A CONTINGENCY FRAMEWORK FOR ANALYSING SUPPLY CHAIN PERFORMANCE

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DEDICATION

To Osman, Fikri, Shukri and Sakinah
ACKNOWLEDGEMENTS

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ABSTRACT

The activities, processes and relationships that fall under the supply chain label are central to industrial modernity. As supply chains are now competing against supply chains, it is vital that they are managed effectively so as to enhance their performance. An examination of the literature on supply chain analysis reveals that it can be viewed from two separate perspectives. The first is the decisional perspective that prescribes to the premise that different decisional variables or factors lead to different performance levels. The second perspective centers on the fact that there is no one best way to manage all supply chains and different supply chains have to be managed differently. The literature also reveals that several different methodologies are employed in looking at those issues and their effects on supply chain performance. Because of the multiple issues involved and the lack of a common methodology in supply chain analysis, the literature paints an almost confusing picture of the subject. Thus, the purpose of this study is to investigate and develop a general framework that could be used as a platform to investigate or analyze the performance of supply chains whilst at the same time incorporating the characteristics of the two perspectives of supply chain analysis that was mentioned earlier. In order to achieve this, an extensive literature review and case study analysis was done. This leads to the coining of new concepts like the supply chain structure, which is made up of the physical variables, relationship variables and spatial variables, and contextual variables for supply chains. These new concepts formed the elements of the proposed contingency framework for supply chain analysis. This framework is based on two guiding principles. One is that different supply chain structures will give rise to different supply chain performances and the other is that there is an interaction between the supply chain structure variables and the contingent variables, which in turn will affect supply chain performance. A purely conceptual framework, though useful in its own right, would have been of limited use especially to practitioners. Thus the applicability of the contingency framework in analyzing supply chains is demonstrated via simulation. The simulation results confirm the hypothesis that different supply chain structures exhibited different performances. The proposed contingency framework could serve as a theoretical base for further research into supply chain analysis, which would give more insight into the dynamics of a supply chain.
ABSTRAK

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<tr>
<td>BDAL</td>
<td>Buyer dominated arms length</td>
</tr>
<tr>
<td>BDC</td>
<td>Buyer dominated collaboration</td>
</tr>
<tr>
<td>EDI</td>
<td>Electronic data interchange</td>
</tr>
<tr>
<td>JIT</td>
<td>Just in time</td>
</tr>
<tr>
<td>OM</td>
<td>Operations Management</td>
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<tr>
<td>PAN</td>
<td>Process Analyzer</td>
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<td>SCM</td>
<td>Supply Chain Management</td>
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<td>SCOR</td>
<td>Supply Chain Operations Reference Model</td>
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<td>SCSSF</td>
<td>Supply chain structures simulation framework</td>
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<td>SDAL</td>
<td>Supplier dominated arms length</td>
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<tr>
<td>SDC</td>
<td>Supplier dominated collaboration</td>
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<td>True collaboration</td>
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CHAPTER 1

INTRODUCTION

1.1. Background of the Problem

A supply chain is a network of facilities and activities involved in delivering a product from raw materials through to the customer. It is concerned with planning, coordinating and controlling material, parts and finished goods from the suppliers to the customer. It involves two distinct flows through the organization that is, material and information (Stevens, 1989). In the early days of discussion about supply chain management the spotlight was primarily centred on management of the supply chain within a single company. The traditional view of supply chain management according to Spekman et al. (1998) is to leverage the supply chain to achieve the lowest initial purchase prices while assuring supply. Typical characteristics of this type of management are multiple partners; partner evaluation based on purchase price; cost based information bases; arm’s length negotiations; formal short-term contracts; and centralized purchasing.

Today’s focus of supply chain management, however, is one of cross-company planning and implementation. Under this new paradigm, supply chain management is redefined as a process for designing, developing, optimising and managing the internal and external components of the supply system, including material supply, transforming materials and distributing finished products or services to customers, that is consistent with overall objectives and strategies. This new way of managing the supply chain will link all partners in the chain including departments within an organization and the external partners including suppliers, carriers, third party companies and information
system providers. The partners all work together to make the whole supply chain competitive (Lummus and Vokurka, 1999).

Since competitive advantage is now defined in terms of supply chains instead of single companies, it is imperative that supply chain analysis are continually analysed so as to improve its performance hence increasing its competitiveness. The importance of supply chain analysis or supply chain management is proven by the large amount of research in the area. An excursion into the literature on supply chain analysis reveals that it is a multi faceted area of research reflected by the multi issues discussed and the various different methodologies adopted. However, it was shown that the literature can be viewed via a taxonomy based on content and methodology (Croom et al., 2000).

