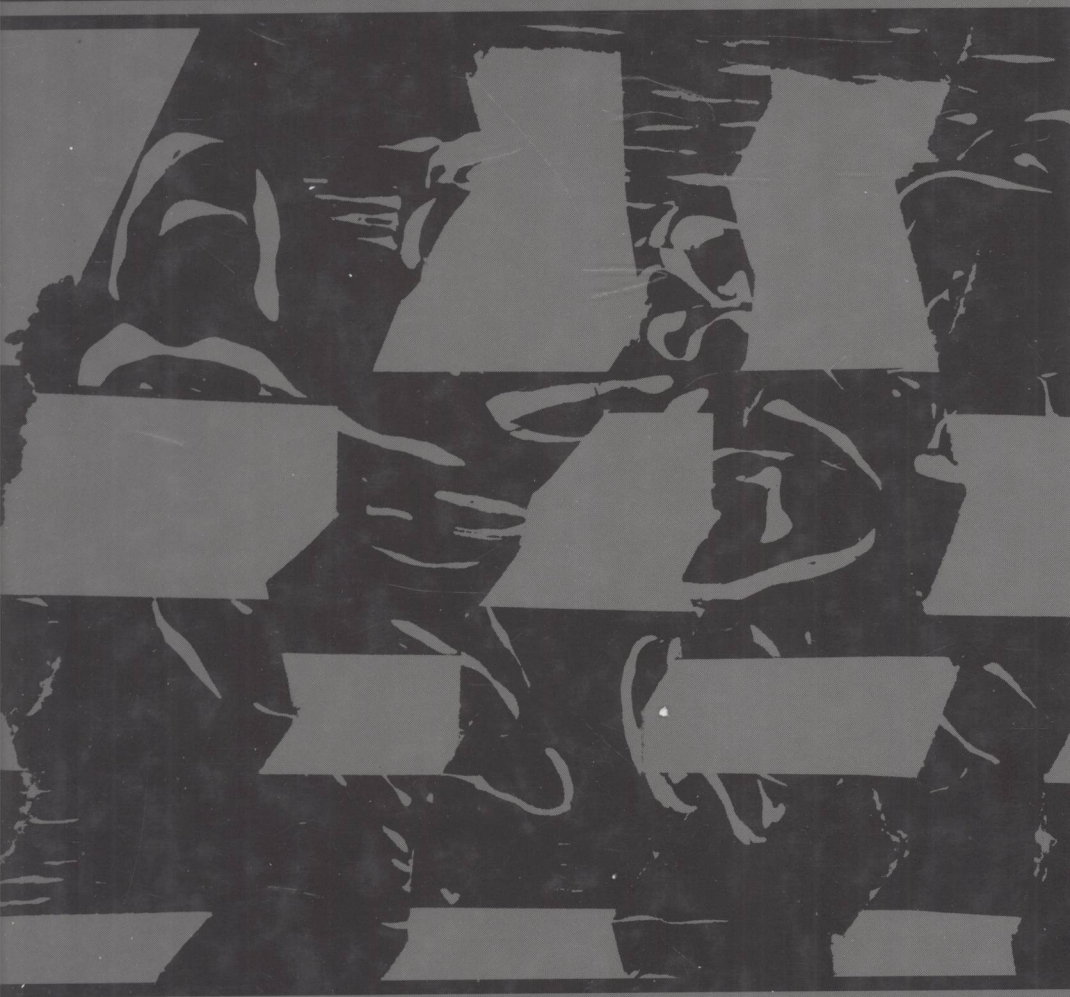
TOPICS IN

JUST-IN-TIME MANAGEMENT



MARC J. SCHNIEDERJANS

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Topics In Just-In-Time Management

Marc J. Schniederjans
University of Nebraska-Lincoln

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PREFACE

The subject of "just-in-time" (JIT) means many things to many people. Some feel it is an approach to production planning and control; to others it is a methodology to achieve manufacturing excellence; to still others it is a philosophy to guide everyday work activities; some businesses even view JIT as a winning strategy in the highly competitive marketplace of the 1990s. All businesses know that when a winning strategy comes along, out of competition, you use it to win, or have it used against you and lose. JIT is well recognized and respected by all as a winning strategy, philosophy, methodology, or approach. The lack of willingness (mostly because of lack of information on the subject) in the 1970s to use JIT has forced the U.S. to play catch-up in the 1980s. Much of the JIT implementation in the 1980s has only moved U.S. industries closer to a state of parity with the Japanese and other foreign competitors who use JIT. Much of this work centered on imitating what the Japanese do in Japan in hopes of making it work in the U.S. Obvious differences between Japanese and U.S. production philosophies, such as the U.S. orientation toward the use of computer technologies, have offered some challenges to those U.S. managers who have been trying to integrate JIT. Combining the 1980s experience with JIT in the U.S. and recent research on how to go about integrating JIT has now poised U.S. operations to extend JIT philosophy by making it a unique "American" philosophy.

