

STRATEGIC AND OPERATIONAL PERFORMANCE FRAMEWORK FOR
AUTOMOTIVE SUPPLY CHAIN IN IRAN

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To my beloved mother, father, wife, and daughters

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ABSTRACT

Supply Chain Management (SCM) is one of the most important and complex issues for automakers in the world. The main objective of this research is to explore the factors, which influence strategic performance of the supply chain (SPSC) and operational performance of the supply chain (OPSC) through quantitative and qualitative research in automotive industries. One of the most significant objectives of this study is to compare the key findings such as tested hypotheses and developed level of constructs between IKCO and Isuzu as cases of study in the automotive industry in IRAN. A total number of 217 and 201 completed questionnaires were collected respectively from IKCO and Isuzu companies. The reliability of data was evaluated by using SPSS to analyze Cronbach's Alpha, where all values of Alpha were acceptable strongly. According to SPSC and OPSC as the main dependent variables, path analysis (PA) technique was used to explore casual relationships among variables using multi regression in SPSS. Based on PA technique, SPSC and OPSCs were structured to evaluate supply chain performance of IKCO and Isuzu. The confirmatory factor analyses (CFA) were utilized based on the Maximum Likelihood (ML) to analyze normality, outliers, and composite reliability, validity and to test hypotheses by Amos. In addition, the qualitative research was done to understand deeply the dimensions and to evaluate current status through interview and documentation. In conclusion, research findings imply that strategic performance of the supply chain was influenced by information technology (IT), organizational learning (OL) and product innovation (PRI), while transformational leadership did not influence SPSC. In addition, operational performance of the supply chain was influenced by process innovation (PI) and partnership quality (PQ). The SPSC and OPSCs were examined for the first time in the automotive industry, which as the research gap was concluded and R&D center and SCM were understood as main bases of automakers.

ABSTRAK

Pengurusan Rantaian Bekalan (SCM) adalah salah satu isu kompleks yang paling penting untuk pembuatan kereta di dunia. Objektif utama kajian ini adalah untuk meneroka faktor yang meramalkan prestasi strategic rantaian bekalan (SPSC) dan prestasi operasi rantaian bekalan (OPSC) melalui kajian dan penyelidikan kajian kes di dua syarikat automotif. Berdasarkan teori rantaian bekalan, kesusasteraan sebelumnya, dan penyelidikan kajian kes, strategik prestasi rantaian bekalan telah diramalkan oleh teknologi maklumat (IT), pembelajaran organisasi (OL), dan produk inovasi (PRI). Di samping itu, prestasi operasi rantaian bekalan telah diramalkan (PI) oleh proses inovasi dan perkongsian kualiti (PQ). Salah satu objektif yang paling penting dalam kajian adalah untuk membandingkan penemuan utama antara IKCO dan Isuzu sebagai kes kajian di automotif industry di Iran. Sebanyak 217 dan 201 soal selidik telah siap dibina oleh syarikat IKCO dan Isuzu. Ketelusan data dinilai dengan menggunakan SPSS untuk menganalisa Alpha cronbach, dimana kesemua nilai Alpha boleh diterima dengan tepat. Menurut SPSC dan OPSC sebagai pembolehubah utama, teknik laluan analisa laluan (PA) digunakan untuk meneroka hubungan antara pembolehubah casual dengan menggunakan pelbagai regresi dalam SPSS. Berdasarkan PA teknik, SPSC dan model OPSC telah distrukturkan untuk menilai rantaian bekalan IKCO dan Isuzu. Analisis faktor pengesahan (CFA) telah digunakan berdasarkan Maxima Kemungkinan (ML) untuk menganalisa kebiasaan, data terpercail, dan kebolehpercayaan komposit, kesahihan ujian berdasarkan Amos. Di samping itu, penyelidikan kualitatif dilakukan untuk memahami lebih mendalam dimensi untuk menilai status semasa melalui wawancara dan dokumentasi.

