

Handbook of Research on Design and Management of Lean Production Systems

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A volume in the Advances in Logistics,
Operations, and Management Science
(ALOMS) Book Series



An Imprint of IGI Global

Managing Director: Lindsay Johnston
Production Editor: Jennifer Yoder
Development Editor: Austin DeMarco
Acquisitions Editor: Kayla Wolfe
Typesetter: Christina Henning
Cover Design: Jason Mull

Published in the United States of America by
Business Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: <http://www.igi-global.com>

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Library of Congress Cataloging-in-Publication Data

Handbook of research on design and management of lean production systems / Vladimir Modrak and Pavol Semanco, editors.

pages cm

Includes bibliographical references and index.

Summary: "This book explores the recent advancements in the areas of lean production, management, and the system and layout design for manufacturing environments, capturing the building blocks of lean transformation on a shop floor level"-- Provided by publisher.

ISBN 978-1-4666-5039-8 (hardcover) -- ISBN 978-1-4666-5040-4 (ebook) -- ISBN 978-1-4666-5041-1 (print & perpetual access) 1. Lean manufacturing. I. Semanco, Pavol, editor of compilation. II. Modrak, Vladimir, 1957- editor of compilation.

TS155.D4757 2014
658.4'013--dc23

2013039026

This book is published in the IGI Global book series Advances in Logistics, Operations, and Management Science (ALOMS) (ISSN: 2327-350X; eISSN: 2327-3518)

British Cataloguing in Publication Data

A Cataloguing in Publication record for this book is available from the British Library.

All work contributed to this book is new, previously-unpublished material. The views expressed in this book are those of the authors, but not necessarily of the publisher.

For electronic access to this publication, please contact: eresources@igi-global.com.

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Preface

ABOUT THE SUBJECT

The term “Lean Manufacturing” was coined by James Womac and Daniel Jones in their book *The Machine That Changed The World*. Lean manufacturing is considered to be a very important success factor in the competitiveness of companies *with a real possibility* for pull type manufacturing systems. Equally, as with many powerful manufacturing concepts, Lean manufacturing strategy and implementation plans *are* seen rather as a journey of sustained process improvement and should not be regarded as a quick-fix solution. Lean Manufacturing Systems evolved as a solution to efficient batch-type production of a variety of part types with low set up time, low work-in-process inventory, short manufacturing lead time, and high quality. The essence of Lean Manufacturing is to focus on improvement techniques to control material flow on the shop floor. Achieving Lean Production is a long, constant process during which the factories have to continuously manage and undergo changes. Lean is more or less the complex philosophy of manufacturing management with continuous improvement to increase overall productivity and quality in a wide segment of manufacturing industries. Therefore, this edited book is seen as a contribution to this process by reflecting several pertinent areas, which designers and managers have to go through in putting a project together for their company.

ORGANIZATION OF THE BOOK

This book is a compilation of 18 contributions to the discussion of the main topic’s concern with exploring and capturing soft building blocks of successful Lean transformation on the shop floor level and also how to maintain and continuously improve Lean status quo from the social, managerial, and organizational perspectives.

These well-selected 18 chapters are written by a group of 34 authors that includes internationally highly respected and experienced authors in the field of designing and management of Lean Production Systems and a set of younger scientists and researchers showing beyond all doubt promising potential for research and development. The book integrates contributions from academe, research, and industry from around of the world to represents good practices, state-of-the-art approaches, principles, and developments that are addressed to this subject.

Design and Management of Lean Production Systems is organized in four essential sections:

Section 1: “Introduction to Development of Manufacturing Paradigms”.

Section 2: “Modeling and Designing of Lean Production Systems” is devoted to development of optimization approaches, techniques, mathematical, and simulation models, and their comparison considering selected aspects like domain-like product sequencing problems, control strategies, and organizational, and technological issues.

Section 3: “Good Practices of Implementation of Lean Manufacturing Principles” presents practical solutions and applications on selected problems including viewpoints and observations of experts in their respective fields of interest.

Section 4: “Operations and Supply Chain Management in Lean Manufacturing Systems and Related Issues” covers state-of-the-art of research on operations management (including lean management and audit), supply chain management, and strategies from the managerial point of view.

The first section, “Introduction to Development of Manufacturing Paradigms,” includes one chapter.

In chapter 1, “The Evolution of Manufacturing Systems: From Craftsmanship to the Era of Customisation,” Mourtzis and Doukas describe and analyze the evolution of manufacturing paradigms, their basic principles, and the links among them. The first chapter also discusses the future trends on manufacturing paradigms derived from the review.

