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Evaluation of Supply Chain Performance

A Manufacturing Industry Approach

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With respect, admiration, and Love,
I dedicate this book to all the people who helped me to identify my own potential, which I did not even believed possessed.

Especially To:

God. He is who giving peace to my life.
My daughter Andrea Sifuentes, she is my daily motivation and my best life project.
My husband Ernesto Sifuentes, he is mine major pillar and support, and the best competition of overcoming.
My parents Mariía A. Sosa and Arturo Avelar, they who sowed in me a great seed of superation. My sisters and brother, they have taught me the value of the family.
My teachers, colleagues, students, and friends for their advice and teachings.

Liliana Avelar-Sosa

Humans take inspiration when they set a goal. To me, my family is my inspiration, which is why I dedicate this book to:
God. I thank Him for everything.

My parents, my life teachers.
My to my children (Jorge Andres García-Rodríguez and Mariana Odette García-Rodriguez) reason to be of my life, my greatest pillars and strengths.
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My brothers who recognize me and accept me as such.

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I dedicate this book to my parents who have been an example of strength and love on the struggles o life. Thanks for all your support.

Aidé Aracely Maldonado-Macías

Foreword

Supply chain management has experienced a rapid evolution as a subdiscipline inside operation management; it is well known that successful world-class companies compete fiercely with their supply chain's performance. In this manner, a critical aspect of successfully managing the supply chain lies in measuring and observing the proper factors that conduct higher benefits. Export-oriented manufacturing industries in developing countries such as México face an even greater challenge in the race for competitiveness, and the performance evaluation approaches applied for them present a great opportunity for research.

Accordingly, the book is divided into three parts. Part 1, Competitive Aspects of Supply Chain encompasses Chaps. 1–4. Chapter 1 presents the concept and importance of competitiveness for the supply chain. This chapter introduces the topics of competitive advantage and comparative advantage in supply chain's performance. Chapter 2 presents additional relevant concepts for a global approach of modern supply chain management and improvement. Chapter 3 introduces the reader to the manufacturing industry in Mexico and its transformation; it helps to understand the context of this research and offers an overview of this industry in developing countries, and Chap. 4 explains the relationship between the supply chain and the export-oriented manufacturing industry and discusses how this relationship can impact the ability of companies to stay competitive in a global market. Additionally, an overview of the most common supply chain evaluation approaches in the export-oriented manufacturing industry is presented.

Part II is entitled Supply Chain Performance Factors and includes Chaps. 5–8. Chapter 5 debates about the concepts related to supply chain performance and supply chain performance evaluation. Companies around the world are continuously searching for a wide range of benefits for competitiveness; in this pursuit, several supply chain attributes play an important role and the proper metrics must be employed for their evaluation. The chapter explains how these attributes and metrics are classified from a financial perspective and how an operational, tactical, or strategic approach can be used to describe the qualitative and quantitative aspects of the supply chain. In Chap. 6, these factors associated with supply chain performance in the manufacturing industry are explained. The main concepts and the

overview of the elements that impact on the supply chain performance are discussed. In this manner, some important topics, such as supply chain risks, manufacturing practices, and regional factors are extensively explained. Chapter 7 describes the performance factors associated with benefits in the supply chain considered in this book. These attributes present relationships with financial and no financial performance. Some attributes include flexibility, agility, customer service, transportation, quality, delivery times, inventory, and financial performance. Chapter 8 discusses some of the most used supply chain evaluation methodologies in the industrial environment. The first chapter addresses the multivariate techniques and then the regression and factor analysis techniques. These methods are needed to understand the methodology proposed in Chap. 9 for determining the critical factors on supply chain performance for achieving competitiveness in manufacturing industry.

