all the activities in blocks.

d. In the worksheet 2.1a, the company-wide activities or departments are mapped first in the left-hand column. This is then followed by mapping the detailed process activities which are taking place within them in the right-hand side of the worksheet 2.1a.

STEP 2.2	IDENTIFY INITIAL RESOURCE MAP

Objective

The objective of STEP 2.2 is to identify and map all the resources that are related to each of the activities within the company that have been mapped in STEP 2.1.

Procedure

a. A table of resource classifications (Table 2.2a) consisting of six resource categories – physical, financial, human, technological, organisational and reputation, including their descriptions and example of resources, is provided to guide the project members to identify the various resources.

b. It is important to clearly explain the descriptions of these resource categories to all project members. Care must be taken in explaining intangible resources which are difficult to clarify.

c. A worksheet (Worksheet 2.2a) is provided for the project members to record the detailed process activities identified in STEP 2.1 and map the related resource types underpinning each of these activities.

d. Close guidance by facilitator is needed at this stage to help the project members to understand, identify and develop the resource map, especially for those intangible resources.

Worksheet 2.1a: Initial Activity Mapping

Company-wide Activity	Process Activity

Table 2.2a: Resource Classifications

Resources	Description
Physical resources	All the firm's assets with the physical form
Financial resources	The firm's borrowing capacity and its internal funds generation determine its resilience and capacity for investment
Human resources	Human available, expertise, skills and know-how which are capable by firm.
Technological resources	Technology that are advanced and may be high-tech so that competitors can not utilise easily
Organisational resources	Skills of groups as well as the organisational routines and interactions through co-ordinations
Reputation	the opinion that customers have about the company, or how much value or recognise, based on past events

Worksheet 2.2a: Initial Resource Mapping

Company-wide Activity	Resources					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation

STAGE 3	IDENTIFY SIGNIFICANT ACTIVITIES AND CRITICAL RESOURCES

Objective

The objective of STAGE 3 is to identify and provide a landscape of significant activities and critical resources based on evaluation of the results of STAGE 2.

After identifying the initial activity and resource maps, it is important to identify the significant activities and critical resources which play important roles for the company to achieve sustainable competitive advantage. Significant activities are activities which are more important then others to the company. Critical resources are the core resources of the company underpinning these activities.

The final output from this stage is a summary list of significant activities and critical resources of the company that can provide a sustainable competitive advantage for the company. This stage 3 of the methodology is executed in the following 2 steps:

- STEP 3.1: Identify Significant Activities

- STEP 3.2: Identify Critical Resources

STEP 3.1	IDENTIFY SIGNIFICANT ACTIVITIES

Objective

The objective of STEP 3.1 is to identify the significant activities from the initial activity map identified in STEP 2.1

Procedure

a. A worksheet (Worksheet 3.1a) is provided for the project members to first record the detailed process activities identified in STEP 2.1, and then to identify the significant activities from them.

b. The project members then brainstorm, evaluate, and identify the significant activities, based on their current and future importance to the company. Each project member rate the importance of each activity based on their current and future importance to the company on a scale of 1-5 as follow:

1	=	least important
2	=	less important
3	=	some important
4	=	important
5	=	very important

c. This step has proposed to limit the maximum number of significant activities identified to 10. Therefore, project members will select not more than 10 activities, based on the highest scores, as significant activities.

STEP 3.2	IDENTIFY CRITICAL RESOURCES

Objective

The objective of STEP 3.2 is to identify the critical resources from the initial resource map identified in STEP 2.2

Procedure

a. A table of evaluation criteria for critical resources (Table 2.3a) consisting of five criteria – superiority, imitability, durability, substitutability, and appropriability, including their descriptions and measurement scales, is provided to guide the project members to evaluate and identify critical resources.

b. It is important to clearly explain the descriptions of these resource categories to all project members. Care must be taken in explaining intangible resources which are difficult to clarify.

c. A worksheet (Worksheet 3.2a) is provided for the project members to first record the detailed resource types identified in STEP 3.2, and then to brainstorm, evaluate, and identify the critical resources, based on the five evaluation criteria.

d. Similar to STEP 3.1, close guidance by facilitator is needed at this STEP 3.2 to help the project members to understand the evaluation criteria and measurement scale, so as to identify critical resources.

e. When both the significant activities and critical resources are identified, they are then recorded on worksheet 3.2b.

Worksheet 3.1a: Identify Significant Activities

Process Activity Name	Importance						Total Score	Remarks
	Current			Future				
	A	B	C	A	B	C		

A, B, & C indicate 3 company members

Level of importance 1 <least> to 5 <most> important

Table 3.2a: Evaluation Criteria for Critical Resources

Measures	Description	Scale
Superiority	Evaluates if and to what extent the resource contributes to differentiating the company from its competitors	1 (Low value) <> 5 (High value)
Imitability	Analyses actual and potential competitors' difficulty in imitating the resource, e.g., its physical uniqueness, path dependency, casual ambiguity or economic deterrence	1 (Easy to acquire) <> 5 (Difficult to acquire)
Durability	Measures if the resource's benefits will also be generated in the long term	1 (Short life span) <> 5 (Long life span)
Substitutability	Assesses how difficult it is for competitors to replace the resource with an alternative that gives the same advantages	1 (Easy to replace) <> 5 (Difficult to replace)
Appropriability	Verifies if the company owning the resource is able to exploit the generated advantages generated in the market	1 (Lesser portion of market profit) <> 5 (Higher portion of market profit)

Worksheet 3.2a: Identify Critical Resources

Process Activity Name		Measures					C R
Resources		Sup	I	D	Sub	A	
Physical							
Financial							
Human							
Technological							
Organisational							
Reputation							

Sup – Superiority; I – Imitability; D – Durability; Sub – Substitutability; A – Appropriability; CR – Critical Resource

Worksheet 3.2b: Summary of Significant Activities and Critical Resources

Significant Process Activities		Critical Resources					
		Physical	**Financial**	**Human**	**Technological**	**Organisational**	**Reputation**

STAGE 4	REVIEW COMPETITIVE STRATEGY

Objective

The objective of STAGE 4 is to firstly understand and confirm the company's current strategy and subsequently the desired strategy for the future. By analysing current and desired strategy, project members can have clear ideas of the required actions to be taken to meet the strategy.

Secondly, this stage also analyses the competitive gaps between the company performance and customer requirements and competitor performance. The competitive gaps analysis is made to understand where any gaps exist between what you achieve and what your customers want and your performances compare with competitors.

The outputs of this stage are the current and desired competitive strategy as well as the competitive gap analysis. This stage comprises of the following 2 steps:

- STEP 4.1: Identify Current and Desired Competitive Strategy

- STEP 4.2: Analyse Competitive Gaps

STEP 4.1	IDENTIFY CURRENT AND DESIRED COMPETITIVE STRATEGY

Objective

The objective of STEP 4.1 is to identify, confirm, and select the current and desired overall competitive strategy for the part of the organisation selected in STAGE 1. This strategy will place emphasis on either of the generic strategies of Customer Intimacy, Operational Excellence or Product Leadership.

Procedure

a. A worksheet (Worksheet 4.1a) is provided to guide the project members to assess and establish the current strategy of the company. Each project member is to assess a number of statements in relation to the company's current approach to business.

b. Another similar worksheet (Worksheet 4.1b) is provided to guide the project members to assess and establish the desired competitive strategy of the company. This time each project member is to assess the statements in relation to how the company should be doing business in the future. This is to establish the desired strategy for the company in the future.

c. Each member then scores their own answers, in categories C, O, and P using worksheet 4.1c. Explanation of the results and the underlying reasoning behind the approach is then carried out by the facilitator.

d. A brief discussion by the facilitator to confirm results of scores, and transformation of the average scores into the current and desired competitive strategy.

STEP 4.2	ANALYSE COMPETITIVE GAPS

Objective

The objective of STEP 4.2 is to understand and analyse the performance gaps between the company and customer requirement as well as competitor performance.

Procedure

a. A worksheet (Worksheet 4.2a) is provided to guide project members to analyse how their current company performance, as measured by a number of key criteria, compares with customer requirements.

b. Using worksheet 4.2a and marking with a *RED* pen, each project member assesses how their current company performance, as measured by a number of key criteria, compares with *customer requirements*. Brief descriptions of the criteria are provided in Table 4.2a.

c. Another similar worksheet (Worksheet 4.2b) is provided to guide project members to analyse their company performance as compared with competitor performance. Using marking with a *BLUE* pen, each project member assesses how their current company performance, as measured by the same key criteria, compares with *competitor performance*.

d. Project members compare their results for both worksheets, and arrive at a consensus. Discussion will be necessary in order to agree on the final group scores. The group results are marked using a summary worksheet 4.2c, again using red and blue to denote customer requirements and competitor performance respectively.

Worksheet 4.1a: Current Competitive Strategy

Consider how each of following statements applies to your *current approach to business*. Tick the appropriate column for each statement (Agree, Disagree, Don't Know)

Statement	Agree	Dis-Agree	Don't Know
1. Our services provide exactly what our customers need			
2. Our core processes are client acquisition and development, and solution development			
3. We are intolerant to error, mistakes, and poor quality and provide zero defect service to our customers			
4. We win the market through great products and invent, develop, and market – fast			
5. Important improvement levers for us are process redesign and continuous improvement			
6. Our company is recognised as a provider of best total solution – provide better overall result for the clients than anyone else			
7. We target our R & D towards development of devices that are smaller, faster, lighter, cooler, cheaper and whatever constitutes better performance than those existing			
8. A customer is not dependent on us we dependent on him, customer satisfaction is the first thing			
9. We provide swift delivery and dependable service			
10. Our employees jobs are structured around the creation of products, not around any particular function			
11. We believe in solving customers broader problem – attend to much broader range of client's need			
12. We are passionate about measuring and monitoring to ensure rigorous quality and cost control			
13. We have compensation systems that reward success and constant product innovation is encouraged			
14. We recognise that the company's current success and future prospects lie in its talented product design people and those who support them			
15. We often put ourselves at risk to further our client's success			
16. We actively collect performance feedback from our customers			
17. We provide product reliability, durability, dependability at the lowest total cost			
18. We focus on the core processes of invention, product development, and market exploitation			
19. We have standardised and efficient operating			

procedures.			
20. We have deep customer knowledge and insights about the client's underlying processes			
21. Being creative is most important for us & we are trend setters and pioneers in the products we create			
22. Our company is recognised as a provider of best total cost.			
23. We try to minimise our distribution and transportation costs.			
24. We have the responsiveness-willingness to help customers and provide prompt service			
25. In our company the team is what counts not the individual			
26 Our company is recognised as a provider of leading products & we produce a continuous stream of state-of-art products and services			
27. We understand how changes to our service offer will benefit our customers			
28. We avoid variety in products and maintain a very narrow product line.			
29. We recognise the need to educate and lead the market regarding the use and benefits of new and innovative products			
30. We believe in retiring (making obsolete) our own products before our competitors do			

Worksheet 4.1b: Desired Competitive Strategy

Consider how each of following statements applies to your *how your company should be doing business in the future*. Tick the appropriate column for each statement (Agree, Disagree, Don't Know)

Statement	Agree	Dis-Agree	Don't Know
1. Our services provide exactly what our customers need			
2. Our core processes are client acquisition and development, and solution development			
3. We are intolerant to error, mistakes, and poor quality and provide zero defect service to our customers			
4. We win the market through great products and invent, develop, and market – fast			
5. Important improvement levers for us are process redesign and continuous improvement			
6. Our company is recognised as a provider of best total solution – provide better overall result for the clients than anyone else			
7. We target our R & D towards development of devices that are smaller, faster, lighter, cooler, cheaper and whatever constitutes better performance than those existing			
8. A customer is not dependent on us we dependent on him, customer satisfaction is the first thing			
9. We provide swift delivery and dependable service			
10. Our employees jobs are structured around the creation of products, not around any particular function			
11. We believe in solving customers broader problem – attend to much broader range of client's need			
12. We are passionate about measuring and monitoring to ensure rigorous quality and cost control			
13. We have compensation systems that reward success and constant product innovation is encouraged			
14. We recognise that the company's current success and future prospects lie in its talented product design people and those who support them			
15. We often put ourselves at risk to further our client's success			
16. We actively collect performance feedback from our customers			
17. We provide product reliability, durability, dependability at the lowest total cost			
18. We focus on the core processes of invention, product development, and market exploitation			

19. We have standardised and efficient operating procedures.			
20. We have deep customer knowledge and insights about the client's underlying processes			
21. Being creative is most important for us & we are trend setters and pioneers in the products we create			
22. Our company is recognised as a provider of best total cost.			
23. We try to minimise our distribution and transportation costs.			
24. We have the responsiveness-willingness to help customers and provide prompt service			
25. In our company the team is what counts not the individual			
26 Our company is recognised as a provider of leading products & we produce a continuous stream of state-of-art products and services			
27. We understand how changes to our service offer will benefit our customers			
28. We avoid variety in products and maintain a very narrow product line.			
29. We recognise the need to educate and lead the market regarding the use and benefits of new and innovative products			
30. We believe in retiring (making obsolete) our own products before our competitors do			

