

Preface

The main aim of this book is to present my recent work on the physics and economics of management through the developmental theory and practice of management science/operations research (MS/OR), which builds on my previous book (Volume 125 in Springer's MS/OR series). Further, this work is a useful contribution to the next-generation discrete system of science and management for higher society.

Scope of This Book

The scope of this book revolves around the science and management of the 3M&I-Time system in the discrete world, which is a complex class that consists of human, materials/machine, money, and time inputs. This system is treated using a stochastic/intelligence (medium) approach.

The science of this system is the interdisciplinary and unity science of physics, management, and economics, and it is based on the synthesis of knowledge and intelligence in the new discrete world. In this book, this domain is referred to as a discrete and complex science (of physics and economics) in industry and society.

Another domain, which is referred to as “higher management science and operations” in this book, stems from the change from traditional management to higher management, which is driven by the power of information and communications technology (ICT) in the cloud computing/global age. This domain exists to meet the needs of logic for real-time/systematic decisions and management in a changeable, speeded up, and risky environment.

Two Reasons for Publishing This Book

The ICT Management Age

In the latter half of the twentieth century, computers rapidly gained importance, and IT management began to be increasingly recognized in society. The next step in MS/OR is required under large and dynamic data, but traditional MS/OR lacks the systematic/sequential processing and decision methodology in this ill-structured world. However, a systematic methodology for higher MS/OR may be possible by taking a stochastic/intelligence approach.

This higher MS/OR may be forward-looking and may dynamically balance the closed world of demand and supply economics in the future, which necessitates a change in enterprises and in social science by taking the stochastic/intelligence (medium) approach rather than the traditional static/statistical (mean) method. In practice, the problems of the post-ERP/SCM (enterprise resource planning/supply chain management) process in this “real-time” age still exist.

After the Springer Book

In 2008, I proposed and published a stochastic management approach for Manufacturing and Service Enterprises with Risks in the 3M&I system. This book discussed the two main models of demand-to-supply and process-cycle management as well as the two or three center models for sales, production, and supply in the job-shop, lot, flexible enterprises, and supply chain types.

In the later chapters of this book, their ellipse maps and strategies can be found in the pair matrix table of (revenue, cost) elements and lead-time, and we discuss the pair view of economics (profit) vs. reliability (lead-time). This first book showed the scheme of enterprise modeling and integration in MS/OR and laid the foundation for higher MS/OR in the next-generation 3M&I-Time system.

Generally, traditional MS is an interdisciplinary science that has a wide range of applications in the real world. However, it has a methodology limited to solvable/well-structured problems, and it would not be applicable to the operations and risk optimization in the 3M&I-Time system at the real/strategic speed of demand. These serious problems can be improved, as addressed in the present book.

Book Outline

Part I: Problem and Preliminaries

In Chap. 1, the objective of this book is directed toward the problem of higher management and operations in the real-time age, and the requisites of real-time management are prepared and outlined.

In Chap. 2, the science of higher management and operations is prepared in the original framework. One form is through Matsui's form ($W = ZL$), the first knowledge form of the discrete world on cyclic views since Ohm's law. This form originated in Matsui's equation in 1977, with Z , L , and W representing cycle time, queue length, and waiting time, respectively, in a queueing system with lost units.

Another form is Muda's form, Chameleon's criteria on efficiency vs. "muda" (loss) issues, which is the second knowledge form of the discrete world. This criterion originates in the change from the mean criterion post-Taylor system to the medium criterion in a newsvendor model. Moreover, this medium approach and control are related to the balancing (harmony) of nature (physics) vs. arts (heart) that is useful for balancing problems of the limited cycle in a world of social optimization and redundancy.

Part II: Basic Method for Higher Management

The two basic tools of traffic accounting and the progressive method are introduced in this part. In Chap. 3, traffic accounting is explained as the costing model of the unit-time base, and this model consists of busy, idle, overflow, and waiting costs in the utilization function. This tool is accompanied with a practical example.

In Chap. 4, the progressive method is described, which is useful as a measurable and controllable tool of inventory, assets, and traffic. This method uses the two cumulative inventory, assets, and visible curves of input (inflow) and output (outflow), and utilizes the two differences in these cumulative values: inventory in height and lead-time in width.

Part III: Developments for Higher Management

The two theories of real-time and matrix logics are proposed and developed here. In Chap. 5, the performance system for enterprise management is presented for enterprise-organizational behavior in a bottom to top strategy system at real-time speed. This is followed by the elliptic strategic map, based on the sandwich theory of the lower/operational and upper/managerial levels of an enterprise (body).

Another matrix logic is not optimization-oriented in MS/OR, but rather, uses the process-oriented (or white-boxed) approach.

In Chap. 6, the invisible collaborations when balancing demand in enterprises are discussed. The findings show that profit maximization occurs at the even-profit level and that relative cost balancing occurs in parallel in each type of enterprise.

Part IV: Soft Tools Toward Post-ERP/SCM

Here, two soft tools are developed and introduced for advanced management and operations toward post-ERP/SCM. In Chap. 7, the SALPS (stochastic assembly line planner with strategy) tool, a strategic planner for stochastic assembly lines, is applied to some sample factories.

In Chap. 8, the DSMAP (strategic demand-to-supply map) tool, a strategic planner for demand-to-supply planning at sales and operation levels, is opened and used as a learning tool to support exercises in the education system. These two soft tools are pilots, but they would be useful to industries, together with the ODICS (on-demand inventory control system) tool (Japan patent) in Chap. 4.

Appendix

The two fundamental physics of factory-like discrete science are here supplemented. Appendix A is the proof of Matsui's equation in Sect. 2.1, as cited from Matsui's paper in 1993 and 2005. Appendix B is the physics of station-centered networks in my books, as based on the world of economics.

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