The second section, “Modeling and Designing of Lean Production Systems,” includes chapters 2 to 6.

In chapter 2, “Mathematical Modeling and Genetic Algorithms for Product Sequencing in a Cellular System,” Süer and Yarimoglu deal with a product-sequencing problem in a synchronized manufacturing environment, which is using uniform time bucket approach for synchronization. A mathematical model is developed for the manpower allocation part of the problem. To perform product sequencing, two methods are used, namely mathematical modeling and five-phase genetic algorithm. Finally, GA results are compared with mathematical model results

In chapter 3, “Maximization of Delivery-Based Customer Satisfaction Considering Customer-Job Relationships in a Cellular Manufacturing Environment,” Süer and Arinsoy propose a mathematical model to maximize overall customer satisfaction subject to minimum satisfaction levels for selected customers. The customer satisfaction is measured in terms of ratio of jobs completed to the total number of jobs from a customer. Experimentation was performed with this model in a multi-period rolling environment and tested four different fuzzy rules modifying the minimum satisfaction levels for customers in a dynamic fashion in a rolling horizon.

In chapter 4, “On Designing Robust Kanban Production Control Strategies in Multiproduct Manufacturing Environments” by Olaitan, Rotondo, Young, and Geraghty, two Kanban Allocation Policies, Shared (S-KAP) and Dedicated (D-KAP), are analyzed to understand how they would perform under different manufacturing scenarios, and the chapter identifies the merits and demerits of each. To evaluate the performance, a three-stage two-product system was simulated under scenarios, which provide for different levels of demand variability for each product. Based on the results from the model, guidelines on how to effectively combine these two policies to achieve the benefits of both in a multiproduct manufacturing system are developed.

In chapter 5, “Lean Manufacturing System Design Based on Computer Simulation: Case Study for Manufacturing of Automotive Engine Control Units,” by Bronislav and Robert, possibilities of making use of simulation are presented in the form of the case simulation study that was performed within the

framework of cooperative ventures between the workplace and an industrial partner. The main task was to build up a model of the prepared lean manufacture system and, especially, to propose a number of variants for the spatial location of operators in a production line of the Continental Automotive Systems Czech Republic company.

In chapter 6, “Modeling and Control of Production Task Flows using High-Level Activity-Based Petri Nets” by Gen’ichi Yasuda, the author presents a systematic methodology for modeling and controlling productive tasks at the organization and coordination levels in advanced production systems, especially focusing on design and implementation aspects of lean production systems. To overcome some difficulties in the modeling of production systems with a large number of elements in Petri nets, High-Level Activity-Based Petri Nets (HAPN) are defined based on condition-event Petri nets.

Section three “Good Practices of Implementation of Lean Manufacturing Principles” includes Chapters 7 to 12.

Chapter 7, “Cell Design for Transforming the Job Shop Production Process to Lean,” by Modrák and Semančo, deals with the transformation of production process from batch to flow as an effective way to optimize material flows in a job shop manufacturing environment. The authors present decision-making rules and principles for this concern. Subsequently, a case study is offered in which methodical procedures for transformation of manufacturing of small- to medium-sized lots with the aim to reach one-piece flow production are described in detail.

Chapter 8, “Implementing Lean in Engineer-to-Order Manufacturing: Experiences from a ETO Manufacturer,” by Matt and Rauch, reviews the state of the art in engineer-to-order production and non-repetitive production to give an overview of existing research and applications of Lean in this sector. Afterwards, a real case study at a medium-sized ETO manufacturer shows an approach to implement Lean Production in such a non-repetitive manufacturing environment. In the consolidation phase of the Lean production system, a Lean-Toolset was defined with the most suitable Lean methods for engineer-to-order manufacturing systems.

Chapter 9, “A Management System for Sustainable Lean Implementation,” by Van Landeghem, describes a back-to-basics approach to Lean implementation, developed specifically for small- and medium-sized businesses (SMEs). It delineates the framework of a management system, which uses standard Lean tools embedded in an IT data-gathering system. This framework consists of three loops that provide the kind of information needed for a sustainable Lean implementation trajectory. Finally, the authors show how the system provides an answer to current gaps in Lean Management.

