

THIRD EDITION

OPERATIONS

MANAGEMENT

FOR MBAs

JACK R. MEREDITH  
SCOTT M. SHAFER



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# *Operations management for MBAs*

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Third Edition

Jack R. Meredith

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*Wake Forest University*



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# Preface

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The continuing enthusiastic reception of this MBA-oriented book has been gratifying!

## The Need

It was originally written because of the express need we felt in our MBA-only program at Wake Forest University for an operations management textbook directed specifically to MBA students, and especially to those who had some real-world experience. We tried all of the current texts but found them either tomes that left no time for the cases and other materials we wanted to include or shorter but simplistic quantitative books. Moreover, all the books were so expensive they did not allow us to order all the cases, readings, and other supplements and class activities (such as Harvard's "Beer Game," see Chapter 7 Supplement) that we wanted to include in our course.

What we were looking for was a short, inexpensive book that would cover just the introductory, basic, and primarily conceptual material. This would allow us, as the professors, to tailor the course through supplementary cases and other materials for the unique class we would be teaching: executive, evening, full-time, short course, and so on. Although we wanted a brief, supplementary-type book so that we could add other material, we have colleagues who need a short book because they only have a half-semester module for the topic. Or they may have to include another course (e.g., management science or statistics) in the rest of the quarter or semester. In addition, we didn't need the depth of most texts that have two extensive chapters on materials management, two long chapters on scheduling, two chapters on quality, and so on; one chapter on each topic would be sufficient for our needs.

## Changes in this Third Edition

We also wanted a contemporary book that included topics our MBAs currently or would soon be facing in industry. In this edition, we have dramatically reorganized the book to stress these recent topics: outsourcing and offshoring, six sigma improvement projects, enterprise resource planning, lean management, process and value planning, and of course, supply chain management. Moreover, we wanted a book that kept the marketing or finance major in mind—what did these students need to know about operations to help them in their careers? Certainly not shop floor control and many of the other details we traditionally taught in our undergraduate classes! So we tossed these topics, and in this edition we also dropped the more technical and engineering aspects of product design. And we tossed much of the heavier quantitative material, keeping only discussions and examples that illustrate a particular concept since finance and marketing majors would not be solving operations problems. Moreover, even operations managers probably wouldn't themselves be solving those problems; more likely, they would be assigned to an analyst.

We also wanted a book with a more strategic point of view since our MBAs were working at the managerial rather than entry level, and in this edition we have attempted to further stress the strategic role of these operations topics. In addition, we have added substantial additional material to Chapter 2: Strategy, Operations, and Global Competitiveness. And we added even more service examples throughout the text, and converted some manufacturing examples to service examples, since the great majority (over 80 percent these days!) of our students would be or are already employed in a service organization. And since these students will be working and competing in a highly global economy, we added a great many international examples and changed many problems and cases to an international setting.

To illustrate the topics and their organization in each chapter, we include an organization chart of the topics at the beginning of each chapter so the instructor and students can quickly and easily see what is coming and how it is organized. We intentionally changed the textual flow of material in the chapters away from the current undergraduate trend. Instead of fracturing the material flow by adding sidebars, examples, applications, solved problems, and so forth, in an attempt to keep the students' interest and attention, given the maturity of MBA students we instead worked these directly into the discussions to attain a smoother, clearer flow. We also altered the end-of-chapter materials by cutting down the questions to just a few that would intrigue and engage more experienced and mature students. We similarly limited the bibliography to what would be of interest to current or soon-to-be midlevel managers. We also considered the caselettes to be of interest for this level of student. For those chapters in which exercises are included, they are intended only to help illustrate the concept we are trying to convey rather than make experts of the students. As noted below, the Instructor's Manual includes suggestions for readings, cases, videos, and other course supplements that we have found to be particularly helpful for MBA classes since this book is intended to be only a small part of the MBA class.