On finer scrutiny, it will be shown in Chapter 2 that the content itself can be separated into two perspectives or paradigms. The first is the decisional perspective that prescribes to the premise that different decisions lead to different supply chain performance levels. The second perspective centres on the fact that there is no one best way to manage all supply chains and supply chain performance is contingent upon various factors. Although each perspective, separately, are effective in explaining and analysing the different issues that arose in supply chain analysis, each on its own presents an incomplete analysis of supply chains. This is due to the fact that (as will be shown in the review of the literature in Chapter 2, Table 2.10) each perspective concentrates only on certain factors and ignore others. In order to obtain a more complete picture of supply chain performance and supply chain dynamics, an encompassing framework that incorporates the features of both paradigms is deemed necessary. This framework will be the underlying methodology for supply chain analysis.
1.2 Definition of terms

Definitions to some terms that are regularly referred to in the thesis are given in Table 1.1.

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<td>Contingency Framework</td>
<td>A framework that is based on the contingency theory, which is an approach to the study of organizational behaviour in which explanations are given as to how contingent factors such as technology, the external environment and culture influence the design and functioning of organizations.</td>
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<td>Supply Chain Performance</td>
<td>Supply chain performance comprises the actual output or results of a supply chain as measured against its intended goals and objectives.</td>
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<tr>
<td>Supply chain analysis</td>
<td>A careful examination of the supply chain with the objective of evaluating its behaviour and performance via suitable qualitative and/or quantitative techniques.</td>
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1.3 Statement of the Problem

Supply chain analysis is important especially in this era of globalisation where supply chains compete with each other. To analyse a supply chain is to determine its current performance and to find ways to improve future performance. There are several ways to analyse supply chains as will be attested by the abundant literature on supply chain analysis and management. However these approaches seems inadequate because it fails to incorporate and combine important relevant factors such as the various types of buyer-supplier relationships, the supply chain structure concept and the contingency
behaviour of supply chains into an encompassing framework. As such supply chain analysis done via existing methods will provide a fragmented and an incomplete picture of the supply chain dynamics and performance. Hence, this study will therefore investigate and develop a general framework that could be used as a platform to analyse the performance of supply chains.

1.4 Purpose of Research

The purpose of the research is to develop a framework for supply chain analysis that unifies two different approaches to supply chain analysis found in the literature. The framework will take into consideration the decisional factors of the decisional paradigm, the structural factors from the structural paradigm and the contingency effect exhibited by supply chains.

1.5 Objectives

The objectives of this research are as follows:

(i) To identify and classify the factors that affect supply chain performance. This will involve the development and formalization of the supply chain structure concept and the contingency variables.

(ii) To develop a contingency based framework that will serve as a methodology for analysing the performance of supply chains. This involves the determination of the relationships between the factors uncovered in (i).

(iii) To investigate the applicability of the developed framework on the performance of supply chains, through the use of modelling and simulation.
1.6 Scope and Key Assumptions.

This study is limited to the following:

(i) The research is conceptual in nature. This means that it relies heavily on existing literature. It is via the literature that the components of the supply chain structure variables and contextual variables are identified and conceptualised. This is consistent with the conceptual modelling approach adopted in Meredith (1993) and Wacker (1998).

(ii) Although equally applicable to other types of supply chains, the focus of this research is on manufacturing supply chains.

(iii) To provide focus on the strategic and structural issues the supply chain, models developed are at a high level of abstraction and are not at the machine level of detail.

(iv) The structural input to the simulation studies is based on limited case studies on local automotive supply chains. The operational input however, is based on a published hypothetical situation (Closs et al., 1998).

The main assumptions of this research are related to the simulation modelling and analysis which is carried out using the simulation package ARENA 5.0 and its separate application Pan Analyzer. These are explained in Chapter 3 and Chapter 5 of the thesis.

1.7 Importance of Research

The research is important and significant both from the theoretical and practical standpoints. The rationale and motivation for this research can be summarised as follows:

(i) Supply chain analysis has attracted researchers from many different domains each utilising a particular methodology and paradigm in examining and solving problems. The boundaries created by the type of methodology and paradigm employed painted a fragmented picture of supply chain dynamics and performance. This makes comparison between studies and generalizations of results difficult and inaccurate. Since
the contingency based framework is an encompassing framework that combines different paradigms in supply chain analysis and incorporate various factors important to the analysis of supply chain performance, it thus presents the researchers and practitioners alike with a common tool that can facilitate comparisons and generalizations between studies as mentioned earlier.

