DECISION SYSTEMS FOR INVENTORY MANAGEMENT AND PRODUCTION PLANNING

Second Edition

Rein Peterson

Edward A. Silver

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PREFACE

Inventories are produced, used (for example, as raw materials, supplies, spare parts, and so forth), or distributed by *every* organization. Moreover, inventories represent a major investment from the perspectives of both individual firms and entire national economies. In addition, enormous costs are incurred in the planning, scheduling, control, and actual carrying out of replenishment (procurement or production) related activities.

Inventory management and production planning have been studied in considerable depth from a theoretical perspective. Yet, those of us who, through consulting work, come into close contact with managerial decision procedures in this area are repeatedly surprised to find how limited, and ad hoc, many of the existing decision systems actually are. The rate at which theory has been developed has far outstripped the rate at which decision practices of firms have been successfully upgraded. A major gap has existed between the theoretical solutions, on the one hand, and the real world problems, on the other.

Our primary objective in the first edition of the book was to bridge this gap through the development of *operational* inventory management and production planning decision systems that would allow management to capitalize on readily implementable improvements to current practices. Extensive feedback from both academicians and practitioners has been very gratifying in this regard. Our primary objective is unchanged in this revised edition. We hope to further bridge the gap with this *substantial* revision that incorporates ideas from our additional consulting and teaching experience and that uses certain aspects of feedback that we have received, as well as recent *practical* research findings.

Major changes made in this edition include:

1. An expanded treatment of the strategic issues of production planning and inventory management.
2. More emphasis on production-related material, that is, a more balanced coverage of inventory management and production planning.
3. Introduction of a unifying framework for planning, scheduling, and control in production situations.
4. A more balanced treatment of capacity-oriented process industry situations versus materials/labor-oriented fabrication/assembly industries.
5. Expanded coverage of Material Requirements Planning and its extensions, including Distribution Requirements Planning.
6. Substantial treatment of scheduling at a bottleneck production operation.

7. Discussion of the Japanese "Just-in-Time" Manufacturing philosophy and the associated details of a Kanban control system.
8. A major revamping and more comprehensive coverage of the strategy and tactics of forecasting.
9. Incorporation of the impacts of inflation.
10. Treatment of control procedures for repairable items.
11. Discussion of some of the latest developments in coordinated inventory control of families of items, multistage lot-sizing, and multiechelon inventory control.

In introducing new technical material and trimming some of the old material, the viewpoint adopted has been to stay away, as much as possible, from complicated mathematics and, instead, to give a primarily qualitative description of the complexity of a particular problem, the general approach taken, and the nature of the results (with appropriate literature references for readers wishing to pursue the specific topic in more depth). In the same vein, most mathematical proofs have been placed in Appendixes at the end of individual chapters. In addition, a few sections, requiring a level of mathematical understanding higher than the rest of the book, *have been marked with asterisks.* In all cases, these sections can be omitted without a loss of continuity. This style of presentation has been deliberately chosen so that sufficient material of interest is made available to the analytically inclined reader, while at the same time providing a meaningful text for a less analytically oriented audience.

Part One of the book presents a discussion of inventory management and production planning decisions as important components of total business strategy. Topics covered include the diverse nature of inventories, the complexity of production/inventory decision making, cost measurement, and an introduction to the important concept of exchange curves. A separate chapter is devoted to the determination of forecasting strategy and the selection of forecasting methods.

Part Two is concerned with traditional decision systems for the inventory control of individual items. The use of approximate decision rules, *based on sound logic*, permits realistic treatment of time-varying (for example, seasonal) demand, probabilistic demand, and the many different attitudes of management toward costing the risk of insufficient capacity in the short run.

Part Three deals with special classes of items, including the most important (Class A) and the large group of low-activity items (Class C). Also discussed are procedures for dealing with items that can be maintained in inventory for only relatively short periods of time—for example, style goods and perishable items.

Part Four addresses two types of coordination of groups of items in nonproduction contexts. First, there is the situation of a family of items, at a single stocking location, that share a common supplier or a common mode of transport. The second type of coordination is in a multiechelon framework where replen-

ishment requests from one stocking point become part of the demand at another location.

Part Five is concerned with decision making in a production environment. A general framework for such decision making is presented. Two separate chapters deal with the details of short-range scheduling and control: one primarily for capacity-oriented flow production and the other for materials/labor-oriented fabrication/assembly situations.

Part Six discusses the important practical problems of planning, implementation, and control of large decision systems. We pool, in this section, our consulting experience with psychological-sociological research findings on bringing about change. The concluding chapter includes a discussion of *computerized* decision systems.

Extensive problem sections (substantially modified from the first edition) have been provided at the end of each chapter. *In addition, a large selection of supplementary problems are available in the Solutions Manual.* Finally, six case studies, entitled MIDAS Canada, are interwoven with the material in the text to provide a context for technical topics and a means of reference to existing managerial practice. *The cases can be utilized individually*, but it is recommended that Case A be read prior to dealing with any other case.

As was the situation with the first edition, the book should be of interest to faculty and students in programs of business administration, industrial/systems engineering, and management sciences/operations research. Although *the presentation is geared to a basic course in production planning, scheduling, and inventory management*, the inclusion of extensive references permits its use in advanced elective courses and as a starting point for research activities. At the same time, the book should continue to have broad appeal to practicing analysts and managers.

Possible paths through the book for different types of users include:

1. Industrial/systems engineering, management sciences/operations research programs:
   a. One-term course on inventory management: Chapters 1–12 and 17–18.
   b. One-term course primarily on production planning and control: Chapters 1–3, 4 (medium-range forecasting), 13–18, and Cases E–F.
2. Graduate business (MBA) programs (as a part of the production/operations management offerings or as an illustration of a functional area application of the management sciences approach to problem solving):
   a. One-term course on inventory managment: Chapters 1–7, 11–12, 17–18, and Cases A–D.
   b. One-term course primarily on production planning and control: Chapters 1–3, 4 (medium-range forecasting), 13–18, and Cases A–F.
3. Undergraduate business and community college programs: Chapters 1–7 and 9–10.

4. Managers exclusively interested in policy issues (perhaps on an executive development program basis): Chapters 1–4, 13, 17–18, and Cases A–F.
5. Practicing inventory/production managers and consultants (the latter both internal and external):
   a. As related to purchasing managers, industrial distributors, and retailers: Chapters 1–7, 9–12, 17–18, and Cases A–D.
   b. As related to manufacturing managers and production planners: All of the above as well as Chapters 13–16 and Cases E–F.

Most organizations face an increasingly competitive environment, both nationally and internationally, in the production and distribution of their goods. It is hoped that this revised edition of our text will help prepare readers to better cope with this complex decision environment.

E.A. Silver
R. Peterson

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The manuscript, as is often the case, had its origin in the teaching notes used by the authors for several years in courses they taught at Boston University, The University of Calgary, Columbia University, the Swiss Federal Polytechnique Institute, the University of Waterloo, the University of Western Ontario, and York University. A large number of students (including many part-time students holding employment in industry) have provided excellent critiques. We would like to particularly thank Maged Abo El-Ela, Blyth Archibald, Louis Brosseau, Ron Craig, Alan Daley, Paul Dixon, Robert Lamarre, John Miltenburg, and Robert Thompstone. A special note of appreciation is in order to Patricia Lundman, Russ McGillivray, and Ken Miller for their excellent work on the Solutions Manual.

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E. A. S.
R. P.

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