## Supplements

Our approach to supplementary MBA-level material here is to reference and annotate in the Instructor's Manual good cases, books, video clips, and readings for each of the 11 textbook chapters. The annotation is intended to help the instructors select the most appropriate materials for their unique course. Although there are brief caselettes at the end of each chapter in the text that we have personally class-tested and found can form the basis of an interesting class discussion, we primarily rely on our favorite Harvard, Darden, Western Ontario, and European cases, plus *Harvard Business Review* readings to fully communicate the nature of the chapter topic we are covering. Although we didn't think that test bank questions, videos or PowerPoint slides would be used by most MBA instructors, these materials are available from the publisher also. For that matter, the publisher can also custom bind with selected content from this text, our larger undergraduate (or any other) Web text, along with cases and articles, should this approach be of interest to the professor. Please contact your local Wiley sales representative for more details.

## Your Inputs Appreciated

We would once again like to encourage users of this book to send us their comments and suggestions. Tell us if there is something we missed that you would like to see in the next edition (or the Instructor's Manual or web site) or if there is perhaps material that is unneeded for this audience. Also, please tell us about any errors you uncover, or if there are other elements of the book you like or don't like. We hope to continue keeping this a living, dynamic project that evolves to meet the needs of the MBA audience, an audience whose needs are also evolving as our economy and society twist and change.

We want to thank the many reviewers of this book and its previous editions: Satya Chakravorty, Kennesaw State University; James A. Fitzsimmons, University of Texas; Lawrence D. Fredendall, Clemson University; Robert Handfield, North Carolina State University; Janelle Heineke, Boston University; David Hollingworth, Rensselaer Polytechnic Institute; Mehdi Kaighobadi, Florida Atlantic University; William C. Giauque, Brigham Young University; Damodar Golhar, Western Michigan University; Suresh Kumar Goyal, Concordia University, Canada; Hector Guerrero, The College of William & Mary; Manoj Malhotra, University of South Carolina; Gus Manoochchri, California State University, Fullerton; Robert F. Marsh, Sacred Heart; Ivor P. Morgan, Babson College; Seungwook Park, California State University—Fullerton; Sue Perrott Siferd, Arizona State University; Jaime S. Ribera, IESE-Universidad de Navarra, Spain; Gary D. Scudder, Vanderbilt University; Asoo J. Vakharia, University of Florida; Jerry C. Wei, University of Notre Dame.

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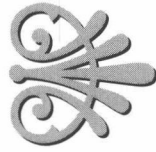
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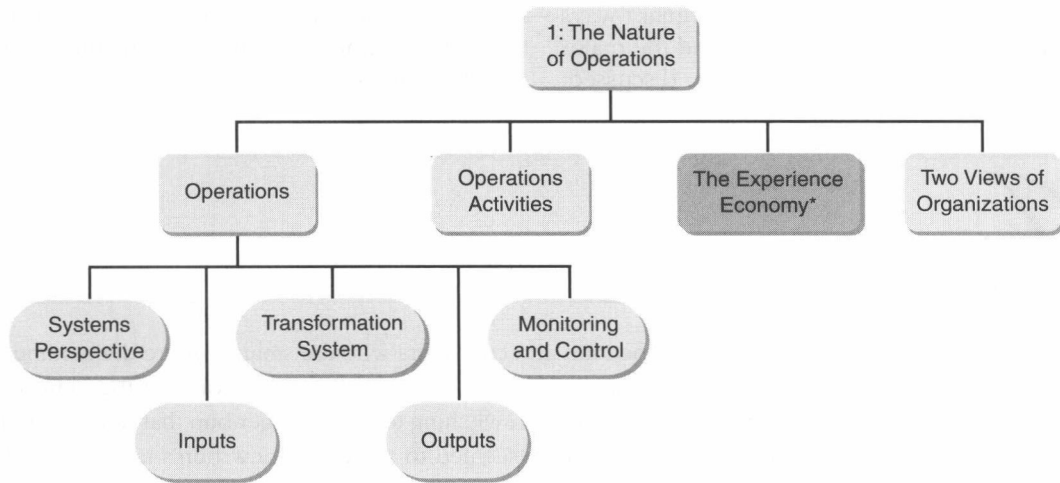
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## *The Nature of Operations*



\*More heavily shaded sections indicate especially timely topics.

## CHAPTER IN PERSPECTIVE

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This first chapter serves as an introduction to the field of operations management. At the beginning of the chapter, *operations* is defined as the activities associated with transforming inputs into useful outputs in order to create a result of value. It is also shown that the actual production system is defined in terms of environment, inputs, transformation system, outputs, and the mechanism used for monitoring and control. The four primary ways that value can be added to an entity and the major subject areas within operations are also discussed.