Worksheet 4.1c: Individual score sheet for worksheets 4.1a and 4.1b

* Put a tick in this column against all those statements that you ticked as AGREE on worksheet 4.1a (your current approach to business)

** Put a tick in this column against all those statements that you ticked as AGREE on worksheet 4.1b (how the company should be doing business in the future)

Statement	Strategy indicator	4.1a (Current*)	4.1b (Future**)
1.	C		
2.	C		
3.	O		
4.	P		
5.	O		
6.	O		
7.	P		
8.	C		
9.	O		
10.	P		
11.	C		
12.	O		
13.	P		
14.	P		
15.	C		
16.	C		
17.	P		
18.	P		
19.	O		
20.	C		
21.	P		
22.	O		
23.	O		
24.	C		
25.	O		
26.	P		
27.	C		
28.	O		
29.	P		
30.	P		

Add your number of Cs, Os, Ps for each column and enter in the Table below

Current scores	**No. of Cs**		**No. of Os**		**No. of Ps**	
Future scores	**No. of Cs**		**No. of Os**		**No. of Ps**	

Table 4.2a: Description of Criteria

Criteria	Descriptions
Service Customisation	Some products sell because the producer is able to offer a tailored service package to customers. The customisation can cover all aspects such as pre-sales activity to understand and meet individual requirements; tailored delivery service such as frequency, volume, and packaging.
Product Customisation	Some products sell because they suit an individual customer's specification. These include both one-offs, and standard products which have a standard design but which require modification for a particular application. This could also be called design flexibility.
After-sales Support	This can include technical support, training, repairs, supply of spares. The range and quality of after-sales services may be critical both in obtaining sales, and in achieving customer loyalty.
Product Availability	This means the supply of a product to a customer on or before the quoted delivery date. In the case where your customer is a consumer, this may mean on-shelf availability. Some companies may call this delivery reliability.
Product Price	For some customers, value for money is paramount. In this case, their consideration is of the total cost of purchasing products from you. This total cost will include purchase price as well as other costs of doing business with you, such as time and convenience.
Quality Conformance	This means both conformance to specification (the product performs as specified) and reliability in use (the product continues to perform for an extended period). Product reliability may be more important to a customer than other attributes such as technological or aesthetic considerations.
Product Attributes	A product may sell because it has some feature that is not available from competitors (latest or unique technology perhaps), or because its performance in a particular feature is superior to its competitors. In some cases, market position is affected by the product variety on offer.
Time to Market	This is concerned with how effective you are at converting ideas into products. In some markets, the firm that gets the orders is the one that gets its products and services on to the market first. This measure will be affected by your ability to manage the development or design of the processes required to get your new products from concept stage to market place.
New Product Introduction Rate	This is about the amount of innovation taking place within the company. It can be measured by counting the number of new or enhanced products or services introduced each year

Worksheet 4.2a: Gap with Customer Requirements

	We lag			We match*			We exceed
	-3	-2	-1	0	1	2	3
Service customisation							
Product customisation							
After sales support							
Product availability							
Product price							
Quality conformance							
Product attributes							
Time to market							
New prod. introduction rate							

OUR performance compared with our customers(mark as CR in RED)

Worksheet 4.2b: Gap with Competitor Performance

	We lag			We match*			We exceed
	-3	-2	-1	0	1	2	3
Service customisation							
Product customisation							
After sales support							
Product availability							
Product price							
Quality conformance							
Product attributes							
Time to market							
New prod. introduction rate							

OUR performance compared with our competitors (mark as CP in BLUE)

Worksheet 4.2b: Summary of Competitive Gaps

	We lag			We match*			We exceed
	-3	-2	-1	0	1	2	3
Service customisation							
Product customisation							
After sales support							
Product availability							
Product price							
Quality conformance							
Product attributes							
Time to market							
New prod. introduction rate							

OUR performance compared with our customers(mark as CR in RED)
OUR performance compared with our competitors (mark as CP in BLU E)

STAGE 5	ALIGNMENT CHECK BETWEEN PERFORMANCE AND STRATEGY

Objective

The objective of STAGE 5 is to check the alignment considering the current and desired strategy, significant activities, critical resources, and competitive gaps.

From the alignment check, it can be observed whether the company's critical resources and activities can be used to enhance the competitive strategy to gain sustainable competitive advantage. Required changes can then be implemented to minimise the competitive gaps.

The outputs for this stage are the alignment checks for significant activities/critical resources and strategy, and competitive gaps and strategy. To realise this STAGE 5, the following 2 steps are carried out:

- STEP 5.1: Alignment of Significant Activities and Critical Resources, and Strategy

- STEP 5.2: Alignment of Competitive Gaps and Strategy

STEP 5.1	ALIGNMENT OF SIGNIFICANT ACTIVITIES AND CRITICAL RESOURCES, AND STRATEGY

Objective

The objective of STEP 5.1 is to identify those areas where the current significant activities and critical resources do not match the current competitive strategy.

Procedure

a. A worksheet (Worksheet 5.1a) is provided to guide project members to record the current significant activities and critical resources, including the current competitive strategy.

b. From this worksheet, project members can clearly notice whether the company's core activities and resources are supporting the strategy and can then review and discuss the gaps.

STEP 5.2	ALIGNMENT OF COMPETITIVE GAPS AND STRATEGY

Objective

The objective of STEP 5.2 is to identify those areas where the current company performance does not match the requirements of the desired competitive strategy.

Procedure

a. In this step, a worksheet (Worksheet 5.2a) is provided to guide project members to record the gaps between the company performance and customer requirement as well as competitor performance, including the desired competitive strategy.

b. Similarly this summary worksheet guides the project members to review and discuss these gaps by considering the desired competitive strategy.

Worksheet 5.1a: Alignment of Significant Activities and Critical Resources, and Strategy

Significant Process Activity	Critical Resources						Customer Intimacy	Operational Excellence	Product Leadership
	Physical	Financial	Human	Technological	Organisational	Reputation			

Worksheet 5.2a: Alignment of Competitive Gaps and Strategy

Summary of Competitive Gaps								Customer Intimacy		Operational Excellence		Product Leadership	
	Lag			Match	Exceed								
	-3	-2	-1	0	1	2	3						
Service customisation													
Product customisation													
After sales support													
Product availability													
Product price													
Quality conformance													
Product attributes													
Time to market													
New product Introduction rate													
Aggregate scores for current and desired competitive strategies							50						
							40						
							30						
							20						
							10						
								Current	Desired	Current	Desired	Current	desired

STAGE 6	FORMULATE STRATEGY

Objective

The objective of the final STAGE 6 of the methodology is to combine all the decisions agreed upon, and to analyse and propose the actions to be taken for the significant activities and critical resources to achieve the desired strategy and to minimise the competitive gaps.

In performing this stage, it is important to remember that new decisions and issues from previous stages may have arisen which may not have been noted. This stage provides a basis for validation and formulation of the implementation plan. The final output from this stage is the summary of proposed actions. There are 3 steps associated with STAGE 6 and these are:

- STEP 6.1: Propose Actions for Significant Activities
- STEP 6.2: Propose Actions for Critical Resources
- STEP 6.3: Summary of Proposed Actions

STEP 6.1	PROPOSE ACTIONS FOR SIGNIFICANT ACTIVITIES

Objective

The objective of STEP 6.1 is to propose the actions to be carried out for the related significant activities to achieve the desired strategy and to minimise the competitive gaps.

Procedure

a. A worksheet (Worksheet 6.1a) is provided to guide project members to record the related significant activities and brainstorm to propose the actions to be taken.

b. From this worksheet, possible appropriate actions suggested include the following:

- Keep & strengthen, grow or nurture
- Outsource, eliminate need for
- Leave outside & strengthen, grow outside, add/change suppliers
- bring in-house & make strength

c. Actions proposed may be different according to the opinion of project members, and therefore facilitation is necessary to get acceptable agreement and actions.

STEP 6.2	PROPOSE ACTIONS FOR CRITICAL RESOURCES

Objective

The objective of STEP 6.2 is to propose the actions to be carried out for the related critical resources underpinning those related activities identified in STEP 6.1, to achieve the desired strategy and to minimise the competitive gaps.

Procedure

a. A worksheet (Worksheet 6.2a) is provided to guide project members to record the related critical resources and brainstorm to propose the actions to be taken.

b. From this worksheet, possible appropriate actions suggested include the following:

   - Invest, upgrade, leverage
   - Retire, retrench
   - Develop new resources

c. Actions proposed may be different according to the opinion of project members, and therefore facilitation is necessary to get acceptable agreement and actions.

STEP 6.3	SUMMARY OF PROPOSED ACTIONS

Objective

The objective of STEP 6.3 is to provide a summary of all the proposed actions recommended for the significant activities and critical resources of the company.

Procedure

a. A summary worksheet (Worksheet 6.3a) is provided to guide project members to list all the proposed actions recommended for all related significant activities as well as critical resources from STEPS 6.1 and 6.2.

b. This STEP 6.3 and worksheet provides a basis for validation and formulation of the implementation plan for the proposed actions to be taken.

Worksheet 6.1a: Actions for Significant Activities

Significant Activities	Actions to be taken

Possible appropriate actions:

- Keep & strengthen, grow or nurture
- Outsource, eliminate need for
- Leave outside & strengthen, grow outside, add/change suppliers
- bring in-house & make strength

Worksheet 6.2a: Actions for Critical Resources

Critical Resources	Actions to be taken

Possible appropriate actions:

- Invest, upgrade, leverage
- Retire, retrench
- Develop new resources

Worksheet 6.3a: Summary of Proposed Actions

Significant Activities	Action to Activities	Invest Resource	Upgrade Resource	Leverage Resource	Retire Resource	Retrench Resource	Develop new Resource

APPENDIX F: CASE STUDY APPLICATIONS OF PILOT SSCP METHODOLOGY

APPENDIX F: CASE STUDY APPLICATIONS OF PILOT SSCP METHODOLOGY

This appendix describes the application of the pilot SSCP methodology in the four different case studies by the participating companies identified in Section 8.2. The application of the methodology in the four participating companies is to observe the methodology in practice in real industry setting and to establish future research needed. The following sections describe each individual company as well as the application of the six-stage methodology within each company.

1. CASE 5: APPLICATION OF THE PILOT SSCP METHODOLOGY

Case 5 is a company established in 1987, and is today one of Asia's leading distributors of high quality mobile and industrial hydraulic components. Besides the Singapore office and workshop, it has two other branches located in Malaysia and Thailand. The products are distributed to local and overseas customers in South East Asia region and are used in a wide range of industries, including construction, manufacturing and marine.

The company aims to be the leader in the customisation of hydraulics accessories for low volume pump and cylinder (repair and replacement), and is continuously improving in the area of customisation in order to gain broader market share and meet the demand of customers. Case 5 also plans to have localised operations in every South East Asian country by providing a complete source of high quality and great value customised fluid power products, so as to expand in tandem with the fast growing regional markets. The main products of Case 5 include hydraulic cylinders, cylinder D.I.Y kits, radial piston pump and valves, and fluid power components and accessories

Stage 1: Scope Issues

Case 5's area of business is mainly in the hydraulics accessories distribution by customising and providing to 100 percent needs of the customers. Hence, hydraulics accessories distribution business has been identified as the focus area for the application of the methodology. Being a small company, management has identified that the product or business area selected for the purpose of review of competitive position needed to cover the whole company. The over-riding challenge for Case 5 was to be the leader in the customisation of hydraulics accessories. Although Case 5's operation is now fully in the customisation of products, but due to increasing demand of the market, it still needs to continuously improve in customisation in order to meet the increasing demand of customers and gain larger market share.

Stage 2: Identify Activity and Resource Landscape

Step 2.1: Identify Initial Activity Map

The company's project members have identified six company level activities and these include: suppliers, branches, warehouse and distribution, accounting and administration, workshop, and sales. From these company level activities, the related process activities were then identified. For warehouse and distribution, there are process activities such as purchasing, distribution and delivery. For accounting and administration, process activities identified include administration, HR, and accounting. The activities within workshop include drawing, machining, welding, assembly, test and QC. The activities for sales include sale and Marketing, forecasting, order processing and quotation. The initial activity map illustrating these activities and their relationship is shown in Figure F.1.