Who Should Read This Book

This book is designed for faculty to use in teaching business and industrial management majors who are interested in learning how to use JIT and how to integrate JIT in modern business organizations for the 1990s. This book is designed as a JIT supplement for an upper level undergraduate or a graduate college course in production planning and control. It can also be used as a primary textbook for a topical course or a seminar in JIT management. The book is also of use to professional production and operations managers who want to learn about JIT and how it can be integrated with computer-based systems.

Organizational Structure Of This Book

The book is organized into three parts. The first part is introductory JIT material and requires no prerequisite knowledge. The second part of the book presents a series of advanced topics. While brief overviews of the advanced applications of JIT are presented in these chapters, students are expected to have completed at least a basic production/operations management course as prerequisite knowledge. The third part of the book presents an optional JIT in-class simulation game to help illustrate some of the basic JIT principles.

Acknowledgments

Regardless of who claims to be an author of a book, it is always a creative work of many individuals. I wish to acknowledge those people with whom I have had direct contact in the process of writing this book. I would like to express my gratitude to Barry Render of the Roy E. Crummer Graduate School of Business at Rollins College, who gave me the opportunity and trust to do this book. I would like to thank Richard J. Schonberger of Schonberger & Associates, Inc. (who introduced me to JIT) and Ellen J. Dumond of California State University-Fullerton, whose very helpful editorial comments helped to shape the final form of the book. I would also like to thank a number of operations practitioners, including Ken "Giant Man" Kahre, Edgar "Hercules" Wood, Daniel "Thor" Hillen, Alan "Hawkeye" McHugh, and especially Mark "Captain America" Helmer. While working at Sregneva Unlimited in St. Louis, these people altered my ironclad views on the applicability of JIT solutions to human resource problems. (Remember "Toad City"!) I would also like to recognize the significant contribution of my editor, Rich Wohl, who kept me on track and supported my efforts. I take full credit for all errors, omissions, and typos.

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PART ONE

An Introduction to JIT

CHAPTER 1
An Introduction to JIT

CHAPTER 2
JIT Inventory Management

CHAPTER 3
JIT Production Planning and Scheduling Management

CHAPTER 4
JIT Quality Management

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CHAPTER ONE

An Introduction to Just-In-Time

Chapter Outline

What is Just-In-Time? An Introduction

Why Study JIT?

How This Book is Designed to Aid in Understanding JIT

Who Should Read This Book

Organizational Structure of the Book

Organizational Structure of the Chapters

Why You Should Read This Book

Limitations of This Book

Learning Objectives

After completing this chapter, you should be able to:

1. Define what JIT is and how it differs from non-JIT operations.
2. Explain the key principles that make up the JIT philosophy.
3. Explain why JIT is a subject worth learning.
4. Describe the productivity cycling process and how JIT makes it work.
5. Define a number of Japanese terms used in JIT.

What is Just-In-Time? An Introduction

The subject of *just-in-time* (JIT) means many things to many people. Some business people feel it is an approach; to others it is a methodology; and to still others it is a philosophy, concept, or strategy. JIT is all these things and more. JIT's origins in Japan during the 1960s caused it to be initially considered as an approach to inventory management [1, p. 5]. (We will discuss JIT as an inventory management approach in Chapter 2.) Others viewed JIT as an approach to quality control. (We will discuss JIT as an approach to quality control in Chapter 4.) The nature of JIT, though, cannot be considered a limited inventory or quality control approach, but a multitude of approaches with applications throughout the business organization. JIT is not just for a couple of departments in an organization, it is for all departments in all types of organizations.

JIT's integrative nature started expanding from inventory and quality control into other areas of operations, like production scheduling. One commonly used JIT scheduling methodology is the *kanban* card system. (We will discuss JIT production scheduling systems in Chapter 3.) As industry and academic researchers explored the ramifications of JIT in the 1970s in Japan and during the 1980s in the United States and throughout the world, it became clear that the dynamic nature of JIT is not a limited methodology, but is made up in part of many methodologies. No longer just a Japanese method of inventory management, JIT is now an internationally known approach to excellence in production and operations management. JIT's pursuit of perfection can philosophically and strategically be seen to embrace all aspects of business operations, in all countries.