The chapter overviews two alternative ways for organizing work activities. In the traditional functional approach, companies organize activities on the basis of the type of work performed. With this approach, operations, marketing, and finance are defined as the three core functional areas in companies. Recently, however, many companies have found that they can significantly improve organizational efficiency and effectiveness by organizing activities on the basis of specific value-creating processes.



## INTRODUCTION

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- Facing increased competition and customers who are smarter, more demanding, and less brand-loyal, McDonald's reevaluated the way it made some of the items on its menu. For example, it considered switching to a hamburger bun that does not require toasting. In trial tests, customers seemed to prefer the new bun's taste and texture. Furthermore, not toasting buns would translate into substantial cost savings due to reduced preparation time and the elimination of commercial toasting equipment. At first, such savings may seem trivial; however, consider that McDonald's processes several billion buns for its hamburgers, chicken, and fish sandwiches (Gibson 1995).
- Getting the Olympic flame to Atlanta for the summer Olympics of 1996 was a major undertaking. Ten thousand runners carried the flame 15,000 miles, passing through 42 states in 84 days. More than two years of planning went into this operation. For example, plans had to be coordinated with 2970 local police jurisdictions. Additionally, plans had to be made to deal with rush-hour traffic, no-show runners, or runners who were not able to complete their leg of the relay. In all, it was estimated that the Olympic flame relay cost in the neighborhood of \$20 million, not including transportation, computers, and communication equipment used to support the project (Ruffenach 1996).
- It is not well known that the Kmart and Wal-Mart chains both date back to 1962. By 1987 Kmart was clearly dominating the discount chain race, with almost twice as many stores and sales of \$25.63 billion to Wal-Mart's \$15.96 billion. However, for the retail year that ended in January 1991, Wal-Mart had overtaken Kmart, with sales of \$32.6 billion to Kmart's sales of \$29.7 billion. Interestingly, although Wal-Mart had taken the lead in sales in 1991, it still had fewer stores—1721 to Kmart's 2330. By the 2000 retail year, Wal-Mart had clearly established itself as the dominant discount

chain, with sales of \$188.1 billion to Kmart's \$36.4 billion. Perhaps equally telling is the shift in market share experienced by these two companies. For the period from 1987 to 1995, Kmart's market share declined from 34.5 percent to 22.7 percent, while Wal-Mart's increased from 20.1 percent to 41.6 percent.

What accounts for this reversal in fortunes? Kmart's response to the competition from Wal-Mart was to build on its marketing and merchandising strengths and invest heavily in national television campaigns using high-profile spokespeople such as Jaclyn Smith (a former *Charlie's Angel*) and Martha Stewart. Wal-Mart took an entirely different approach and invested heavily in operations in an effort to lower costs. For example, Wal-Mart developed a companywide computer system to link cash registers to headquarters, thereby greatly facilitating inventory control at the stores. Also, Wal-Mart developed a sophisticated distribution system. The integration of the computer system and the distribution system meant that customers would rarely encounter out-of-stock items. Further, the use of scanners at the checkout stations eliminated the need for price checks. By Kmart's own admission, its employees were seriously lacking the skills needed to plan and control inventory effectively (Duff and Ortega 1995).

Fast forward to 2004 and analysts are still commenting on Kmart's problems with getting merchandise on its shelves. Given its apparent inability to address its operational problems, Kmart appears to have adopted a new strategy to compete with Wal-Mart, namely, merging with Sears, Roebuck & Co. Analysts have speculated that a key benefit of such a merger is potential synergies between Kmart's convenient locations and Sears' strong brands. However, it remains to be seen to what extent the merger between Kmart and Sears helps close the significant performance gap between these chains and Wal-Mart. For example, in 2003, Wal-Mart was ringing up sales of \$433 per square foot compared with \$184 per square foot at Kmart and \$286 at Sears. When multiplied across Wal-Mart's 3,033 stores and Kmart and Sears' combined 2,374 stores, this translates into sales of \$256 billion at Wal-Mart versus combined sales of \$63 billion at Sears and Kmart (Duff and Ortega 1995, Merrick and Zimmerman 2004).