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LIST OF ABBREVIATIONS

ABC	-	Activity-Based Costing
ATS	-	Assemble To Stock
B2B	-	Business to Business
BSC	-	Balanced Score Card
BTF	-	Build-To-Forecast
CFA	-	Confirmatory Factor Analysis
CKD	-	Complete Knocked Down
CRM	-	Customer Relationship Management
CSM	-	Customer Service Management
CTO	-	Configure-To-Order
DM	-	Demand Management
ECR	-	Efficient Customer Response
EDI	-	Electronic Data Interchange
EFQM	-	European Foundation Quality Management
EIS	-	Executive Information System
ERP	-	Enterprise Resource Planning
ES	-	Employees' Skills
ETO	-	Engineer-To-Order

FLR	-	Framework for Logistic Research
GDP	-	Gross Domestic Product
HRM	-	Human Resource Management
IKCO	-	Irankhodro Co
IT	-	Information Technology
JIT	-	Just in Time
LMC	-	Logistics Managements Council
MFM	-	Manufacturing Flow Management
MIS	-	Management Information System
ML	-	Maximum Likelihood
MTO	-	Make-To-Order
MTS	-	Make-To-Stock
NPD	-	New Product Development
NTB	-	New Technology-Based
OEM	-	Original Equipment Manufacturers
OF	-	Order Fulfilment
OI	-	Organizational Innovation
PA	-	Path Analysis
PD	-	Product Development
PI	-	Process Innovation
PQ	-	Partnership Quality
PRI	-	Product Innovation

R&D	-	Research and Development
ROI	-	Return On Investment
SASC	-	Strategic Audit Supply Chain
SC	-	Supply Chain
SCALE	-	Supply Chain Advisor Level Evaluation
SCI	-	Supply Chain Integration
SCM	-	Supply Chain Management
SCOR	-	Supply Chain Operation Reference
SCP	-	Supply Chain Performance
SEM	-	Structural Equation Modelling
SP	-	Starting Production
SPM	-	Strategy Profit Model
SPSS	-	Statistical Package for the Social Sciences
SRM	-	Supplier Relationship Management
SSPD	-	Strategic Studies and Planning Department
SWOT	-	Strengths, Weaknesses, Opportunities, and Threats
TKS	-	Technical Knowledge Sharing

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CHAPTER 1

INTRODUCTION

One of the reasons why firms need to manage the supply chain is to reduce production costs, improve quality, and maintain competitive advantage. The supply chain theory is explained as a value network, including individual cross-functions, which is committed to provide knowledge and resources to gain the goals of effective management of suppliers and all chains (Lau and Lee, 2000). Therefore, the main purpose of supply chain management is to integrate all suppliers and to manage all effective resources.

Many researchers have focused on newer subjects by providing new ideas to develop organizations and new products (Downs and Mohr, 1976; Aragon-Correa *et al.*, 2007). There are three perspectives about innovation such as organizational innovation, process innovation and product innovation. Process innovation focuses on production process and procedures, and product innovation emphasizes on new product (Cooper and Edgett, 2008; Damanpour and Aravind, 2012) and organizational innovation emphasize on structures, procedures and relationships (Armbruster *et al.*, 2008). Innovations of product, process, and technology have been investigated across supply-chain management. This research has investigated the role of factors, which affect operational and strategic performance of the supply chain.

1.1 Background of Study

Since 1980s, manufacturing firms have drawn and developed supply chain to decrease managerial loads and production costs (Miles and Snow, 2007). They have

increased the number of production, quality, and new product development (NPD) via outsourcing. Most studies have been conducted on domain of operational performance of supply chain. However, there are no considerable studies in domain of strategic performance.