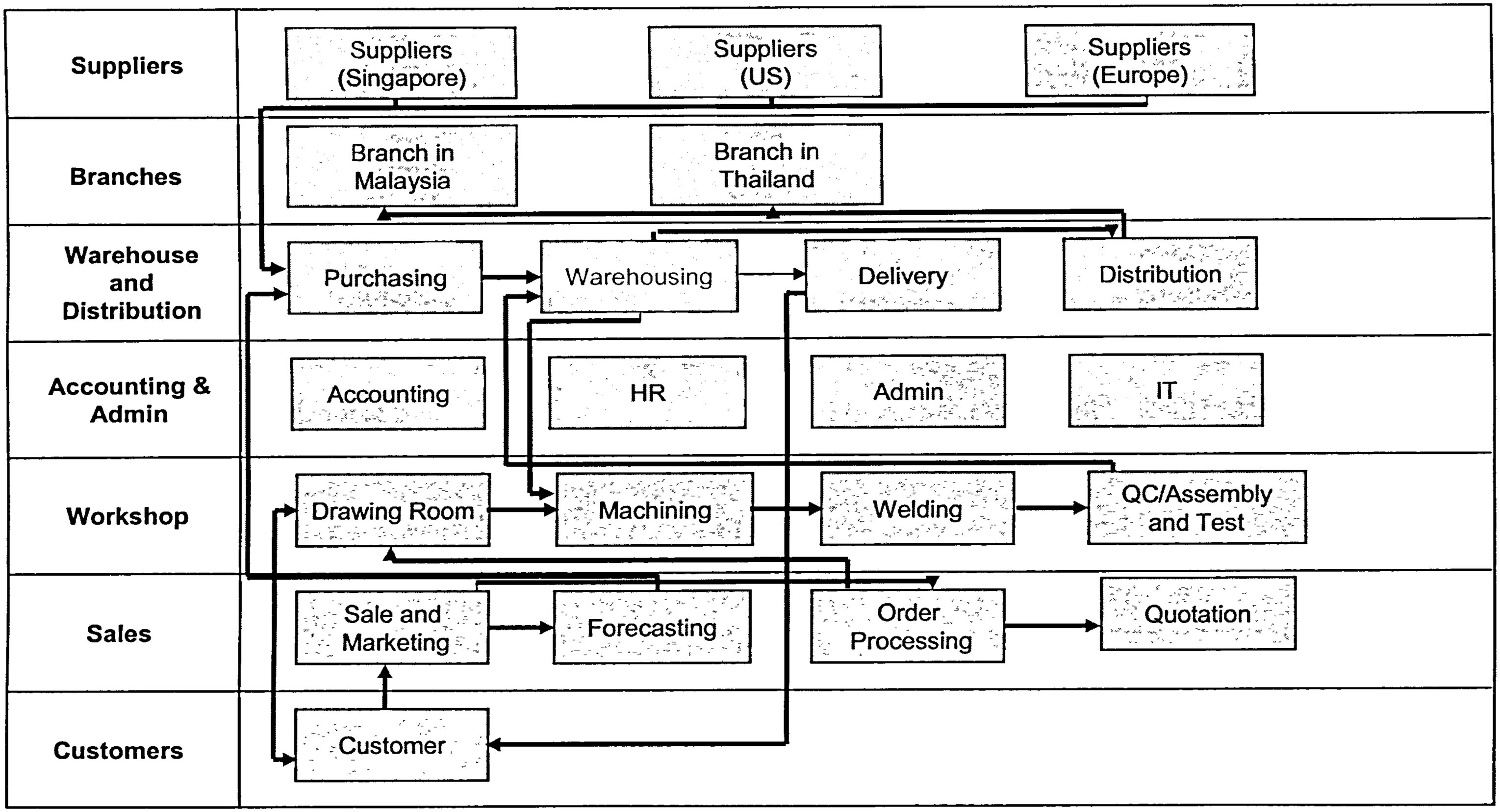


Figure F.1: Initial Activity Map for Case 5

Worksheet F.1: Initial Resource Map for Case 5

Warehouse and Distribution	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Purchasing	Supplier quotation documentation	Capital	Purchasers		Network with suppliers, know-how in market	
Warehousing	Building, Crane, Folk lift, Conveyer.		Storekeepers		Inventory control system	
Delivery	Truck		Workers, drivers		Sub-contract network	
Distribution	Certificate, Export/import documentation	Letters of Credit	Understanding in export/import nature of work		Relationship with logistic company, dealer network, Joint Venture	
Accounting & Admin	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Accounting	Accounting documentation,		Accounting staffs with basic accounting skill			
HR & Admin	Detailed payment slips		Skill concerning with office paper work		Communication with employee especially for their matters	

Workshop	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Drawing	Computers,		Designers, Related skill in CAD/CAM	AutoCAD, CAD/CAM	Negotiation with customer requirement	
Machining	CNC, lathes, milling machines	Investment for machining	Operators, leadership skill		Tightly coupled network with drawing room	
Welding	Welding machine		Welders, Basic essential skills		Organisational culture	
QC/Assembly & Test	Equipments	Reinforcement in required equipments	Expertise in end products		Organisational culture (supervised closely by owner to make the ends meet)	
Sales	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Sale and marketing	Customer requirement documentation		Sales persons, Sale expertise		Reward system, Network with suppliers and customers, Alignment within company	
Forecasting	Forecasting documentation		Knowledge of market demand		Strong network in market, organisation culture	
Order processing	Detailed order documentation				Relationship with supervisor	
Quotation	Customer quotation				Strong team work	

Step 2.2: Identify Initial Resource Map

After mapping the initial activities of the company, the initial resource map was developed as shown in Worksheet F.1 based on the resource category of physical, financial, human, technological, organisational, and reputation, which cover all tangible and intangible resources of the company. Physical resources identified are the warehouses, vehicles, machines, computers and office rooms. Financial resources include capital, investment in machine and credits. Human resources include job skills in welding, designing, operations, and experience and expertise in end products. Technological resources include AutoCAD and CAD/CAM. Organisational resources include network with suppliers, relationship with logistic company, dealer network, joint venture and organisational culture.

Stage 3: Identify Significant Activities and Critical Resources

Step 3.1: Identify Significant Activities

At this stage, project members were tasked to identify the significant activities of the company. A worksheet was provided for the project members to rate the importance of each activity based on their current and future importance to the company on a scale of 1-5. From the project, the members have identified significant activities as purchasing, machining, welding, distribution, QC/assembly, sales and marketing, forecasting, order processing, and quotation.

Step 3.2: Identify Critical Resources

Similarly, in this section, the project members were tasked to identify the critical resources of the company. To do this, a table of evaluation criteria comprising of criteria like superiority, imitability, durability, substitutability, and appropriability was provided to guide the members in the evaluation and selection of critical resources. Critical resources identified include network with suppliers, organisational culture, logistic network relationship with logistic company, dealer network, expertise in end products, knowledge of market demand, leadership

Worksheet F.2: Summary of Significant Activities and Critical Resources for Case 5

Significant Activity	Critical Resources					
	Physical	**Financial**	**Human**	**Technological**	**Organisational**	**Reputation**
Purchasing					Network with suppliers	
Distribution					Relationship with logistic company, dealer network, Joint Venture	On time delivery
Machining			Leadership skill			
Welding					Organisational culture	
QC/Assembly test			Expertise in end products		Organisational culture	
Sale and marketing					Network with suppliers & customers; Alignment within company	
Forecasting			Knowledge of market demand		Network with other sectors; Organisational culture	
Order processing					Relationship with supervisors	
Quotation					Strong team work	

skill, network with customers, alignment within company, relationship with supervisors and strong team work.

Step 3.3: Summaries of Significant Activities and Critical Resources

After the project members have completed Steps 3.1 and 3.2, both the significant activities and critical resources are summarised and shown in Worksheet F.2.

Stage 4: Review Competitive Strategy

At this stage the project members were tasked to analyse the current and future competitive strategy for the part of the organisation selected, based on the list of statements structured to identify the business strategy. The project senior members' experience and knowledge of the company strategy and operation were used as the input of this stage and the relevant conclusion were made based on the agreement of the project members.

Step 4.1: Identify Current Strategy and Future Strategy

From the assessment of current strategy, Case 5's current competitive strategy was assessed to be Customer Intimacy. Case 5 is a distributor company with not much technology or operational advantages. The company has therefore always tried to improve its strong relationship with customers, by improving the operation efficiency, on time delivery, and reduce the inventory cost. From these facts, the current business strategy has been confirmed to be Customer Intimacy.

From the assessment of future strategy, Case 5's desired competitive strategy was assessed to be also Customer Intimacy. In order for Case 5 to gain customer satisfaction for all customers, the company needs to focus on service customisation and product customisation. In addition, Case 5 also needs to

improve in the area of after sales support, which is becoming very important to the customers. From these facts, the desire future business strategy has been confirmed as Customer Intimacy.

Step 4.2: Analyse Competitive Gaps

After specifying current and future competitive strategy, gap analysis is to be carried out to make alignment between the desired level of strategy and the performance level that the company can provide. The two areas to be considered are company performance level and its customer requirements level as well as competitor performance level. According to the results, Case 5 was found to exceed its competitors in the area of service customisation and product price. However the company lagged behind competitors and in fulfilling customer requirement in the area of product availability, time to market and new product introduction rate.

Stage 5: Check Alignment between Performance and Strategy

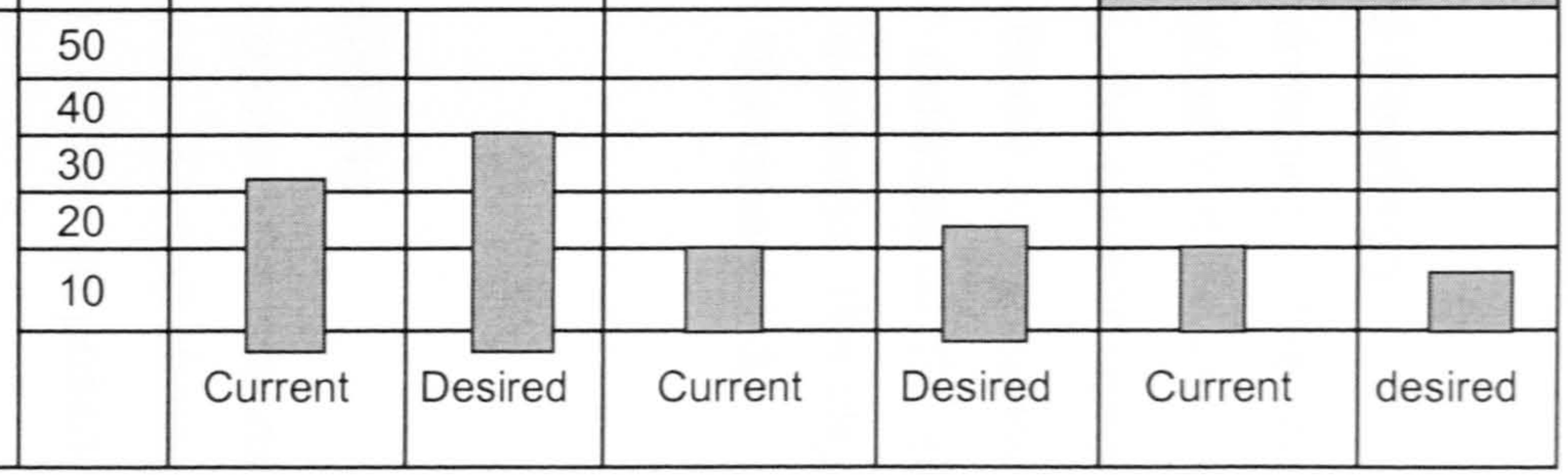
Step 5.1: Alignment of Significant Activities and Critical Resources, and Strategy

In this stage, the project members identified whether the current significant activities and critical resources are aligned and support the current competitive strategy. According to the results in the worksheet, the project members have identified the significant activities of purchasing, distribution, machining, welding, and QC/assembly and their related critical resources as supporting Operational Excellence. On the other hand, the significant activities of sales and marketing, forecasting, order processing, and quotation have been identified as supporting Customer Intimacy.

Worksheet F.3: Alignment of Competitive Gaps and Strategy for Case 5

Summary of Competitive Gaps								Customer Intimacy	Operational Excellence	Product Leadership
	Lag			Match	Exceed					
	-3	-2	-1	0	1	2	3			
Service customisation				**CPCR**						
Product customisation					**CR**	**CP**				
After sales support				**CPCR**						
Product availability		**CPCR**							- 2 CP, - 2 CR	
Product price				**CR**		**CP**				
Quality conformance				**CP**	**CR**					
Product attributes				**CP**	**CR**					
Time to market		**CR**		**CP**						- 2 CR
New product Introduction rate	**CPCR**									- 3 CP, -3 CR

Aggregate scores for current and desired competitive strategies



Step 5.2: Alignment of Competitive Gaps and Strategy

Step 4.1 has established that the current and desired strategies of the company were both Customer Intimacy, and Step 5.1 has established that the Operational Excellence is an important supporting strategy. Hence, the current competitive gaps between the company and customers and competitors performance were critical and improvement were needed in the area of Operational Excellence. Further improvement in Customer Intimacy would also be needed. The alignment of competitive gaps and strategy for Case 1 is shown in Worksheet F.3.