A simple definition for JIT is the successful completion of a product or service at each stage of production activity from vendor to customer just-in-time for its use and at a minimum cost. JIT can also be generally defined as a strategy or guiding philosophy whose goal it is to seek manufacturing excellence [2]. JIT is based on eight key principles:

1. Seek a produce-to-order production schedule.
2. Seek unitary production.
3. Seek to eliminate waste.
4. Seek continuous product flow improvement.
5. Seek product quality perfection.
6. Respect people.
7. Seek to eliminate contingencies.
8. Maintain long-term emphasis.

Let's examine each of these key principles. While introductory in nature, these principles provide a foundation on which each of the chapters of this book will build. The entire JIT philosophy is dynamically changing all the time and cannot adequately be expressed in a single chapter or even a single book. Also, please keep in mind that no single organization can embrace every aspect of JIT, but to a greater or lesser degree, all organizations can use these principles. They have application to both manufacturing and service organizations. They can be used to improve the production of custom products in **job shop** operations as well as homogeneous products in **repetitive manufacturing.** The extent to which an organization can embrace the JIT principles will help define the extent to which they can expect to share in its reported benefits.

Principle 1. Seek a Produce-to-Order Production Schedule In a *produce-to-order* system the manufacturer waits to produce products until the customer places the order. The goal of the system is to produce the finished goods just-in-time for consumption. Under this system, the item is immediately sent to the customer when completed. It doesn't become a carrying cost draining inventory items, but instead immediately generates sales from its waiting customer. The JIT operation produces only what is necessary in time for its use. In contrast, non-JIT operations using **produce-to-stock** systems rely on forecast projections of demand and place production into their inventory. Unfortunately, forecasts are often in error, and inventory that is held in stock by inaccurate forecasting is costly.

While all organizations can seek a produce-to-order system, they may never accomplish it perfectly. Lead times for customers waiting for an order may be quite prohibitive. Also, some organizations using produce-to-order systems can and do have buffer inventories of finished goods. This JIT principle, as well as the rest, are designed to motivate the organization to "seek" its unique level of implementation. JIT principles do not have to be completely implemented for an organization to be a JIT operation.

Principle 2. Seek Unitary Production Each unit of finished product is viewed as a separate order. The goal of the JIT system is a production lot size of one. Why have such small lot sizes? This principle allows production flexibility and reduces inventory costs. It is much easier to make minor adjustments in a

unitary production system to meet shifts in demand, than to revise the non-JIT large-lot operation. Large-lot production requires more planning and lead time. Once a large lot size is set in the non-JIT system, an organization's production planning for equipment, human resources, and vendor contracts are usually also set. When a minor change is needed to adjust for a shift in demand, management in a non-JIT operation will be motivated to resist any minor deviation from the large lot production levels to avoid the cost and effort the changes might entail. The ability to make quick shifts to meet changes in demand avoids the costs of unwanted inventory during a decrease in demand and avoids the costs of missed sales during an increase in demand. We can view the unitary production as a means to avoid what the Japanese call ***mura*** or a production unevenness. By being able to make small unitary changes in production schedules, firms can avoid major shifts in inventory planning and human resource reallocations necessary in large lot production scheduling.

Another reason for seeking unitary production is to help reveal inventory and production problems. Raw materials, component parts, and subassemblies are all paced to arrive just-in-time for their use during **work-in-process (WIP).** No buffer or excessive amounts of inventory are desired in the operation. If a defective component part is found or a worker accidentally wastes a part, they will have no buffer inventory to use in its place. The defective component will prevent a unit of finished product from being completed, and will therefore noticeably motivate the revealing of component problems. The sooner defective components can be revealed, the less rework will be incurred in replacing them, and the sooner the problem causing the defect can be eliminated.

Principle 3. Seek to Eliminate Waste Waste, referred to by the Japanese as ***muda,*** should be eliminated in every area of the operation. The goal is to use no more than the minimum amount of equipment, materials, and human resources necessary to achieve production objectives.

One of the factors that causes waste is imbalance or unevenness between actual and needed capacity. Many firms possess an excess (i.e., an imbalance) of equipment capacity as a preventive measure to cover for machines that have broken down. These excess machines are a waste of equipment and costly when not used. By instituting adequate preventive maintenance as suggested under JIT, machine down time might be eliminated, and the firm spared the need for the backup equipment. Extra workers to cover for absenteeism are a waste and should be eliminated. When properly motivated under JIT, teamwork effort will replace the need for extra workers. Defects requiring costly and time-consuming rework are a waste and should be eliminated. Most importantly, the imbalance between production and demand causes waste and should be balanced out. If we produce unwanted units (i.e., overproduce), we generate inventory that causes carrying costs, and wastes money. If we don't produce enough inventory, we cause stockout

costs, and lose money, and possibly lose customers. All areas of waste in a JIT system are continually identified and eliminated.