(ii) The lack of a theoretical base to the area of supply chain management has been highlighted by New (1997). Without a sound theoretical base, the field of supply chain management will reduce to a passing fad (Chandra and Kumar, 2000). Thus, this research is timely and relevant as it provides new theoretical descriptions, in terms of the contingency framework and its components. Furthermore, this can become a basis for other theoretical developments in the field of supply chain analysis and management.

1.8 Research Methodology

This section briefly introduces the research methodology. The details however, are presented in Chapter 3. The proposed contingency framework for supply chain analysis was developed via three phases as illustrated in Figure 1.1.

| Phase One | Determination and classification of various factors that affect supply chain performance |
| Phase Two | Determining the nature of the relationship between the factors in the context of evaluating the performance of a supply chain and incorporating them and their interrelationships in one encompassing framework? |
| Phase Three | Demonstrating the applicability of the framework. |

Figure 1.1: Phases of development of the proposed contingency framework
This research is largely theoretical in nature. It thus follows, in the first part, the theory building concepts found in the operations management literature of which supply chain management is a part. In phase one of the research, a critical review of the literature on supply chains is done. This is achieved via a framework that is based on the content and methodology taxonomy. The literature reveals that there are two different paradigms in supply chain analysis and that several decisional and structural factors affect supply chain performance. Using conceptual analysis a classification of these decision variables was done. It led to the supply chain structure concept and the contingency variables.

Phase two of the research is concerned with discovering the interrelationships between the variables discovered in Phase One and supply chain performance. Here, the literature reveals that there is no “one size fits all method” to analyse or manage supply chains. This fact points to a contingency framework for supply chain analysis based on the theory developed in organizational studies. This phase resulted in the proposed contingency framework for supply chain analysis.

The third and final phase of the research is the proof of concept. It demonstrates the credibility and applicability of the framework. This is done by embedding simulation into the supply chain structures simulation framework. Here it is shown that different supply chain structures characterized by different relationship profiles exhibit different levels of performance.

1.9 Research Contributions

The different and sometimes divergent approaches in analysing supply chains and the concept of different styles for different supply chains provided the impetus for this research. Figure 1.2 highlights the main contribution of this research in the form of a hierarchy of contributions. In seeking a holistic paradigm that combines the different approaches to supply chain analysis resulted in the main contribution, which is the contingency framework. This framework provides a systematic and rigorous approach
to effectively analyse supply chains. One of the main components of the framework is the newly formed supply chain structure concept, which is made up of the physical structure variables, the relationship structure variables and the spatial structure variables. The framework incorporates the interactions between the contextual variables, the supply chain structure variables and supply chain performance. The proof of concept and the applicability of the framework are handled via the supply chain structure simulation framework, which is another research contribution. Other specific contributions are the relationship profiles and relationship constructs which are related to the modelling and simulation considerations of the framework. Details of the contributions are given in Chapter 7.

Figure 1.2: Summary of main research contributions
1.10 Organization of the Thesis

This thesis consists of seven chapters as shown in Figure 1.3. Chapter 1 serves as an essential introduction to the research. Chapter 2 presents the review of the relevant literature that leads to the formulation of this thesis. Chapter 3 describes the chosen methodology and the rationale behind its choice. Chapter 4 describes the research main contribution that is, the contingency framework. In this chapter the components of the framework are presented. The concept of supply chain structure with respect to the overall contingent framework is developed and explained. The relevance and novelty of the framework is highlighted. Chapter 5 describes the modelling approaches, the simulation models and analysis done in ARENA used in showing the credibility and applicability of the framework. In light of the results presented in Chapter 3 and 4, Chapter 6 provides the overall discussion of the research findings. Chapter 7 concludes the thesis with lists of contributions, conclusions and suggestions for further research.
This chapter has provided the foundation of the thesis. It has introduced the research problem and described the motivations for the research. The research methodology is also briefly described. A list of research contributions is also given. The organization of the thesis is also outlined.

1.11 Summary

This chapter has provided the foundation of the thesis. It has introduced the research problem and described the motivations for the research. The research methodology is also briefly described. A list of research contributions is also given. The organization of the thesis is also outlined.

Figure 1.3: The layout of the chapters in the thesis.
REFERENCES