Stage 6 – Formulate Strategy

Step 6.1: Propose Actions for Significant Activities

At this stage, the project members brainstormed and proposed the actions to be carried out for the related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.4.

Step 6.2: Propose Actions for Critical Resources

Once the actions to be taken for the significant activities were proposed, the project members then proposed the actions to be carried out for the related critical resources underpinning those related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.4.

Step 6.3: Summary of Proposed Actions

In the final stage, the project members summarised the proposed actions for the significant activities and critical resources of the company in a summary worksheet as shown in Worksheet F.4. Upon completion of the methodology, Case 5, as a distributor, found that their current and desired strategies are

Worksheet F.4: Summary of Proposed Actions for Case 5

Significant Activities	Action to Activities	Invest Resource	Upgrade Resource	Leverage Resource
Purchasing	Keep & strengthen		Network with suppliers	
Distribution	Strengthen, grow outside			Relationship with logistic company, dealer network, Joint Venture
Machining	Grow		Leadership skill	
Welding	Grow		Organisational culture	
QC/Assembly test	Keep	Expertise in end products	Organisational culture	
Sale and marketing	Keep & strengthen, Grow	Network with suppliers & customers; Alignment within company		
Forecasting	Grow	Network with other sectors; Organisational culture	Knowledge of market demand	
Order processing	Grow and make a strength		Relationship with supervisors	
Quotation	Keep		Strong team work	

mainly concerned with Customer Intimacy and their performance exceeded their competitors. Their significant activities such as sales and marketing, order processing and etc. are also very aligned to Customer Intimacy, with other supporting activities like distribution, machining and QA/QC assembly aligning to Operational Excellence. Their critical resources are mainly human and organisational resources where they have vast experiences and essential knowledge, while their physical and technological resources have no advantages over others. Case 5 was found to be totally lagging in Product Leadership, but no action was proposed since Case 5 is not a Product Leadership company.

2. CASE 6: APPLICATION OF THE PILOT SSCP METHODOLOGY

Case 6 is one of the contract manufacturing companies operating in the metal industry, supplying various kinds of metal accessories for different customers. The company is now manufacturing various kinds of metal sheets by the operations of drilling, milling, grinding, shaping, and coating, so as to fulfill the requirements of the customers. Case 6's main target market is the oil and gas industry providing metal accessories to its customer with hundred percent satisfactions by applying on-time delivery with the introduction of full quality and reliable products. Case 6 is also currently manufacturing the metal related accessories for the aerospace and semiconductor industries

For industrial challenges, Case 6 is firstly facing the problem of on-time delivery where only 65% of work done have been delivered on time. Secondly, as a contract manufacturing company, their two main customers make up 80% of all their orders which is risky for the company if these orders were to terminate.

Stage 1: Scope Issues

Case 6's main clients are in the oil and gas industry which make up about 80% of their orders. Since the company is a SME, management has decided to apply

the methodology to cover the whole company. For the over-riding challenge faced by Case 6, firstly they are facing the problem of on-time delivery whereby only 65% of work done have been delivered on time. The reason has been attributed to the loosely coupled network of front-end customer sites with the back-end production sites. Furthermore, as a contract manufacturing company, their two main customers make up 80% of all their orders, which is risky for the company if these orders were to terminate. The company, therefore, wants to reduce relying on the 2 main customers by pursuing new customers to approximately equal the order percentage.

Stage 2: Identify Activity and Resource Landscape

Step 2.1: Identify Initial Activity Map

The company's project members have identified six company level activities and they are suppliers, purchasing, production, QA/QC, sales and customer support. From these company level activities, the related process activities were then identified. For purchasing, the process activities include purchasing of raw materials and components from suppliers worldwide, store at the warehouse and delivery. The process activities for production include CAD/CAM, planning, milling, grinding, shaping and drilling. For QA/QC, the process activities include sub-out, processing, IT, CMM and manual check. The process activities for sales include sales engineering, order processing, and accounting. The initial activity map illustrating these activities and their relationship is shown in Figure F.2.

Step 2.2: Identify Initial Resource Map

Similar to Case 5, the project members of Case 6 developed the initial resource map as shown in Worksheet F.5 based on the resource categories of physical, financial, human, technological, organisational and reputation. The physical resources include documentation of the user requirement, order, accounting and

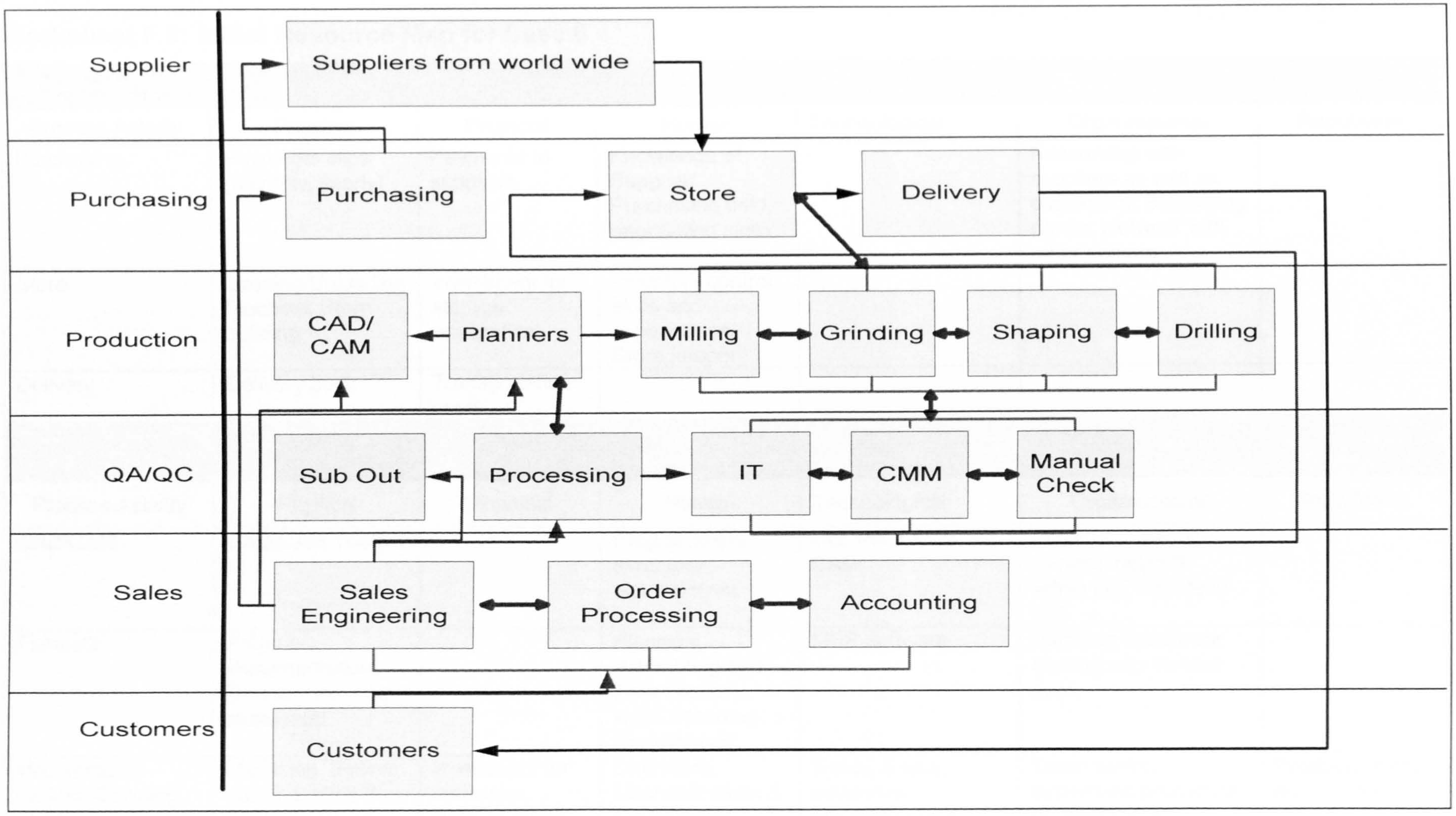


Figure F.2: Initial Activity Map for Case 6

Worksheet F.5: Initial Resource Map for Case 6

Purchasing	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Purchasing	Payments slips (monthly, yearly)	Payments to suppliers	Knowledge of Supplier/ Purchasing field, negotiation skills		Networking with suppliers as well as customers; Bargaining power; Network with other sectors	
Store	Loading/Unloading Machine, Store building	Investment for storage occupation	Inventory control skills and experiences, Store keeper			
Delivery	Delivery truck	Transportation costs				
Production	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
CAD/CAM	CAD/CAM Tools		Programmers' skills and experiences,	UG, PRO ENG, 3D CAD	Alignment with all sectors, network within and outside of firm	
Planners	Project Documentation, Detailed steps by steps map		Planners, Scheduling and Optimisation skills, Planning Experiences	MRP software	Planning team work dealing with various dept.	
Machining (Milling, Grinding, Shaping, Drilling)	Machines, tooling building, shop floor & plant	Investment for machines, tools, building, plants	Operators, Mechanic skills & Experiences, know-how in Oil & Gas industry	3-axis, 5-axis, advanced machining tech.	Team works, systematic procedure of each stages	Products brand and quality

QA/QC	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Sub Out	Contracts, User Requirements, data of sub-contractors		Experiences of outsourcing		Co-ordination with sub-contractors; Bargaining power	
Processing	Details Process Steps Documentation		Process Engineer, Industrial Knowledge plus experiences		Networking with almost all the sectors	
CMM & Manual Check	CMM machines, measuring tools	QA/QC machines investments	Programming skills, QA/QC experiences; Skill of precision	CMM technology		
Sales	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Sales Engineering	Documentation of User Requirements	Investment for new product	Engineering Staffs, Knowledge of marketing & sales		Alignment with all sectors, network within and outside of firm	
Order Processing	Order Documentation,		Customer Order Handling skills		Organisational climate, internal relationship for on time delivery	
Accounting	Profit & loss, Balance sheet, Accounting Documentation		Accountants, Accounting skills & Experiences	Accounting Software	Co-ordination with other departments concerning accounting factors	

processing step, data of sub-contracts, CMM machines and measure tools, CAD/CAM tools, tooling building, shop floor and plant. The financial resources identified include investment of new product, investment of machines, tools and plants, investment for storage, transportation cost. The human resources include the job skills of respective activities. The technological resources include the software of accounting and MRP, CMM technology, UG, PRO ENG, 3D CAD and 3-axis, 5-axis, advanced machining tech. The organisation resources include alignment and co-ordination with the internal or external departments to realise the relevant activities.

Stage 3: Identify Significant Activities and Critical Resources

Step 3.1: Identify Significant Activities

After identifying the initial activity map, the project members brainstormed to identify those significant activities, since not all the activities are equally important. Accordingly, the project members have identified the significant activities as purchasing, CAD/CAM, machining, CMM and manual check, planning, processing and sales. These are the activities which are important for the company to increase their future competitive capabilities.

Step 3.2: Identify Critical Resources

Similarly, in this section, the project members were tasked to identify the critical resources of the company. To do this, a table of evaluation criteria comprising of criteria like superiority, imitability, durability, substitutability, and appropriability was provided to guide the members in the evaluation and selection of critical resources. Critical resources identified include shop floor & plant, payments to suppliers, investment for machines, tools, building and plants, programming and designing skills and experiences, know-how in Oil & Gas industry, QA/QC experiences, skills in precision engineering, network within & outside of firm, and products quality.

Step 3.3: Summaries of Significant Activities and Critical Resources

After the project members have completed Steps 3.1 and 3.2, both the significant activities and critical resources are summarised and shown in Worksheet F.6.

Stage 4: Review Competitive Strategy

At this stage the project members were tasked to analyse the current and future competitive strategy for the part of the organisation selected, based on the list of statements structured to identify the business strategy. The project senior members' experience and knowledge of the company strategy and operation were used as the input of this stage and the relevant conclusion were made based on the agreement of the project members.

Step 4.1: Identify Current Strategy and Future Strategy

From the assessment of current strategy, Case 6's current competitive strategy was assessed to be Operational Excellence. Case 6 currently offers the best quality product with the great prices - i.e. it provides the best total cost to customers. To do so, it has standardised and efficient operating procedures, swift delivery and dependable services and low cost product and service support. From these facts, the current competitive strategy of the company has been confirmed to be Operational Excellence.

From the assessment of future strategy, Case 6's desired competitive strategy was assessed to be also Operational Excellence. Case 6 is currently facing the problem of on-time delivery whereby only 65% of work done have been delivered on time. The reason has been attributed to the loosely coupled network of front-end customer sites with the back-end production sites. Furthermore, as a contract manufacturing company, their two main customers make up 80% of all

Worksheet F.6: Summary of Significant Activities and Critical Resources for Case 6

Significant Activity	Critical Resources					
	Physical	**Financial**	**Human**	**Technological**	**Organisational**	**Reputation**
Purchasing		Payments to suppliers				
CAD/CAM			Programming & Designing skills and experiences			
Machining	Shop floor & plant	Investment for machines, tools, building, plants	Know-how in Oil & Gas industry			Products quality
CMM and manual check		QA/QC machines investments	QA/QC experiences, Skills of precision			
Planning			Experiences			
Processing			Industrial experiences			
Sales		Investment for new product	Engineering Staffs, experience		Network within & outside of firm	

their orders, which is risky for the company if these orders were to terminate. The company, therefore, wants to reduce relying on the 2 main customers by pursuing new customers to approximately equal the order percentage. From these facts, the desire future competitive strategy has been confirmed as Operational Excellence.