1.1.1 Supply Chain Performance

Previous studies have focused on operational performance more than strategic performance with the intensively competitive global market, effective supply-chain management (SCM) plays a critical role and has been recognized as a key factor for organizational performance and competitive advantage (Schneller *et al.*, 2006; White and Mohdzain, 2009). In the competitive environment, organizations are required to provide high-quality products and services, delivery on time, rapid response, and develop dynamic capabilities that are congruent with the rapidly changing business environment (Fawcett and Magnan, 2001; Lin *et al.*, 2005; Teece, 2009). Some scholars have investigated the impact of partnership quality of suppliers on main firms' competitive advantage. Suppliers' partnership in the field of product and process development has led to attain faster new product development, low costs, and high quality products. The main firms as leaders should develop partnership quality among suppliers (Kotabe *et al.*, 2003). Many investigations have focused on information technology as the infrastructure of supply chain management.

1.1.2 Innovation

Some studies suggested that organizational learning and knowledge is the engine of innovation (Baker and Sinkula, 1999; Sørensen and Stuart, 2000; Cohen and Levinthal, 2001). A basic assumption about learning role as a key factor for enabling companies, is to achieve speed and flexibility at domain of innovation process (Brown and Eisenhardt, 1995; De Weerd-Nederhof *et al.*, 2002; Miles and Snow, 2007).

Some studies have focused on achieving high performance of innovation via interaction and collaboration with external players such as partners, suppliers and customers (Fritsch and Lukas, 2001; Chesbrough, 2003; Laursen and Salter, 2006). Interaction between internal and external resources can help to produce new ideas and innovation. Two of the external actors are the main organizations' customers (Gruner and Homburg, 2000; Thomke *et al.*, 2002) and suppliers (Wagner, 2003; Song and Di Benedetto, 2008). The focal firms act as leaders of supply chain for interaction on innovation issues among chains such as suppliers, customers, and dealers. These issues are explained by showing the role of suppliers, focal firm, and customers that lead to innovate across SCM. Wagner (2010) pointed out that suppliers help to attain sustainable benefits and high performance of innovation in different aspects. Therefore, after focal firms, suppliers are the most important member to develop innovation. Creative employees and researchers improve innovation in organizations. Some studies have focused on the role of creative talents and some factors such as organizational structure, leadership and environment effects on innovation (Paulus, 2000; Ofori-Dankwa and Julian, 2002; Janssen *et al.*, 2004).

1.1.3 Automotive Industry

The automotive industry has been one of the biggest economies, which comes after oil and banking. Building 60 million vehicles requires about eight million people who are directly involved. Automotive industry possesses around 5% of worlds' total manufacturing employment. In 2009, automotive industry had 2000 billion-dollar turnover and more than 50 million indirect and direct employees throughout the world. In 2014, more than 80 million automobiles were produced worldwide (OICA, 2014).

Generally, an average car consists of over 15000 components, in which automotive assembler produce a few of them (Pérez and Sánchez, 2001). Hence, the price and grade of automotive components determine the car's price. Pricing automotive components depend on technology, quality level and the relationship between buyer and supplier (Pérez and Sánchez, 2001). The professional behavior of

buyers and suppliers show the degree of their skill in the production process, raw material costs and production and assembly costs.

Most of the supply chain activities are confined within Iran due to trade sanctions imposed by the United Nations (UN). All product development and process improvement has to be carried out independent of partners from overseas. This has posed a great challenge because new technology in software and hardware cannot be brought into Iran. Automotive companies in Iran have to develop its own suppliers without assistance from foreign partners. Limited access to new technology has forced companies to develop the capacity of supply chain with their own resources and ingenuity.

1.2 Statement of Problem

Supply-chain management is one of the most important issues in industries, especially in automotive industries (Pires and Neto, 2008). Complexity and extent of supply variables, costs, quality, delivery and resources have caused firms to concentrate on supply chain development. Many previous studies have investigated the issues of SCM.