Chapter 10, “Integration of MRP Logic and Kanban Shopfloor Control,” by Powell, presents a framework for the integration of MRP and Kanban, which gives details of the purpose of the master production schedule, documents the two primary roles of inventory management considerations, and explains how Kanban operates in such a system in order to eliminate non-value-adding activities and to simplify the production management task. An illustrative case study is also presented with practical examples applications of techniques (production leveling [Heijunka], net-requirements planning, backflushing, and cost-accounting) in an integrated MRP-Kanban system.

Chapter 11, “Lean Transformation in Small and Medium Enterprises: Practices, Enabling Factors, and Constraints,” by Panizzolo, Bernardel, and Biazzo, presents the empirical research work divided into three parallel sections, namely Lean Manufacturing, Lean Design, and Lean Office. In each section, the crucial issues about Lean Transformation are investigated through a Delphi study, which was performed by joining the “Lean Community” research project. The study involves 32 manufacturing SMEs in Northeastern Italy, with a proved and excellent experience on Lean Thinking.

Chapter 12, “Is Lean Supply an Option for SMEs in the Automotive Industry: An Irish Case Study,” by Davis, Geraghty, and Lambert, ascertains the many internal and external challenges that MSMEs face when trying to achieve equitable amounts of value from the lean supply concept with larger, more powerful suppliers.

Section 4, “Operations and Supply Chain Management in Lean Manufacturing Systems and Related Issues,” is the last section of the book. It integrates the final 6 chapters.

Chapter 13, “A Corporate Perspective on Global Management and Development of Lean Production Systems: A Case Study,” by Bellgran, elaborates factors (level of standardization on principles and tools, how to structure and organize additional resources, how to share experiences within the organization, and how to sustain the effort) from a factory perspective based on the presentation of the lean journey of Gyproc AB, a process industry company within the Gypsum part of the large Saint Gobain group. The company has worked for about 10 years in implementing world-class manufacturing and has extensive experience on the issues of start-up and sustaining the lean-based concept.

In chapter 14, “Auditing for Measuring the Extent of Lean Implementation,” by Vindoh, Kamala, Shama, and Aravindraj, the objective is to present the details of lean audit conducted among 25 Indian automotive manufacturing organizations. The audit consists of 59 indices grouped among 20 categories. The lean audit investigates the lean adoption and derives the appropriate lean phase. The conduct of the lean audit examined the leanness level of organizations and the possible improvement proposals for leanness improvement.

Chapter 15, “Lean Management and Supply Chain Management: Interrelationships in the Aerospace Sector,” by Martínez-Jurado and Moyano-Fuentes, mainly focuses on evaluation of the state-of-the-art of research on Lean Management and Supply Chain Management strategies in the aerospace sector using systematic literature review methodology. The analysis has enabled three main topics to be identified: a) adoption and implementation of lean management; b) development of supply chain management; and c) deployment of lean principles and practices across the supply chain. Finally, range of academic and professional implications is set out.

In chapter 16, “Dynamic Supply Chain Management for Lean Manufacturing,” Tanimizu proposes a strategy for MTO (Make To Order) companies to find suitable business partners in the dynamic supply chain environment and to enter into proper contracts with the partners as well as to obtain appropriate profits. A two-layered supply chain model and its three-layered extension are proposed to provide a negotiation protocol to determine suitable prices and delivery times for ordered products through the iteration of the negotiation process between the organizations, as well as through the modification processes of production schedules.

Chapter 17, “The Role of Lean Production on Organizational Performance,” by Kasemsap, introduces the role of Lean Production on organizational performance, thus explaining the management practices of Lean Production of just in time, total productive maintenance, total quality management, cellular manufacturing, and human resource management. The chapter highlights some significant revelations about various facets of simultaneous implementation of Lean Production paradigms in the manufacturing organizations.

In chapter 18, “Blending Green with Lean - Incorporating Best-of-the-Breed Practices to Formulate an Optimum Global Supply Chain Management Framework: Issues and Concerns,” by Joshi and Sharma, the objective is to identify potential areas in which firms can integrate Green into current business practices based on an existing set of literature. The chapter provides an assessment of existing academic research on the relationship and links between Lean and Green Supply Chain Management Practices. Existing explanatory frameworks are explored and discussed.

Target Audience

The target audience of this book is composed of scholars, professionals, and researchers concerned with the field of Lean Manufacturing design and management. The book is also intended to support practitioners in developing and implementing Lean Manufacturing techniques and projects. It is also intended to support subjects of Lean Production and Management.

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Prešov, October 2013