Step 4.2: Analyse Competitive Gaps

After specifying current and future competitive strategy, gap analysis is to be carried out to make alignment between the desired level of strategy and the performance level that the company can provide. The two areas to be considered are company performance level and its customer requirements level as well as competitor performance level. According to the results, Case 6 was found to currently match with the customer requirement in the area of operational excellence and exceed the competitors in product availability, product price, and quality conformance. However, the company is lagging behind the customer requirement in the area of customer Intimacy, such as product customisation and after sales support.

Stage 5: Check Alignment between Performance and Strategy

Step 5.1: Alignment of Significant Activities and Critical Resources, and Strategy

In this stage, the project members identified the significant activities and critical resources to the 3 competitive strategies: customer intimacy, operational excellence, and product leadership. According to the results in the worksheet, the project members have identified the significant activities of purchasing, CAD/CAM, machining, processing, planning and CMM & manual check and their related critical resources as supporting Operational Excellence. The other significant activity of sales and critical resources are supporting Customer Intimacy.

Step 5.2: Alignment of Competitive Gaps and Strategy

Step 4.1 has established that the current and desired strategies of the company were both Operational Excellence, and Step 5.1 has established that the Operational Excellence is an important supporting strategy. Hence, the current competitive gaps between the company and customers and competitors performance were critical and improvement were needed in the area of Operational Excellence. Further improvement in Customer Intimacy would also be needed. The alignment of competitive gaps and strategy for Case 6 is shown in Worksheet F.7.

Stage 6 – Formulate Strategy

Step 6.1: Propose Actions for Significant Activities

At this stage, the project members brainstormed and proposed the actions to be carried out for the related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.8.

Step 6.2: Propose Actions for Critical Resources

Once the actions to be taken for the significant activities were proposed, the project members then proposed the actions to be carried out for the related critical resources underpinning those related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.8.

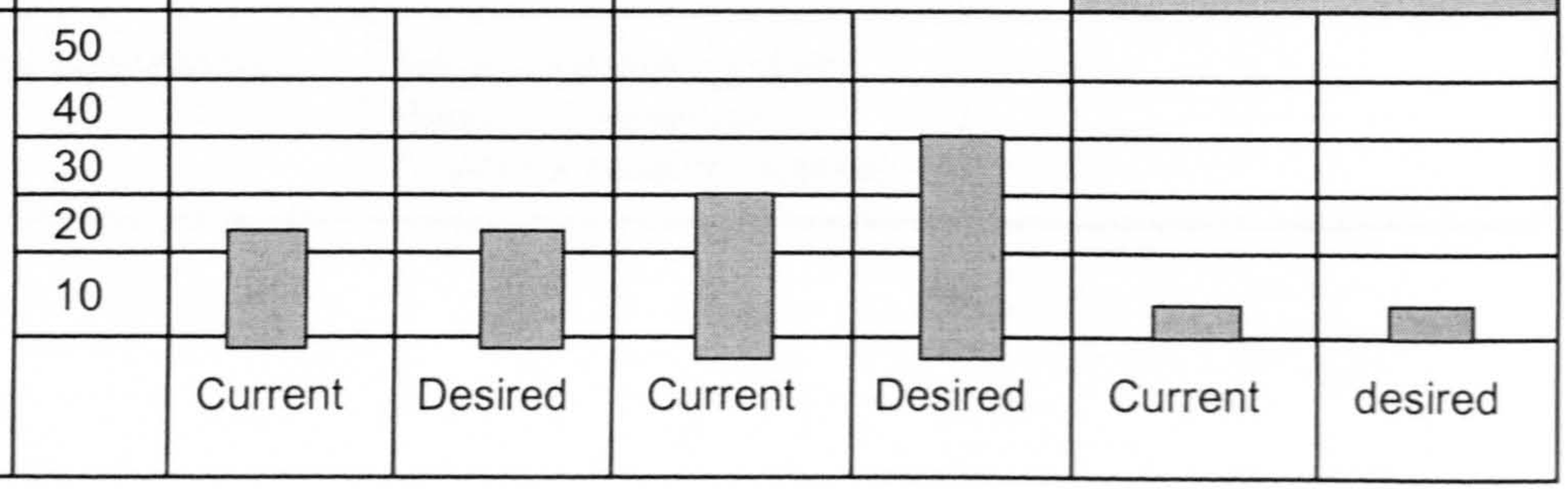
Step 6.3: Summary of Proposed Actions

In the final stage, the project members summarised the proposed actions for the significant activities and critical resources of the company in a summary worksheet as shown in Worksheet F.8. Upon completion of the methodology, Case 6 found that most of the critical resources are from the machining

Worksheet F.7: Alignment of Competitive Gaps and Strategy for Case 6

Summary of Competitive Gaps								Customer Intimacy	Operational Excellence	Product Leadership
	Lag			Match	Exceed					
	-3	-2	-1	0	1	2	3			
Service customisation				**CPCR**						
Product customisation			**CR**		**CP**			- 1 CR		
After sales support			**CR**	**CP**				- 1 CR		
Product availability				**CR**	**CP**					
Product price				**CR**	**CP**					
Quality conformance				**CR**		**CP**				
Product attributes										
Time to market										
New product Introduction rate										

Aggregate scores for current and desired competitive strategies



Worksheet F.8: Summary of Proposed Actions for Case 6

Significant Activities	Action to Activities	Invest Resource	Upgrade Resource	Leverage Resource
Purchasing	Keep & strengthen, Grow		Payment to suppliers	
CAD/CAM	Keep & strengthen, Grow	QA/QC machines investments		Programming & Designing skills and experiences
Machining	Keep & strengthen, Bring in-house & make strength	Shop floor & plant	Know-how in Oil & Gas, Product quality	Investment for machines, tools, building, plants
CMM and manual check	Keep & strengthen		QA/QC expertise	
Planning	Keep & Grow		Planner's skill & experience	
Processing	Keep & strengthen	Processing industrial knowledge	Processing industrial knowledge	
Sales	Keep & strengthen	Investment for new product	Sales engineering staffs, Marketing expertise, Customer relation network	

department, which means that they have better ability in machining to produce good quality products. They also have robust programs for CNC machining in CAD/CAM for their main clients so that lead time is reduced noticeably. It can also be seen that Case 6 has strong financial resources as compared to their competitors because they can invest in new product and project where certain time, money and effort are needed. Some of their new projects are risky and costly and doubtful of success, but they are being carried out for the good of the clients. As a result, strong relationship with customers are developed and long term partnership created, which is very difficult for their competitors to imitate.

3. CASE 7: APPLICATION OF THE PILOT SSCP METHODOLOGY

Case 7 is a machine tool maker with a regional support network. The 2 manufacturing facilities in Singapore and China manufacture CNC turning machines with high performance that meet the high standards of machine quality. By producing machines close to the market, Case 7 understands the needs of the customers and can provide the best after sales services and support in the region. However, due to the dynamic nature of the market and changing demands from the customers, the company is facing keen competitions in the areas of R&D of new machines and providing customer satisfaction.

Furthermore, the number of competitors in the regional market producing similar machines is increasing, and many of the multi-national competitors have R&D centres in the region. It is therefore crucial for Case 7 to identify the capability of the competitors and to upgrade its technology in order to keep abreast with the competitors.

Stage 1: Scope Issues

For industrial challenges, Case 7 is firstly facing customer related problems in

which the company is unable to fully fulfill and support the customer requirements. Secondly, the R&D centre is located in Singapore and in order to access a wider market region as well as to gain the trust of customers, the R&D should move closer to the customers in order to gain a better and deeper understanding of the needs of the customers.

Stage 2: Identify Activity and Resource Landscape

Step 2.1: Identify Initial Activity Map

The company's project members have identified four company level activities and they are warehousing & delivery, engineering, production, and sales. From these company level activities, the related process activities were then identified. For warehousing & delivery, the process activities include ASRS and delivery. The process activities of engineering include D&D comprising of drawing and documentation, and R&D which is basically to customise software. The process activities for production include all the manufacturing processes which are turning, milling, grinding, machine assembly, tooling, fabrication and QC. The process activities for sales include negotiation, order processing, service, and turnkey handling. The initial activity map illustrating these activities and their relationship is shown in Figure F.3.

Step 2.2: Identify Initial Resource Map

Similar to Case 6, the project members of Case 7 developed the initial resource map as shown in Worksheet F.9 based on the resource categories of physical, financial, human, technological, organisational and reputation. The physical resources include ASRS system, delivery trucks, computers, documentation of design data, general/turning/milling/grinding/laser machines, CMM machines and satellite order and communication equipment. The human resources include the job skills, experiences and technical background of the respective activities. The technological resources include the AS 400, simulation and control software,

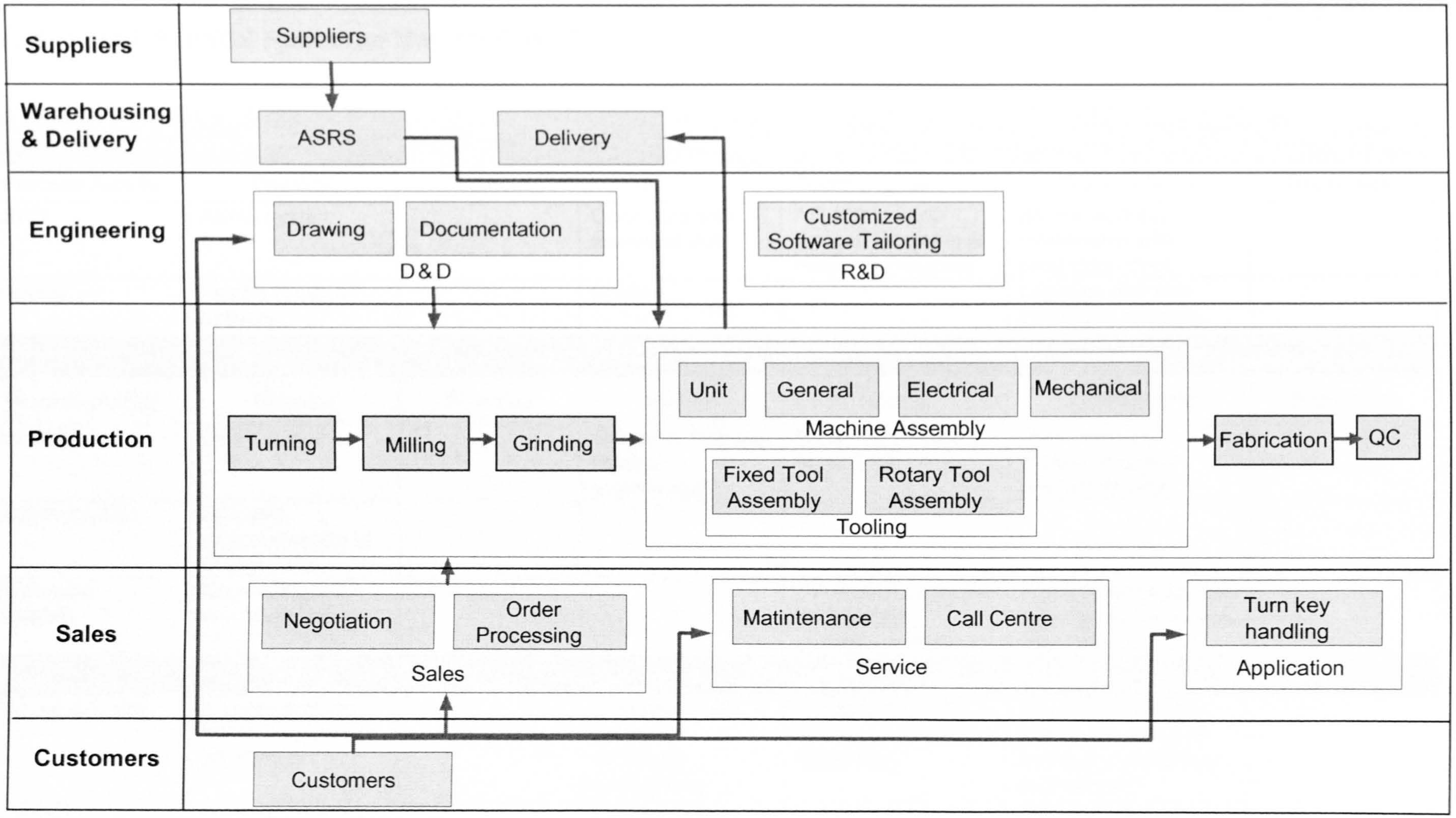


Figure F.3: Initial Activity Map for Case 7

Worksheet F.9: Initial Resource Map for Case 7

Warehousing & Delivery	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
ASRS	ASRS system		Operators with essential skill	AS 400 to keep track of incoming & outgoing materials	Strong working relationship with production dept.	
Delivery	Trucks for local delivery		Drivers		Logistics and sub-contractor network	
Engineering	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Drawing	5 computers		Designer skill and related experiences	UGS, Solid Work, Auto-CAD	Good working relationship with production dept.	
Documentation	Detailed documentation of design data					
Customise Software	Computing room, and computers			Simulation software and control software system	Project-based job and good relationship with sales dept.	
Production	**Resources**					
Turning & Milling	Turning & milling: E410, Integrated 30, E1060		Operators with essential technical background	Advanced turning, milling, and robotic technology	Good organisation system for operator and training oriented environment	
Grinding	Surface grinding, centre-hole grinding, ID&OD grinding		Operators with essential technical background		Training oriented environment	