1.2.1 Supply Chain Performance

Automotive industries have tried to create value chain in the supply chain. In Iran, automakers have faced critical challenges in operational and strategic performance. The challenges in operational performance consist of on-time delivery, quality, lead-time and inventory level (Mehri and Hosseini, 2010); strategic performance include mission and vision, quality, long-term goals, competitor assessment and new product development. It is crucial for automotive companies in Iran to focus and concentrate its efforts to improve operational performance. For now, companies are not sure which factors to focus upon and where to start. When this study was completed in 2014, Iran was still under sanctioned from the UN. In

2016, the sanction was lifted and there will be foreign competitors coming in and flooding the Iranian car market. Hence, it is important for the automakers to manage the supply chain in order to remain competitive. Iranian automakers are faced with challenges such as production cost, quality, new product development, reduce inventory level and meeting customer requirements.

SCM in automotive industry starts from idea conception, NPD, process design, manufacturing, delivery, assembly, quality test and finally sales to customers. Within these value chains, there are complex relationships with customers and suppliers.

1.2.2 Innovation

Manufacturing firms have encountered challenges such as sales reduction, accurate forecast of future needs of customer and new-product development. Many firms believed that innovation has the positive effect on organizational performance, but many of them could not develop it. They are encountered with challenges to develop innovative product based on customer needs. Innovations need huge investment. Therefore, firms those are not able to invest encounter limit growth of new products, new markets and new customers. The stressful environment, which includes traditional organizational management, decreases the encouragement of employees to innovate.

Iranian automakers are faced with challenges to innovate in the forms of process and product partly due to limited access to technology because of the sanction. Access to knowledge and expertise from foreign partners is also restricted and this further hampered innovation.

1.3 Research Objectives

The main objective of this study is to determine factors that affect operational and strategic performance of supply chain in order to develop supply chain performance framework in automotive industry. This research will trace the role of factors needed to develop operational and strategic performance in Iran's automotive supply chain. This research will also explore how these factors affect supply chain performance.

The objectives of this research are as follows:

1. To determine factors influencing strategic performance of supply chain (SPSC).
2. To determine factors influencing operational performance of supply chain (OPSC).
3. To compare the results and findings between IKCO and Isuzu in order to determine weaknesses and strengths using benchmarking and organizational learning.
4. To develop supply chain performance framework.

1.4 Research Questions

Research questions to address issues in SC performance are as follows:

RQ1a: What factors affect strategic performance of supply chain (SPSC)?

RQ1b: How the identified factors affect strategic performance of supply chain (SPSC)?

RQ2a: What factors affect operational performance of supply chain (OPSC)?

RQ2b: How the identified factors affect operational performance of supply chain (SPSC)?

RQ3: What are the differences of findings at IKCO and Isuzu and why?

1.5 Research Hypothesis

The hypothesis provide the direction of data analysis and prediction of the results (Sekaran, 2006). This study will investigate what factors and how it affects strategic and operational performance of supply chain. The hypotheses of this research are stated below:

H1: Information technology (IT) has positive effect on organizational learning (OL).

H2: Information technology (IT) has positive effect on product innovation (PRI).

H3: Organizational learning (OL) has positive effect on product innovation (PRI).

H4: Information technology (IT) has positive effect on strategic performance of supply chain (SPSC).

H5: Product innovation (PRI) has positive effect on strategic performance of supply chain (SPSC).

H6: Organizational learning (OL) has positive effect on strategic performance of supply chain (SPSC).

H7: Transformational leadership (TL) has positive effect on strategic performance of supply chain (SPSC).

H8: Process innovation (PI) has positive effect on partnership quality (PQ).

H9: Process innovation (PI) has positive effect on operational performance of supply chain (OPSC).

H10: Partnership quality (PQ) has positive effect on operational performance of supply chain (OPSC).

H11: Information technology (IT) has positive effect on operational performance of supply chain (OPSC).

1.6 Significance of the Study

Supply chain management is one of the most important factors in automotive industry. This study focuses on operational and strategic performance of the supply chain. At operational performance, this research evaluates delivery on time, lead-time, inventory level and rejected parts at both IKCO and Isuzu. At strategic performance, it evaluates long-term goals, competitors' analysis, and on time strategic decisions for NPD. This research provides direction on operational and strategic performance of automotive industry via case study. In addition, comparison was done through results between IKCO and Isuzu. Some factors were perceived as enablers such as product and process innovation, organizational learning and partnership quality.