Finally, Part III presents the Impact of Competitiveness Aspects on the Supply Chain. Chapter 9 describes the complete methodology for validating latent variables which will help define and measure the constructs needed in this research. This step precedes the determination of structural equations models to establish the relationship among variables and determine their impact on the declared dependent variables. Proper interpretation for each model is provided with respect to the impact of these variables on supply chain's performance. Chapter 10 makes an exploratory analysis of the data collected in the research and discusses the aspects used to measure supply chain risks, manufacturing practices, and regional impact factors. Statistical data of 225 questionnaires are reported, out of which the 67% are companies with more than 500 employees, and the 29.8% are of automotive industrial sector. Chapter 11 presents the effects of manufacturing practices and risk factors on supply chain performance through structural equation models to consider the relationships between three types of supply chain risk factors—supply risks, demand risks, production process risks—and supply chain performance indices. Chapter 12 explains the impact of regional aspects on supply chain performance. Specifically, these aspects are: regional infrastructure, regional costs, services, service quality, and the role of the government as regulator. Simple and more complex models are developed to understand the influence of these aspects on achieving supply chain performance benefit variables. Chapter 13 explores the Regional Impact Factors with supply chain performance benefits. Main results indicate that aspects such as infrastructure and government support are important for companies to operate, yet they cannot be controlled inside of the facilities and depend on external forces. In his manner, they are the cause of uncertainty for companies. Chapter 14 explores the impact of manufacturing practices on supply chain performance. The relation between four management strategies for manufacturing are studied, total quality management, just in time, maintenance and advanced manufacturing technology. The results show that advanced manufacturing technologies present a significant contribution in achieving better results in the process and in quality control.

Finally, Chap. 15 presents the impact of manufacturing practices on the performance of the supply chain, for example, in agility and flexibility. Furthermore, this chapter shows an integrator model that summarizes all the contents explained in this book, since it is, perhaps, the most important contribution. The integrator model points out the impact that risk factors, regional impact factors, and manufacturing practices present to the performance of supply chains for exportation. Therefore, some conjectures are validated, such as the fact that to improve the competitiveness of a company, it is necessary to consider the features of the environment, where it operates. For example, it can be considered the Government participation, supporting companies, available infrastructure, services, or qualified task force among many others.

We genuinely believe that this book contributes to increase the knowledge of the supply chain attributes and their relationship with main benefits to remain competitive. Accordingly, this book offers specific strategies to improve the supply chain performance and the metrics to develop reliable actions for continuous improvement among all the supply chain members. Therefore, we widely recommend it for being very useful to students, decision makers, researchers in academia, and professional engineers working in these areas. We hope that you find its lecture not only useful but also enjoyable and help you in your profession to visualize a new perspective of modern logistics for manufacturing industry.

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Preface

Nowadays, globalization has made supply chains more complex and brings important challenges related to products, customer locations, suppliers, transportation requirements, trade regulations, and taxes on international trade. All these challenges appear from the beginning of the production process, yet companies, as inherent elements of the supply chain, must work to simplify the supply chain stages and process as much as possible to increase earnings and achieve success. To the largest extent possible, and according to the particular characteristics of each supply chain, it is important to reincorporate new business strategies to transform the organization and guarantee its survival and competitiveness. A supply chain consists in many parties and production stages (Liu and Liu 2017). More explicitly, a supply chain involves a system of organizations, people, activities, information, and resources working together for moving a product or service from supplier to customer. In a supply chain takes place the transformation of natural resources, raw materials, and components into a finished product that is provided to the end customer (Kain and Verma 2018). The study of supply chains starts in the early 1990s when old business paradigms must be changed due to globalization. Nowadays, companies around the world recognize that they can gain competitive advantage through its supply chain proficiencies. However, supply chain of export-oriented manufacturing industries in developing countries such as Mexico present peculiarities of interest and very little has been published about them. Competitiveness in exporting manufacturers is a hot topic for scholars and industrialists alike in their pursuit of the best recipe for higher profitability within an uncertain and dynamic competitive environment. However, the legal and government institutions that nowadays regulate the economies also have an important role in the implementation of long-term economic development projects that provide not only long-lasting competitive strategies, but also ways to systematically improve these strategies, thereby reinventing their ability to enter complex global value chains successfully. The competitiveness of exporting companies in Mexico largely depends on the global value chains in which these companies participate. That said, these companies must comply with specific tasks, forms of work, basic knowledge requirements, experience, abilities, and skills (including foreign language skills) to

produce better products at lower costs and with timely deliveries. This allows them to move from a regionally competitive industry to an internationally competitive sector.

