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Best Practices in Lean Manufacturing

A Relational Analysis

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Preface

Production and manufacturing processes are becoming increasingly complex, requiring complex control and management systems. Specifically, Mexico has made an effort to excel in the maquiladora industry sector. A maquiladora is a company that has its headquarters in another country and imports most of the raw materials, carries out assembly activities in the national territory, and then exports the finished products. This industrial-style takes advantage of the free trade agreements with the United States and Canada and the associated tariff benefits.

These manufacturing companies that come to Mexico bring with them many methods and machinery for their production processes, which are highly technological. One of these methodologies is lean manufacturing (LM), a set of tools focused on minimizing waste in production processes to minimize inventories, increase product quality and meet customer needs.

Although there are currently several studies focused on the maquiladora sector in Mexico and other countries, they are focused on analyzing some of the LM tools in isolation, so more integrative studies are needed, as LM practices are rarely implemented independently. This book aims to identify the level of implementation that these maquila industries have concerning LM best practices, but not by analyzing them independently. This book conducts a comprehensive and relational analysis since LM tools are not applied independently.

The importance of this industrial sector in Mexico is that currently (May 2021), there are 5185 companies of this type, 491 are established in the state of Chihuahua and, specifically, 328 are located in Ciudad Juárez. Economically speaking, from January to October 2020, maquiladora industry imports and exports were 201,099 and 213,656 million USD at the national level. At the state level, imports and exports were 22,184 22,637 million USD. Specifically, Ciudad Juárez had imports and exports of 16,638 and 16,978 million USD, respectively. These manufacturing companies generate 2,702,116 direct jobs, 486,057 in Chihuahua state, and 322,787 in Ciudad Juárez.

Given the economic and social importance of the maquiladora industry, this book focuses on this industrial sector and consists of seven chapters. Chapter one, called Lean manufacturing origins and concepts, as its name indicates, explains the concepts

and origins of LM in the manufacturing industry. The chapter defines the main tools that integrate LM, identifies the most critical enablers and barriers for its implementation, reports some industrial successes implementation, indicates the benefits that companies are gaining, and finally, defines the research problem and objective of this book.

Chapter 2 describes some of the LM tools or best practices, their purpose in the industrial environment, applications, and expected benefits. Specifically, this book focuses on the following: Cellular layouts (CEL), Pull system (PUS), Small lot production (SLP), Quick setups (SMED), Uniform production level (UPL), Quality control (QUC), Total productive maintenance (TPM), Supply networks (SUN), Flexible resources (FLR) and Inventory minimization (INMI).

Chapter 3 defines the methodology followed in carrying out the study. The literature review is reported, the creation of the questionnaire and its application to the industrial sector, the data debugging, the techniques analyzed, and the conclusions obtained are briefly reported. Specifically, four models are reported in this book to relate the LM practices; the first three models report the variables or LM practices mentioned above. The fourth model reports a second-order model to integrate the different models into a single one.

Chapter 4 reports the first model, which is called Distribution and Maintenance and integrates four variables. The independent variables are Cell layout (CLA), Total productive maintenance (TPM), Single-Minute Exchange of Die (SMED), and Inventory minimization (INMI) is the dependent variable. Descriptive analysis for each variable is performed, six hypotheses are established, and conclusions are given based on the model and sensitivity analysis.

Chapter 5 presents model two, which is called Pull system and Quality control. It integrates four LM practices, the independent variables of which are Pull system (PUS), Small lot production (SLP) with six items, and Uniform production level (UPL). At the same time, Quality control (QUC) is the dependent variable. Six statistically tested hypotheses relate to the variables, and the conclusions and industrial implications from the relationships and sensitivity analysis are reported.

Chapter 6 reports model three, called Supplier network and Inventory minimization, and integrates four variables. The independent variables are Pull system (PUS), Small lot production (SLP), and Uniform production level (UPL), while the dependent variable is Quality control (QUC). The four variables are related using six hypotheses, which are statistically tested and concluded based on the results found from the model and the sensitivity analysis.

Finally, an integrative model with four second-order variables is reported since, as mentioned above, LM practices are not implemented in isolation in production systems. LM practices are integrated according to their role in the production process. The independent variables are Machinery (MAC) (Cellular layout, Total productive maintenance and Single-Minute Exchange of Die), Production Planning (PRP) (Push system, Small lot production, and Supplier networks), and Production process (PRR) (Inventory minimization, Uniform production level, and Flexible resources). In contrast, the dependent variable is Quality control (QUC).

Although this study and the models reported have been statistically validated with information from the Mexican manufacturing industry, this does not mean that they are not applicable in other geographical contexts. Hence, the authors hope that the results reported here will be helpful to all managers and engineers responsible for decision-making processes that seek to increase the efficiency of the production processes in their charge.

Ciudad Juárez, Mexico

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