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These brief examples highlight the diversity and importance of operations. Take the description of McDonald's. This example provides a glimpse of two themes that are central to operations: *customer satisfaction* and *competitiveness*. This example also illustrates a more subtle point—that improvements made in operations can simultaneously increase customer satisfaction and lower costs. The Wal-Mart example demonstrates how a company obtained a substantial competitive advantage by improving basic operational activities such as controlling its inventory. Finally, all three examples illustrate that the field of operations is as applicable to service organizations as it is to manufacturing.

Today, in our international marketplace, consumers purchase their products from the provider that offers them the most value for their money. To illustrate, you may be doing your course assignments on a Japanese notebook computer, driving in a German automobile, or watching a sitcom on a television made in Taiwan while cooking your food in a Korean microwave. However, most of your services—banking, insurance, personal care—are probably domestic, although some of these may also be owned by, or outsourced to, foreign corporations.

There is a reason why most services are produced by domestic firms while products may be produced in part, or wholly, by foreign firms, and it concerns an area of business known as operations.

A great many societal changes that are occurring today intimately involve activities associated with operations. For example, there is great pressure among competing nations to increase national productivity. Similarly, businesses are conducting national crusades to improve the quality of their offerings, build effective supply chains, and improve their processes through “six-sigma,” “lean management,” and other operations-based programs.

Another characteristic of our modern society is the explosion of new technology. Technologies such as cell phones, e-mail, notebook computers, personal digital assistants, and the Web, to name a few, are profoundly affecting business and are fundamentally changing the nature of work. For example, many banks are shifting their focus from building new branch locations to using the Web as a way to establish and develop new customer relationships. Banks rely on technology to carry out more routine activities as well, such as transferring funds instantly across cities, states, and oceans. Our industries also rely increasingly on technology: robots carry and weld parts together, and workerless, dark “factories of the future” turn out a continuing stream of products. And soft operations technologies, such as “supply chain management” and “lean production” (Feld 2000; Womack, Jones, and Roos 1991) have transformed world markets and the global economy.

This exciting, competitive world of operations is at the heart of every organization and, more than anything else, determines whether the organization survives in the international marketplace or disappears into bankruptcy or a takeover. It is this world that we will be covering in the following chapters.

## OPERATIONS

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Why do we argue that operations be considered the heart of every organization? Fundamentally, organizations exist to create value, and operations involves tasks that create value. Michael Hammer (2004) maintains that operational innovation can provide organizations with long-term strategic advantages over their competitors. Regardless of whether the organization is for-profit or not-for-profit, primarily service or manufacturer, public or private, it exists to create value. Thus, even non-profit organizations like the Red Cross strive to create value for the recipients of their services in excess of their costs. Moreover, this has always been true, from the earliest days of bartering to the modern-day corporations.

Consider McDonald's as an example. This firm uses a number of inputs, including ingredients, labor, equipment, and facilities; transforms them in a way that adds value to them (e.g., by frying); and obtains an output, such as a chicken sandwich, that can be sold at a profit. This conversion process, termed a *production system*, is illustrated in Figure 1.1. The elements of the figure represent what is known as a **system**<sup>1</sup>: ***a purposeful collection of people, objects, and procedures for operating within an environment.***

<sup>1</sup>Note the word *system* is being used here in a broad sense and should not be confused with more narrow usages such as information systems, planning and control systems, or performance evaluation systems.

Note the word *purposeful*; systems are not merely arbitrary groupings but goal-directed or purposeful collections. Managing and running a production system efficiently and effectively is at the heart of the operations activities that will be discussed in this text. Since we will be using this term throughout the text, let us formally define it. **Operations** is concerned with transforming inputs into useful outputs and thereby adding value to some entity; this constitutes the primary activity of virtually every organization.

Not only is operations central to organizations, it is also central to people's personal and professional activities, regardless of their position. People, too, must operate productively, adding value to inputs and producing quality outputs, whether those outputs are information, reports, services, products, or even personal accomplishments. Thus, operations should be of major interest to every reader, not just professionally but also personally.