QC	CMM machine, laser calibration & measuring equip		Testers with essential skill		Training oriented environment	
Machine Assembly	Balancing machines		Operators with essential skill	Certain know-how in assembly	Training oriented environment	
Fixed Tool Assembly	General machines for tooling		Operators with essential skill		Training oriented environment	
Rotary Tool Assembly	General machines for tooling		Operators with essential skill		Training oriented environment	
Fabrication	Laser machine, pressed break, loading and routing Equip		Operators with essential skill		Training oriented environment	Fabrication
Sales	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Negotiation & Order Processing	Satellite order processing equipments		Order handling skill	Satellite order processing system, customer database system	Good make-to-order system	
Maintenance	Laptops, communication equipments		Service teams experience in service industry	Real-time satellite maintenance software system	Good maintenance network system	
Call Centre	Hardware required for necessary communication			Telephone, Fax, E-mail		
Turnkey Handling	Manual of various products		Good programming & drawing skill, controller skill			

UGS, Solid Work, Auto-CAD, advanced turning/milling/robotic technology, and satellite order and maintenance processing system. The organisation resources include good organisation system, strong working relationship between departments, and training oriented environment to realise the relevant activities.

Stage 3: Identify Significant Activities and Critical Resources

Step 3.1: Identify Significant Activities

After identifying the initial activity map, the project members brainstormed to identify those significant activities, since not all the activities are equally important. Accordingly, the project members have identified the significant activities as ASRS, customise software, turning & milling, machine assembly, fabrication, negotiation and order processing, maintenance and turnkey handling. These are the activities which are important for the company to increase their future competitive capabilities.

Step 3.2: Identify Critical Resources

Similarly, in this section, the project members were tasked to identify the critical resources of the company. To do this, a table of evaluation criteria comprising of criteria like superiority, imitability, durability, substitutability, and appropriability was provided to guide the members in the evaluation and selection of critical resources. Critical resources identified include AS 400 system, simulation and control software system, advanced turning/milling/ robotic technology, satellite order processing system, customer database system, experienced employee, real-time satellite maintenance software system, processing machines, and training oriented environment

Step 3.3: Summaries of Significant Activities and Critical Resources

After the project members have completed Steps 3.1 and 3.2, both the

significant activities and critical resources are summarised and shown in Worksheet F.10.

Stage 4: Review Competitive Strategy

At this stage the project members were tasked to analyse the current and future competitive strategy for the part of the organisation selected, based on the list of statements structured to identify the business strategy. The project senior members' experience and knowledge of the company strategy and operation were used as the input of this stage and the relevant conclusion were made based on the agreement of the project members.

Step 4.1: Identify Current Strategy and Future Strategy

The company Case 7's current approach to the business with respect to its main products and customers was evaluated. The company currently tries to achieve best quality product and offers them at great prices i.e provides the best total cost. The core processes include end-to-end product delivery and customer service cycle. It also emphasises on process redesign and continuous improvement and actively pursues lean manufacturing. From the above we can conclude that the current competitive strategy of the company is Operational Excellence.

How the company should be doing business in the future with its main products and customers were also evaluated. In the future Case 7 would like to tackle some of the customer related problems such as the inability to fully fulfil and support the customer requirements and the need to upgrade the manufacturing and sales resources to increase market share and make higher profit. Clearly the desired competitive strategy of the company is Operational Excellence, supported closely by Customer Intimacy.

Worksheet F.10: Summary of Significant Activities and Critical Resources for Case 7

Significant Activity	Critical Resources					
	Physical	**Financial**	**Human**	**Technological**	**Organisational**	**Reputation**
Turning & Milling	Turning & milling: E410, Integrated 30, E1060		Operators with essential technical background	Advanced turning, milling, and robotic technology	Good organisation system for operator and training oriented environment	
Sales (Negotiation + Order)	Satellite order processing equipments			Satellite order processing system, customer database system		
Machine Assembly				Certain know-how in assembly	Training oriented environment	
Maintenance			Service teams experience in service industry	Real-time satellite maintenance software system		
Turnkey Handling			Good programming & drawing skill, controller skill			
Fabrication	Laser machine, pressed break, loading and routing Equip				Training oriented environment	
Customise Software				Simulation software and control software system		
ASRS				AS 400 to keep track of incoming & outgoing materials	Strong working relationship with production dept.	

Step 4.2: Analyse Competitive Gaps

After specifying current and future competitive strategy, gap analysis is to be carried out to make alignment between the desired level of strategy and the performance level that the company can provide. The two areas to be considered are company performance level and its customer requirements level as well as competitor performance level. According to the results, Case 7 was found to currently exceed the customer requirement and competitors in product availability and quality conformance. However, the company is lagging behind the customer requirement and competitors in product price, service customisation and after sales support.

Stage 5: Check Alignment between Performance and Strategy

Step 5.1: Alignment of Significant Activities and Critical Resources, and Strategy

In this stage, the project members identified the significant activities and critical resources to the 3 competitive strategies: customer intimacy, operational excellence, and product leadership. According to the results in the worksheet, the project members have identified the significant activities of ASRS, customise software, turning & milling, machine assembly, fabrication and their related critical resources as supporting Operational Excellence. The other significant activity of negotiation and order processing, maintenance and turnkey handling and critical resources are supporting Customer Intimacy.

Step 5.2: Alignment of Competitive Gaps and Strategy

Step 4.1 has established that the current and desired strategies of the company were both Operational Excellence, and Step 5.1 has established that the Operational Excellence and Customer Intimacy are important supporting strategies. Hence, the current competitive gaps between the company and customers and competitors performance were critical and improvement were

needed in the area of Operational Excellence and Customer Intimacy. Further improvement in Customer Intimacy would also be needed. The alignment of competitive gaps and strategy for Case 7 is shown in Worksheet F.11.

Stage 6 – Formulate Strategy

Step 6.1: Propose Actions for Significant Activities

At this stage, the project members brainstormed and proposed the actions to be carried out for the related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.12.

Step 6.2: Propose Actions for Critical Resources

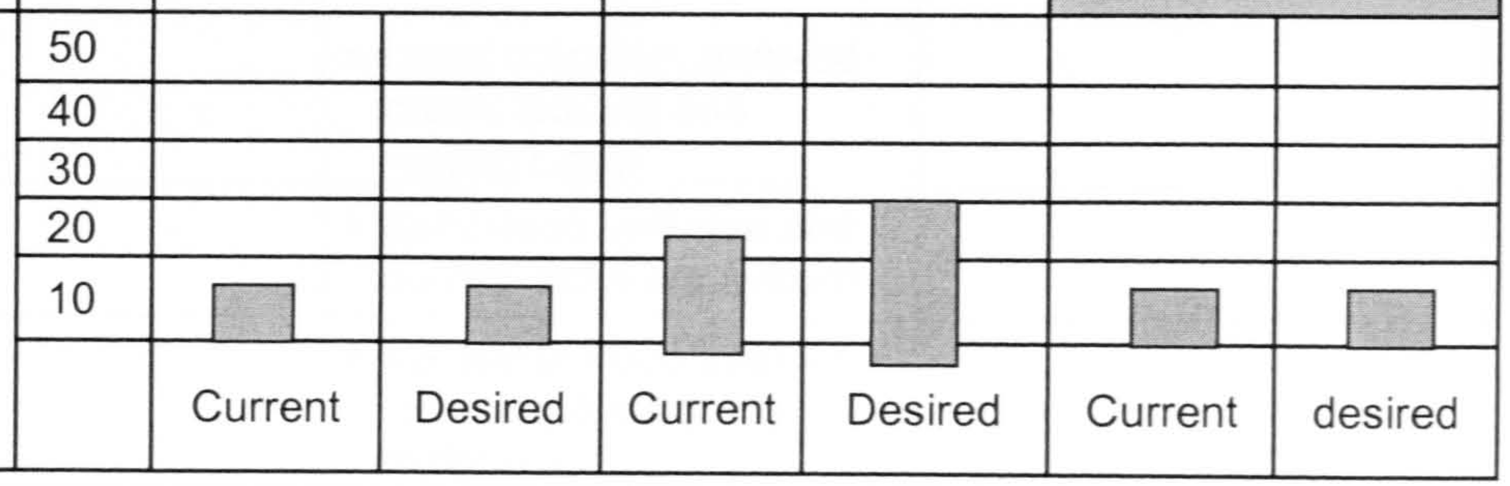
Once the actions to be taken for the significant activities were proposed, the project members then proposed the actions to be carried out for the related critical resources underpinning those related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.12.

Step 6.3: Summary of Proposed Actions

In the final stage, the project members summarised the proposed actions for the significant activities and critical resources of the company in a summary worksheet as shown in Worksheet F.12. Upon completion of the methodology, Case 7 found that most of the critical resources are from the production and sales department, and the activities and resources in these departments need to be strengthened and need to grow. They also have strength in their warehouse and engineering departments. It can be seen that Case 7 has the challenge of product price and fully fulfilling and supporting the customer requirements in terms of service customisation and after-sales support. To overcome these challenges, Case 7 needs to keep, strengthen, and grow these significant

Worksheet F.11: Alignment of Competitive Gaps and Strategy for Case 7

Summary of Competitive Gaps								Customer Intimacy	Operational Excellence	Product Leadership
	Lag			Match	Exceed					
	-3	-2	-1	0	1	2	3			
Service customisation		**CP**	**CR**					- 2CP, -1 CR		
Product customisation					**CPCR**					
After sales support		**CP**	**CR**					- 2CP, -1 CR		
Product availability					**CPCR**					
Product price			**CPCR**						- 1CP, -1 CR	
Quality conformance					**CR**	**CP**				
Product attributes				**CPCR**						
Time to market				**CPCR**						
New product Introduction rate				**CPCR**						
Aggregate scores for current and desired competitive strategies										



Worksheet F.12: Summary of Proposed Actions for Case 7

Significant Activities	Action to Activities	Invest Resource	Upgrade Resource	Leverage Resource
Turning & Milling	Keep & strengthen	• Turning & milling: E410, Integrated 30, E1060 • Advanced turning, milling, and robotic technology	• Operators with essential technical background	
Sales (Negotiation + Order)	Keep & strengthen, Grow		• Satellite order processing system, customer database system	
Machine Assembly	Keep & strengthen, Grow	• Training oriented environment	• Certain know-how in assembly	
Maintenance	Keep & strengthen	• Service teams experience in service industry	• Real-time satellite maintenance software system	
Turnkey Handling	Keep & Grow	• Good programming & drawing skill, controller skill		
Fabrication	Keep & strengthen		• Laser machine, pressed break, loading and routing Equip	
Customise Software	Keep & Grow		• Simulation software and control software system	
ASRS	Keep & strengthen		• AS 400 to keep track of incoming & outgoing materials	

activities like turning, milling, machine assembly and fabrication in the production departments as well as sales negotiation, maintenance and turnkey handling in the sales department. Similarly they also need to invest and upgrade these related critical resources. As a result, customers' requirements can then be met and strong relationship with customers and long term partnership created. In addition, the product price can also be reduced, making Case 7 very competitive and difficult for their competitors to imitate.

4. CASE 8: APPLICATION OF THE PILOT SSCP METHODOLOGY

Case 8 is a local SME company that provides third-party semiconductor and burn-in testing services, and also manufactures burn-in testing equipment used in the testing of wafers, devices and other electrical components. These testing services will enable semiconductor devices and other electronic components to meet the requirements of aerospace, industrial and commercial applications. Case 8 has 2 subsidiaries located in Singapore and China. The company mission of Case 8 is to provide high quality products and services for the semiconductor manufacturing industry that fulfill the price and quality requirements of their customers, create opportunities for achievement and personal growth for their employees, and enhance the value of shareholders. The corporate policy is to provide quality products and services that conform to the requirements of all their customers and to continually improve their processes to enhance customer satisfaction.