This book presents a quite complete approach for increasing the knowledge of the logistics and supply chain management of these industries. Export-oriented manufacturing industries entail intensive mounting processes that requires majorly handwork. They arose from the presence of Mexico into the North American Free Trade Agreement (NAFTA) with the USA and Canada, facilitating the exportation of their products. As a result, logistic activities among these industries have increased their relevance due to the movement of import of raw materials and export of finished goods thru their supply chains (Avelar-Sosa et al. 2015).

Once this context is explained, the book presents the conceptualization of the supply chain performance in which several performance indicators are described and the evolution of these measurements is overviewed. Additionally, in order to conduct evaluation practices, several factors must be considered. In this way, those related to supply chain's performance in the manufacturing industry are widely discussed in twosome chapters. Accordingly, the book presents several risk management perspectives and risk assessment methodologies. Accordingly, evaluation approaches for supply chain performance have proliferated in the literature and this book has compiled the most accepted methodologies. Nevertheless, the book proposes an entire methodology to determine the relationship among supply chain factors with their corresponding benefits using structural modeling. It also includes an integrative model to clarify these relationships and determine direct, indirect and total effects to quantify the impact of these factors to obtain mayor benefits.

During its 15 chapters, this book offers valuable information that encourages companies to evaluate their supply chain performance and proposes a complete methodology to achieve this goal as well. A competitive world requests for the best companies, and this book is offering a clear methodology to determine those specific factors that impact companies' profits.

In this manner, we believe that this book is the ideal way for spreading knowledge among decision makers, postgraduate students, academics, researchers, and other professionals interested in the improvement of supply chain performance and manufacturing industries around the world. We have confidence that readers can find our work useful, interesting, innovative and a real contribution to improving supply chain performance in manufacturing environments.

Ciudad Juárez, Mexico

Liliana Avelar-Sosa
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Part I
Competitiveness Aspects of Supply Chain

Chapter 1
Conceptualization of Supply Chain Competitiveness

1.1 Evolution of the Concept of Competitiveness

Corporate competitiveness is the most pursued economic benefit in this globalized era. It is commonly addressed by economist and politics around the world (Pérez-Moreno et al. 2016). The origins of competitiveness date back to the fifteenth and seventeenth centuries and emerged from the economic theory known as mercantilism. Mercantilism stated that the way a country could produce wealth was mainly through foreign trade, and to this end, the rule was that "the value of what is sold to foreigners annually must always be greater than our domestic consumption of products" (García Ochoa et al. 2017). However, in 1776, Adam Smith's classical theory opposed to this perspective that viewed trade as a zero-sum game. To address the deficiencies of mercantilism, Adam Smith proposed an economic model that considered trade as a sum-sum game in which all traders could obtain benefits with minimum unit costs.

After Adam Smith's theory, Eli Hecksecher's neoclassical theory emerged in 1919, and then, Bertil Ohlin's theory in 1993. Both gave rise to the factor endowment theory, which claims that all nations share the same technology, but each nation has different factor endowments (Jones 2011). This principle means that a country or region can be a net exporter of the relatively more abundant factorial products and/or services, and a net importer of those relatively scarce factorial goods and/or services (Nyahoho 2010).

Eventually, the modern economic theory emerged from Krugman's classical principles (Krugman 1979) to argue that competitiveness does not depend only on a country's factor endowments, but also on labor capacities, specialized infrastructure, and supplier networks, among others. As a result, Porter (1990) proposed his competitiveness theory by claiming that "*Prosperity depends on a country's competitiveness, which is based on the productivity with which the country produces goods and services.*" In other words, strong macroeconomic policies and solid, legal institutions are necessary but not sufficient to guarantee prosperity.

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