## Systems Perspective

As Figure 1.1 illustrates, a production system is defined in terms of environment, inputs, transformation system, outputs, and the mechanism used for monitoring and control. The environment includes those things that are outside the actual production system but that influence it in some way. Because of its influence, we need to consider the environment, even though it is beyond the control of decision makers within the system.

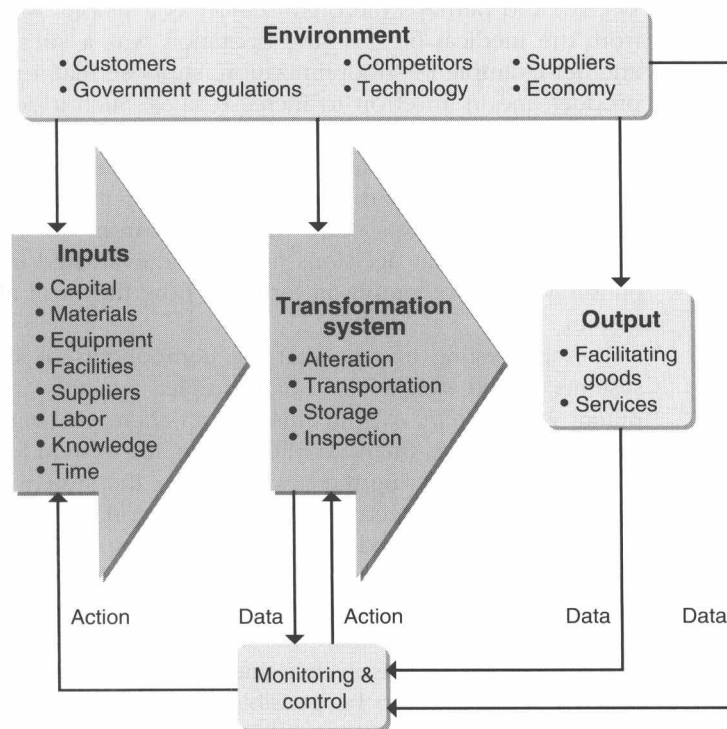


Figure 1.1 The production system.

For example, a large portion of the inputs to a production system are acquired from the environment. Also, government regulations related to pollution control and workplace safety affect the transformation system. Think about how changes in customers' needs, a competitor's new product, or a new advance in technology can influence the level of satisfaction with a production system's current outputs. As these examples show, the environment exerts a great deal of influence on the production system.

Because the world around us is constantly changing, it is necessary to monitor the production system and take action when the system is not meeting its goals. Of course, it may be that the current goals are no longer appropriate, indicating a need to revise the goals. On the other hand, it may be determined that the goals are fine but that the inputs or transformation system or both should be acted upon in some way. In either case, it is important to continuously collect data from the environment, the transformation system, and the outputs. Then, on the basis of an analysis of these data, appropriate actions can be devised to enhance the system's overall performance.

Thinking in terms of systems provides decision makers with numerous advantages. To begin, the systems perspective focuses on how the individual components that make up a system interact. Thus, the systems perspective provides decision makers with a broad and complete picture of an entire situation. Furthermore, the systems perspective emphasizes the relationships between the various system components. Without considering these relationships, decision makers are prone to a problem called *suboptimization*. Suboptimization occurs when one part of the system is improved to the detriment of other parts of the system, and perhaps the organization as a whole. An example of suboptimization from the medical field is "the operation was a success but the patient died!" As another example of suboptimization, suppose that a retailer decides to broaden its product line in an effort to increase sales. Such a decision could actually end up hurting the retailer as a whole if it does not have sufficient shelf space available to accommodate the broader product line, sales, and service personnel that are knowledgeable about the new products, or if the broader product line increases inventory-related costs more than profits from the increased sales. The point of this example is that decisions need to be evaluated in terms of their effect on the entire system, not simply in terms of how they will affect one component of the system.

It is interesting to note that the components of systems are often themselves systems, called *subsystems*. For example, a factory that assembles personal computers is a system. Within this system there are many subsystems, such as the system that reports financial information, the system for assembling the computers, the system for ordering the raw materials, the system for designing new products, and the system for recruiting and hiring workers. And many of these subsystems could be further divided into sub-subsystems. To illustrate, the system that reports financial information may be composed of a system that reports information to sources outside the organization and another system that provides financial information to employees within the organization.