Principle 4. Seek Continuous Product Flow Improvement Improving product flow is the same as improving productivity. In a JIT system the product flow goal is to eliminate bottlenecked processes and all problems that decrease the production flow. By eliminating idle time in production flow caused by imbalances in production activities or wasted effort by the workers, productivity increases.

Let's say that the time it takes a product to be completed (i.e., to flow through a facility) is a function of motion and work:

Product Time = Motion Time + Work Time

Those activities that take up *motion time* include handling materials, transporting goods, preparation time, waiting, and counting things. All of these activities are wasteful and should be eliminated. Only the activities of *work time* (e.g., fabrication, assembly, etc.) add value to the product and make it worth purchasing by the customer. In focusing effort on eliminating motion activities a JIT operation can improve product flow. How can JIT eliminate such basic material handling activities? This can be accomplished through a continuous effort of self improvement in what the Japanese call the "5 S's" [3, p. 28]. The 5 S's are: proper arrangement (the Japanese term, ***seiri***), orderliness ***seiton,*** cleanliness ***seiso,*** cleanup ***seiketsu,*** and discipline ***shitsuke.*** Continuously sorting through inventory and equipment to discard what is unnecessary (*seiri*) and arranging what is left in an efficient manner for use (*seiton*) will reduce future work motion activities. Similarly, an uncluttered work center (*seiso*) and well maintained equipment (*seiketsu*) will avoid effort to find and use work center facilities in a timely manner. Finally, and most importantly, these efforts for improvement must become habitual (*shitsuke*) for continued long-term improvement in performance.

Principle 5. Seek Product Quality Perfection The goal in a JIT system is the habitual seeking of zero defects. Under the JIT concept called **total quality control (TQC)** quality is an ongoing and never-ending pursuit of perfection in the product [4, pp. 47–82]. (We will discuss TQC in greater detail in Chapter 4.) In a JIT operation the monitoring of quality is chiefly left up to the workers who produce the product. The worker is the ideal member of the production team to see the impact of poor quality in materials, component parts, or subassemblies. The worker is also in an ideal position to observe and report problems concerning worker and machine-caused defects.

Embracing the TQC concept requires quality control activities of all members for the total organization. When defects are found, their causes are immediately determined and corrected. The **acceptance sampling** ideas of taking random samples of incoming goods and finished products to determine if an entire lot has

obtained an acceptable quality level are dropped in a JIT operation. In its place TQC concept dictates a 100 percent inspection. Every piece of raw material, every component part, every subassembly, and every finished product must be inspected as it passes through the production system. In this way quality is built into the product rather than hoping it is screened out through random selection process.

Principle 6. Respect People People produce goods, systems do not. People are the most important asset a company has. In a JIT operation that importance is made clear to everyone. In a JIT system people are given greater responsibility to control work flow and greater authority to insist on product quality improvements than in non-JIT operations. In JIT operations workers are given the opportunity to control production with either stop/go switches at work centers or some type of management signaling system. In some operations where the stopping of an operation might cause excessive start up costs, worker centers have red (a serious problem) and yellow (a minor problem) lights that are used to signal management that a production or quality problem has been encountered and needs correcting. The Japanese term used to describe these lighting signaling systems is ***andon.***

By placing these *andon* systems at the workers' command, management shows a commitment that quality is important and that the worker's opinion about quality is vital. The presence of the stop/go switches at work stations actually grants the worker the authority to force management to respond to production and quality problems that workers report. This is a substantial difference from the passive suggestion box approach of the past.

Principle 7. Seek to Eliminate Contingencies When management is concerned about having enough inventory to cover a surge in customer demand, they acquire contingency inventory that represents a waste if it is not used. When management is concerned about having enough workers to cover production requirements, they acquire a contingency supply of workers that represents a waste if not used. There are many of areas in an operation where management invests resources wastefully as a part of their contingency planning efforts. While it is certainly prudent to perform contingency planning, making wasteful investments in those contingency plans is avoided in a JIT system.

In a JIT system demand is a prerequisite for production scheduling. When a production schedule is established, management should plan to produce just what is stated in the schedule. Planning the use of inventory, equipment, and people is focused on the minimum allowable resource investment to achieve the desired production schedule. While this will place stress on the production system, the goal in the JIT operation is to use this stress in a positive effort to seek further improvements in the production system. Workers are more likely to suggest ideas for improving work flow when they are behind than when they are comfortably ahead of their production quotas. By eliminating contingencies like buffer

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