Case 8 has strong commitment to research and development that has enabled the company to advance as one of the regional burn-in system manufacturers with very impressive results.

Stage 1: Scope Issues

Case 8 provides high quality products and services for the regional

semiconductor manufacturing industry that fulfil the price and quality requirements of their customers. As burn-In board driver is one of its main products which generates high profit margin for the company, it is selected as the business area for review. For industrial challenges, this business is currently facing the problem of losing customers as there are many competitors arising in the semiconductor industry. With the opening of new markets in China, India and other South East Asian countries with lower labour cost, there are many competitors arising and the company is losing customers due to their higher product and service costs. The company is also not able to provide and meet 100% support services for customers, and is facing the competitive pressure of rapidly evolving technology and volatile marketplace.

Stage 2: Identify Activity and Resource Landscape

Step 2.1: Identify Initial Activity Map

The project members have identified six company level activities and they comprise of logistics, finance, manufacturing, quality assurance, testing operations, and sales & marketing. From these company level activities, the related process activities were then identified. For logistics, the process activities include purchasing, store, distribution and delivery. The process activities for finance include banking & finance, taxation, audit and legal. The activities for manufacturing include designing & price calculation and board assembly. The activities for quality assurance include incoming and outgoing QA. The activities for test operations include engineering test operations. The activities for sales & marketing include sales engineering and order processing. The initial activity map illustrating these activities and their relationship is shown in Figure F.4.

Step 2.2: Identify Initial Resource Map

Similar to Case 7, the project members of Case 8 developed the initial resource map as shown in Worksheet F.13 based on the resource categories of physical,

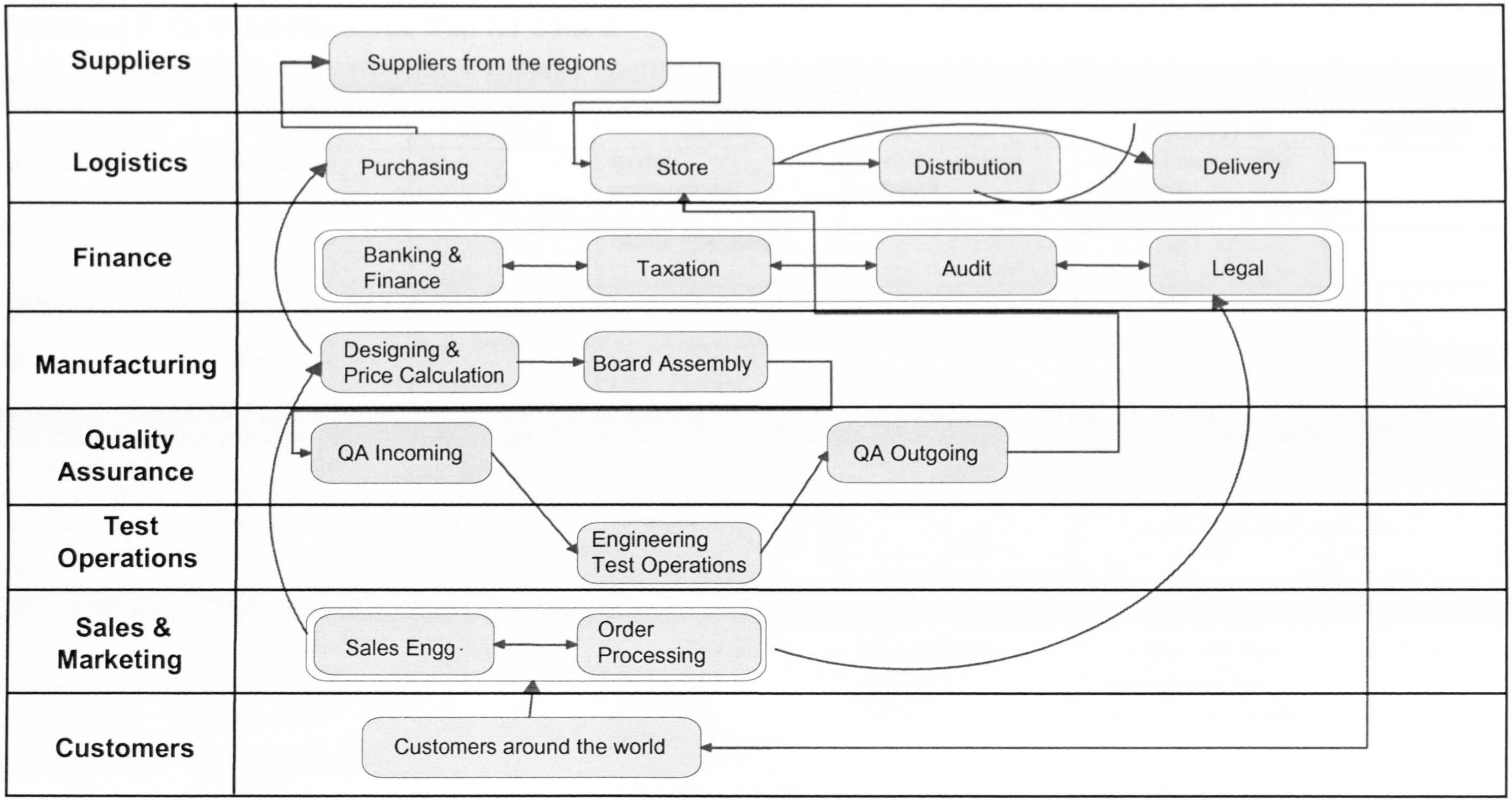


Figure F.4: Initial Activity Map for Case 8

Worksheet F.13: Initial Resource Map for Case 8

Logistics	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Purchasing	Office rooms Computers		Skilful procurement	Inventory control software	Maintain best quality using best components	
Store	Plant spaces Computers		Skilful operators			
Distribution	Trucks					
Delivery	Trucks					Reliable product delivery
Finance	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Financial Works (Banking, Taxation, Audit, Legal)	Office rooms Computers	Investments for business development	Accountants Auditors			
Manufacturing	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Designing & Price Calculation	Office rooms Computers		Skilful design engineers Skilful technicians	AutoCAD Pro-Eng	Coordination with purchasing and sales	
Board Assembly	Plant trolleys & forklifts Tools for Assembly		Skilful Technicians Low cost and flexible recruitments of contract operators		Product customisation according to customer requirements	

Quality Assurance	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
QA Incoming	Office spaces		QA/QC inspectors		Test procedures Documentation	
QA Outgoing	Office spaces		QA/QC inspectors		Test procedures Documentation	
Test Operations	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Engineering Test Operations	Office rooms Instruments Computer systems		Skilful engineers Skilful technicians	Accurate way of testing	Documentation Performance monitoring	Reputation for quality assurance
Sales & Marketing	**Resources**					
Process Activity	Physical	Financial	Human	Technological	Organisational	Reputation
Sales Engg.	Office rooms Computers		Sales engineers		Good customer network	
Order Processing	Office rooms Computers		Normal operators			

financial, human, technological, organisational and reputation. The physical resources include office rooms, computers, instruments, plant, trolleys, forklifts, and tools for assembly and trucks. The financial resources include investment for business development and new product development. The human resources include the job skills of engineers and technicians, and low cost contract operators. The technological resources include the accurate way of testing, AutoCAD, Pro-Eng and inventory control software. The organisation resources include good customer network, performance monitoring, test procedures and documentation. The reputation resources include reputation for quality assurance and reliable product delivery.

Stage 3: Identify Significant Activities and Critical Resources

Step 3.1: Identify Significant Activities

After identifying the initial activity map, the project members brainstormed to identify those significant activities, since not all the activities are equally important. Accordingly, the project members have identified the significant activities as purchasing, delivery, designing & price calculation, board assembly, and engineering test operations. These are the activities which are important for the company to increase their future competitive capabilities.

Step 3.2: Identify Critical Resources

Similarly, in this section, the project members were tasked to identify the critical resources of the company. To do this, a table of evaluation criteria comprising of criteria like superiority, imitability, durability, substitutability, and appropriability was provided to guide the members in the evaluation and selection of critical resources. Critical resources identified include skilful engineers and technicians, low cost and flexible recruitments of contract operators, accurate way of testing, and reputation for quality assurance and reliable product delivery.

Step 3.3: Summaries of Significant Activities and Critical Resources

After the project members have completed Steps 3.1 and 3.2, both the significant activities and critical resources are summarised and shown in Worksheet F.14.

Stage 4: Review Competitive Strategy

At this stage the project members were tasked to analyse the current and future competitive strategy for the part of the organisation selected, based on the list of statements structured to identify the business strategy. The project senior members' experience and knowledge of the company strategy and operation were used as the input of this stage and the relevant conclusion were made based on the agreement of the project members.

Step 4.1: Identify Current Strategy and Future Strategy

The company Case 8's current approach to the business with respect to its main products and customers was evaluated. The company currently offers high quality product and best prices for the regional semiconductor manufacturing industry. To do so, it has standardised and efficient operating procedures, manufacturing, product and services support. From the above we can conclude that the current competitive strategy of the company is Operational Excellence.

In the future the company would like to focus on tackling the problem of losing customers due to their higher product and service costs, and inability to provide and meet 100% support services for customers, and is facing the competitive pressure of rapidly evolving technology and volatile marketplace. Clearly the desired competitive strategy of the company is Operational Excellence, supported by closely by Customer Intimacy.

Worksheet F.14: Summary of Significant Activities and Critical Resources for Case 8

Significant Activity	Critical Resources					
	Physical	**Financial**	**Human**	**Technological**	**Organisational**	**Reputation**
Purchasing			Skilful procurement		Maintain best quality using best components	
Delivery						Reliable product delivery
Designing & Price Calculation			Skilful design engineers Skilful technicians			
Board Assembly			Skilful Technicians Low cost and flexible recruitments of contract operators		Product customisation according to customer requirements	
Engineering Test Operations			Skilful engineers Skilful technicians	Accurate way of testing		Reputation for quality assurance

Step 4.2: Analyse Competitive Gaps

After specifying current and future competitive strategy, gap analysis is to be carried out to make alignment between the desired level of strategy and the performance level that the company can provide. The two areas to be considered are company performance level and its customer requirements level as well as competitor performance level. According to the results, Case 8 was found to currently match and exceed the customer requirement and competitors in operational excellence on product availability and quality conformance, and in customer intimacy on service and product customisation. However, the company is lagging behind the customer requirement and competitors in product price and after sales support.

Stage 5: Check Alignment between Performance and Strategy

Step 5.1: Alignment of Significant Activities and Critical Resources, and Strategy

In this stage, the project members identified the significant activities and critical resources to the 3 competitive strategies. According to the results in the worksheet, the project members have identified all the significant activities of purchasing, delivery, designing & price calculation, board assembly, and engineering test operations and their related critical resources as supporting Operational Excellence.

Step 5.2: Alignment of Competitive Gaps and Strategy

Step 4.1 has established that the current and desired strategies of the company were both Operational Excellence, and Step 5.1 has established that the Operational Excellence and Customer Intimacy are important supporting strategies. Hence, the current competitive gaps between the company and customers and competitors performance were critical and improvement were

needed in the area of Operational Excellence and Customer Intimacy. The alignment of competitive gaps and strategy is shown in Worksheet F.15.

Stage 6 – Formulate Strategy

Step 6.1: Propose Actions for Significant Activities

At this stage, the project members proposed the actions to be carried out for the related significant activities to achieve the desired strategy and to minimise the competitive gaps. A summary of the actions proposed to be taken is shown in Worksheet F.16.

Step 6.2: Propose Actions for Critical Resources

Once the actions to be taken for the significant activities were proposed, the project members then proposed the actions to be carried out for the related critical resources. A summary of the actions proposed to be taken is shown in Worksheet F.16.