It also stands to reason that since systems can be divided into component subsystems, it should also be possible to combine them into larger systems. This is indeed the case. Consider the example of a personal computer assembly plant. This plant may be just one of a number of plants making up a particular division



of the company. Thus, combining these plants would form a system corresponding to the division of this company. Furthermore, combining the divisions of the company would create a system for the whole company. This logic could be extended to creating systems for the entire industry, and all the way up to creating a system for the entire economy.

This discussion highlights the importance of defining a system's boundary appropriately. Specifically, defining a boundary determines what a decision maker will and will not consider, since things outside the system boundary are considered to be part of the environment and beyond the decision maker's control. Defining a system boundary is important, because if it is defined too narrowly, important relationships among system components may be omitted. On the other hand, extending the boundary increases the complexity and costs associated with developing and using the model. Unfortunately, determining the system boundary is more of an art than a science and is based on the experience, skill, and judgment of the analyst.

Regardless of where the system boundary is defined, all production systems receive inputs from their environments, transform these inputs, and create value in the form of outputs. In the remainder of this section we elaborate on inputs, the transformation system, and outputs.

## Inputs

The set of inputs used in a production system is more complex than might be supposed and typically involves many other areas such as marketing, finance, engineering, and human resource management. Obvious inputs include facilities, labor, capital, equipment, raw materials, and supplies. Supplies are distinguished from raw materials by the fact that they are not usually a part of the final output. Oil, paper clips, pens, tape, and other such items are commonly classified as supplies because they only aid in producing the output.

Another very important but perhaps less obvious input is knowledge of how to transform the inputs into outputs. The employees of the organization hold this knowledge. Finally, having sufficient time to accomplish the operations is always critical. Indeed, the operations function quite frequently fails in its task because it cannot complete the **transformation activities** within the required time limit.

## Transformation System

The transformation system is the part of the system that adds value to the inputs. Value can be added to an entity in a number of ways. Four major ways are described here.

1. *Alter*: Something can be changed structurally. That would be a *physical* change, and this approach is basic to our manufacturing industries where goods are cut, stamped, formed, assembled, and so on. We then go out and buy the shirt, or computer, or whatever the good is. But it need not be a separate object or entity; for example, what is altered may be *us*. We might get our hair cut, or we might have our appendix removed.

Other, more subtle, alterations may also have value. *Sensual* alterations, such as heat when we are cold, or music, or beauty may be highly valued on certain occasions. Beyond this, even *psychological* alterations can have value, such as the feeling of worth from obtaining a college degree or the feeling of friendship from a long-distance phone call.

- 2. *Transport*: An entity, again including ourselves, may have more value if it is located somewhere other than where it currently is. We may appreciate having things brought to us, such as flowers, or removed from us, such as garbage.
- 3. *Store*: The value of an entity may be enhanced for us if it is kept in a protected environment for some period of time. Some examples are stock certificates kept in a safe-deposit box, our pet boarded at a kennel while we go on vacation, or ourselves staying in a motel.
- 4. *Inspect*: Last, an entity may be more valued because we better understand its properties. This may apply to something we own, plan to use, or are considering purchasing, or, again, even to ourselves. Medical exams, elevator certifications, and jewelry appraisals fall into this category.

Thus, we see that value may be added to an entity in a number of different ways. The entity may be changed directly, in space, in time, or even just in our mind. Additionally, value may be added using a combination of these methods. To illustrate, an appliance store may create value by both storing merchandise and transporting (delivering) it. There are other, less frequent, ways of adding value as well, such as by “guaranteeing” something. These many varieties of transformations, and how they are managed, constitute some of the major issues to be discussed in this text.

Outputs

Two types of outputs commonly result from a production system: services and products. Generally, products are physical goods, such as a personal computer, and services are abstract or nonphysical. More specifically, we can consider the characteristics in Table 1.1 to help us distinguish between the two.

TABLE 1.1 • Characteristics of Products and Services

Products	Services
Tangible	Intangible
Minimal contact with customer	Extensive contact with customer
Minimal participation by customer in the delivery	Extensive participation by customer in the delivery
Delayed consumption	Immediate consumption
Equipment-intense production	Labor-intense production
Quality easily measured	Quality difficult to measure