The significance of this study is as the follows:

1. Factors identified are examined in two automotive companies in Iran. Two models that are SPSC and OPSC are derived from path analysis technique.
2. This study measures the effects of organizational learning, information technology, and product innovation on strategic performance of the automotive supply chain.
3. This study measures the effects of process innovation on operational performance of the supply chain.

The findings and results of the hypothesis examination can provide better insights to improve supply chain performance. Some benefits of this study are described as follows:

1. The findings will help managers to develop organizational, product and process innovation planning across automotive supply chain.
2. The results will help automotive companies to improve planning for knowledge sharing across the supply chain.
3. The findings will provide recommendations to develop road map for new product development.

1.7 Scope of the Study

The research is limited to supply chain of automotive industry in Iran. IKCO group and Isuzu were chosen as two case studies in Iran. IKCO produces passenger vehicles and Isuzu produces commercial vehicles. The research areas cover information technology, organizational learning, product innovation, process innovation, partnership quality, and transformational leadership, which affect strategic and operational performance through quantitative and qualitative analysis.

The validation of framework is done through expert validation only. Hypothesis testing is done through structural equation modeling and path analysis technique. Data collection is performed through survey questionnaire and interview questions.

1.8 Thesis Organization

This thesis consists of six chapters. As shown at Figure 1.1, the first chapter described introduction, background of the study, problem statement, research objectives, research questions and scope of the study. The second chapter is on literature review, which discusses about SCM and innovation and conceptual framework underlying the study. The third chapter describes the adopted methodology to conduct this research, including the instruments and methods which are used to collect data on the parameters studied. Chapter four presents quantitative data analysis, which consist of the description of the results, research findings, and testing of research questions and hypotheses. Chapter five consists of qualitative findings and results of both case studies. Chapter six is the final chapter which explain the conclusions of this research and recommendations for future research.

Chapter 1 Introduction	Background of Research Problem Statement Research Questions	Research Objectives Research Hypothesizes	Significant of the Study Scope of the Study Thesis Organization
Chapter 2 Literature Review	Operational Performance Automotive Supply Chain Strategic Performance of SC	Organizational Learning Product Innovation Process Innovation	Partnership Quality Conceptual Framework
Chapter 3 Research Methodology	Quantitative Research Research Procedure Qualitative Research	Path Analysis Technique Pilot Study Data Analysis Methods	Research Validity Research Reliability
Chapter 4 Quantitative Data Analysis	IKCO Case Study ISUZU Case Study Descriptive Statistic	Normality and Outlier Test Path Analysis Construct Validity (SEM)	Discriminate Validity Convergent Validity Hypothesis Evaluation
Chapter 5 Qualitative Data Analysis	Interview Procedure Dimensions Coding Dimensions Evaluation of SPSC at IKCO	Dimensions Evaluation of OPSC at IKCO Dimensions Evaluation of SPSC at ISUZU Dimensions Evaluation of OPSC at ISUZU	
Chapter 6 Discussion and Recommendation	RQ1- Quantitative Results RQ1- Qualitative Results RQ2- Quantitative Results	RQ2- Qualitative Results RQ3- Results Comparision Contribution of the Research	Implication of Research Recommendation for Future Research

Figure 1.1 Thesis organization

1.9 Summary

To sum up, this chapter describes background of the study, which provides background to the research. The research questions were explained, which focus on operational and strategic performance of the supply chain in the automotive industry. Some challenges in operational domain include delivery time, order lead-time, quality, and inventory. In strategic performance, challenges include mission and vision, new product development, competitors' strategy and on time decision making. Research objectives to meet research questions include factors that affect operational and strategic performance and comparing the results of case studies at both IKCO and Isuzu. Comparison is made between path analysis technique and structural equation modeling. The significance of the study and scope of the study were also described.

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