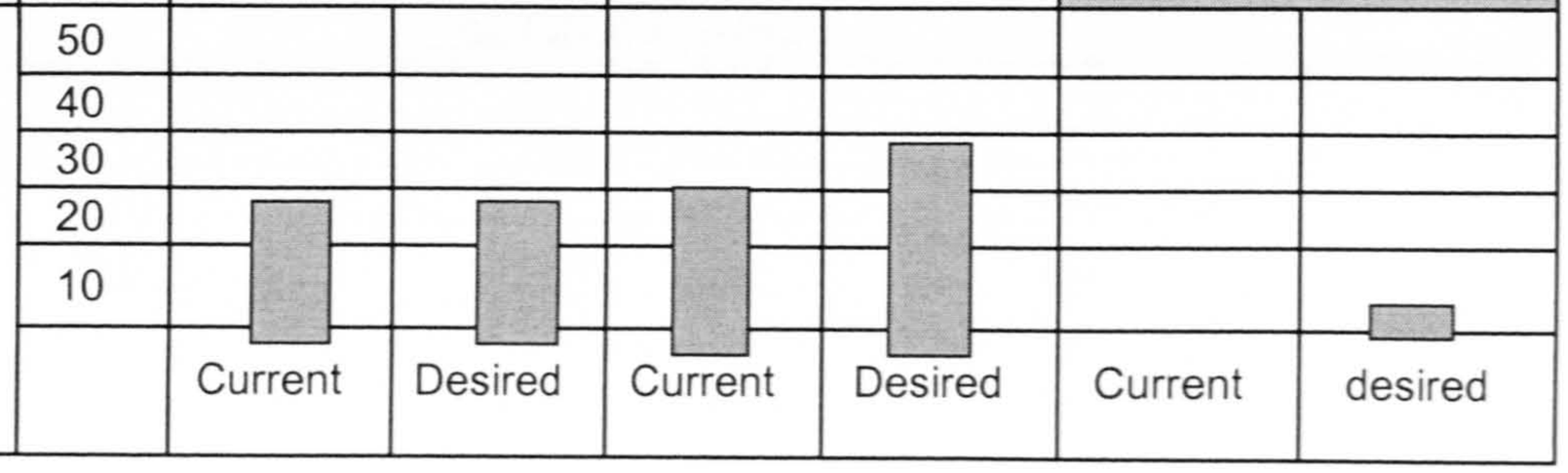
Step 6.3: Summary of Proposed Actions

In the final stage, the project members summarised the proposed actions for the significant activities and critical resources of the company in a summary worksheet as shown in Worksheet F.16. Upon completion of the methodology, Case 8 found that most of the critical resources are from the logistics, manufacturing and test operations departments, and the activities and resources in these departments need to be strengthened and need to grow. It can be seen that Case 8 has the challenge of product price and fully fulfilling and supporting the customer requirements in terms of after-sales support. To overcome these challenges, Case 8 needs to keep, strengthen, and grow these significant activities like purchasing, delivery, designing & price calculation, board assembly, and engineering test operations. Similarly they also need to invest and upgrade these related critical resources.

Worksheet F.15: Alignment of Competitive Gaps and Strategy for Case 8

Summary of Competitive Gaps								Customer Intimacy	Operational Excellence	Product Leadership
	Lag			Match	Exceed					
	-3	-2	-1	0	1	2	3			
Service customisation				CR	**CP**					
Product customisation				CR	**CP**					
After sales support			**CP CR**					- 1CP, -1 CR		
Product availability				**CP**	CR					
Product price			**CP**	CR					- 1CP	
Quality conformance				CR	**CP**					
Product attributes				**CPCR**						
Time to market				**CPCR**						
New product Introduction rate				**CPCR**						

Aggregate scores for current and desired competitive strategies



Worksheet F.16: Summary of Proposed Actions for Case 8

Significant Activities	Action to Activities	Invest Resource	Upgrade Resource	Develop New Resource
Purchasing	Keep & strengthen, Grow	Maintain best quality using best components	Skilful procurement	
Delivery	Keep & Grow		Reliable product delivery	
Designing & Price Calculation	Keep & Grow		Skilful design engineers Skilful technicians	
Board Assembly	Keep & strengthen, Grow	Product customisation according to customer requirements	Skilful Technicians Low cost and flexible recruitments of contract operators	
Engineering Test Operations	Keep & strengthen	Accurate way of testing	Reputation for quality assurance Skilful engineers Skilful technicians	

APPENDIX G: POST ASSESSMENT RESULTS OF CASE STUDY APPLICATIONS OF PILOT SSCP METHODOLOGY

CASE 5: POST ASSESSMENT RESULTS

1. CASE 5 - FACILITATOR POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	Feasibility
	Score
Q.1 Completeness	5
Q.2 Consistency	5
Q.3 Applicability	4
Q.4 Contingency	4
	Very good

USABILITY

Criteria	Usability
	Score
Q.6 Time	2
Q.7 Ease of Use	2
Q.8 Understanding	3
Q.9 Robustness	3
Q.10 Issues	4
Q.11 Preparation	4
Q.12 Participation	4
Q.13 Case Study	5
Q.14 Consultation	5
	Good

USEFULNESS

Criteria	Usefulness
	Score
Q.23 Successful	4
Q.24 Effectiveness	3
Q.25 Contribution	3
Q.26 Influence	4
Q.27 Efficiency	2
Q.28 Usefulness	4
	Good

2. CASE 5 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	Feasibility		
Respondents	R1	R2	Average
Q.1 Completeness	5	4	4.5
Q.2 Consistency	4	4	4.0
Q.3 Applicability	4	5	4.5
Q.4Contingency	4	3	3.5
Total Average			16.5
On a scale of 1 to 5 = 4 X 5 = 20	Total		82.5%

USABILITY

Criteria	Usability		
Respondents	R1	R2	Average
Q.6 Time	2	2	2.0
Q.7 Ease of Use	2	2	2.0
Q.8 Understanding	2	3	2.5
Q.9 Robustness	4	4	4.0
Q.10 Issues	3	3	3.0
Q.11 Preparation	3	3	3.0
Q.12 Participation	4	4	4.0
Q.13 Case Study	4	4	4.0
Q.14 Consultation	4	5	4.5
Total Average			29.0
On a scale of 1 to 5 = 9 X 5 = 45	Total		64.4%

USEFULNESS

Criteria	Usefulness		
Respondents	R1	R2	Average
Q.23 Successful	5	5	5.0
Q.24 Effectiveness	5	5	5.0
Q.25 Contribution	3	4	3.5
Q.26 Influence	4	3	3.5
Q.27 Efficiency	3	4	3.5
Q.28 Usefulness	5	5	5.0
Total Average			25.5
On a scale of 1 to 5 = 6 X 5 = 30	Total		85.0%

CASE 6: POST ASSESSMENT RESULTS

1. CASE 6 - FACILITATOR POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	Feasibility
	Score
Q.1 Completeness	4
Q.2 Consistency	4
Q.3 Applicability	5
Q.4 Contingency	5
	Very Good

USABILITY

Criteria	Usability
	Score
Q.6 Time	2
Q.7 Ease of Use	2
Q.8 Understanding	2
Q.9 Robustness	4
Q.10 Issues	3
Q.11 Preparation	4
Q.12 Participation	4
Q.13 Case Study	4
Q.14 Consultation	4
	Average

USEFULNESS

Criteria	Usefulness
	Score
Q.23 Successful	4
Q.24 Effectiveness	4
Q.25 Contribution	4
Q.26 Influence	4
Q.27 Efficiency	3
Q.28 Usefulness	4
	Good

2. CASE 6 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**				
Respondents	R1	R2	R3	R4	Average
Q.1 Completeness	4	5	4	5	4.5
Q.2 Consistency	4	4	3	5	4.0
Q.3 Applicability	4	4	3	4	3.8
Q.4 Contingency	4	4	3	4	3.8
Total Average					16.0
On a scale of 1 to 5 = 4 X 5 = 20	Total				80%

USABILITY

Criteria	**Usability**				
Respondents	R1	R2	R3	R4	Average
Q.6 Time	2	2	2	2	2.0
Q.7 Ease of Use	2	2	2	2	2.0
Q.8 Understanding	2	2	3	3	2.5
Q.9 Robustness	2	2	3	3	2.5
Q.10 Issues	3	3	4	4	3.5
Q.11 Preparation	3	4	4	4	3.8
Q.12 Participation	4	4	4	4	4.0
Q.13 Case Study	4	4	5	4	4.3
Q.14 Consultation	4	4	4	5	4.3
Total Average					28.8
On a scale of 1 to 5 = 9 X 5 = 45	Total				63.9%

USEFULNESS

Criteria	**Usefulness**				
Respondents	R1	R2	R3	R4	Average
Q.23 Successful	5	5	4	5	4.8
Q.24 Effectiveness	4	5	4	4	4.3
Q.25 Contribution	4	4	3	4	3.8
Q.26 Influence	4	4	3	4	3.8
Q.27 Efficiency	4	4	3	4	3.8
Q.28 Usefulness	4	4	4	4	4.0
Total Average					24.3
On a scale of 1 to 5 = 6 X 5 = 30	Total				80.8%

CASE 7: POST ASSESSMENT RESULTS

1. CASE 7 - FACILITATOR POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	Feasibility
	Score
Q.1 Completeness	4
Q.2 Consistency	4
Q.3 Applicability	4
Q.4 Contingency	3
	Good

USABILITY

Criteria	Usability
	Score
Q.6 Time	2
Q.7 Ease of Use	2
Q.8 Understanding	2
Q.9 Robustness	4
Q.10 Issues	4
Q.11 Preparation	4
Q.12 Participation	5
Q.13 Case Study	5
Q.14 Consultation	5
	Good

USEFULNESS

Criteria	Usefulness
	Score
Q.23 Successful	4
Q.24 Effectiveness	4
Q.25 Contribution	4
Q.26 Influence	4
Q.27 Efficiency	2
Q.28 Usefulness	4
	Good

2. CASE 7 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**					
Respondents	R1	R2	R3	R4	R5	Average
Q.1 Completeness	4	4	5	4	4	4.2
Q.2 Consistency	4	4	4	5	4	4.2
Q.3 Applicability	3	4	5	5	4	4.2
Q.4 Contingency	4	3	4	3	5	3.8
Total Average						16.4
On a scale of 1 to 5 = 4 X 5 = 20	Total					82.0%

USABILITY

Criteria	**Usability**					
Respondents	R1	R2	R3	R4	R5	Average
Q.6 Time	2	2	2	2	2	2.0
Q.7 Ease of Use	2	2	2	3	2	2.2
Q.8 Understanding	3	3	2	2	2	2.4
Q.9 Robustness	3	3	3	3	3	3.0
Q.10 Issues	3	4	3	3	3	3.2
Q.11 Preparation	4	4	4	5	4	4.2
Q.12 Participation	4	4	4	5	4	4.2
Q.13 Case Study	4	4	4	5	4	4.2
Q.14 Consultation	4	4	4	4	4	4.0
Total Average						29.4
On a scale of 1 to 5 = 8 X 5 = 40	Total					65.3%

USEFULNESS

Criteria	**Usefulness**					
Respondents	R1	R2	R3	R4	R5	Average
Q.23 Successful	4	4	4	4	5	4.2
Q.24 Effectiveness	4	4	5	4	5	4.4
Q.25 Contribution	3	3	4	4	4	3.6
Q.26 Influence	3	3	4	4	4	3.6
Q.27 Efficiency	4	4	4	4	4	4.0
Q.28 Usefulness	4	4	4	4	4	4.0
Total Average						23.8
On a scale of 1 to 5 = 6 X 5 = 30	Total					79.3%

CASE 8: POST ASSESSMENT RESULTS

1. CASE 8 - FACILITATOR POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	Feasibility
	Score
Q.1 Completeness	4
Q.2 Consistency	3
Q.3 Applicability	4
Q.4 Contingency	2
	Good

USABILITY

Criteria	Usability
	Score
Q.6 Time	2
Q.7 Ease of Use	2
Q.8 Understanding	3
Q.9 Robustness	3
Q.10 Issues	3
Q.11 Preparation	4
Q.12 Participation	4
Q.13 Case Study	5
Q.14 Consultation	4
	Average

USEFULNESS

Criteria	Usefulness
	Score
Q.23 Successful	4
Q.24 Effectiveness	3
Q.25 Contribution	3
Q.26 Influence	4
Q.27 Efficiency	4
Q.28 Usefulness	5
	Good

2. CASE 8 - PARTICIPANTS POST ASSESSMENT RESULT (QUANTITATIVE ANALYSIS)

FEASIBILITY

Criteria	**Feasibility**			
Respondents	R1	R2	R3	Average
Q.1 Completeness	4	4	5	4.3
Q.2 Consistency	4	3	4	3.7
Q.3 Applicability	5	4	5	4.7
Q.4Contingency	4	3	4	3.7
Total Average				16.3
On a scale of 1 to 5 = 4 X 5 =20	Total			81.7%

USABILITY

Criteria	**Usability**			
Respondents	R1	R2	R3	Average
Q.6 Time	2	2	2	2.0
Q.7 Ease of Use	2	2	2	2.0
Q.8 Understanding	2	3	2	2.3
Q.9 Robustness	2	3	3	2.7
Q.10 Issues	3	3	2	2.7
Q.11 Preparation	4	3	4	3.7
Q.12 Participation	4	4	4	4.0
Q.13 Case Study	4	3	4	3.7
Q.14 Consultation	4	3	4	3.7
Total Average				26.7
On a scale of 1 to 5 = 9 X 5 = 45	Total			59.3%

USEFULNESS

Criteria	**Usefulness**			
Respondents	R1	R2	R3	Average
Q.23 Successful	4	4	5	4.3
Q.24 Effectiveness	3	4	4	3.7
Q.25 Contribution	3	4	4	3.7
Q.26 Influence	3	4	4	3.7
Q.27 Efficiency	3	4	4	3.7
Q.28 Usefulness	4	5	5	4.7
Total Average				23.7
On a scale of 1 to 5 = 6 X 5 = 30	Total			78.9%