双语教学丛书

商业流程管理

Managing Business Process Flows

拉维·恩纽平迪(Ravi Anupindi)
森尼尔·乔普瑞(Sunil Chopra)
舒德凯·D·德什穆克(Sudhakar D. Deshmukh) 著
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Preface

Managing Business Process Flows (MBPF) is a novel approach to studying some of the core concepts in operations, one of the three major functional fields in business together with finance and marketing. MBPF views operations management as the design and management of business processes and uses this process view as the unifying paradigm to study operations.

MBPF uses a logical and rigorous approach to discuss core concepts in three steps. First model and understand the process and its flows. Then study causal relationships between process structure and certain performance metrics. Finally, formulate implications for managerial actions by filtering out managerial levers ("process drivers") and their impact on process performance.

The objective of the book, which consists of four parts, is to show how managers can plan and control process structure and process drivers to achieve desired business process performance.

Part I, Process Management and Strategy, introduces the basic concepts of business processes and management strategy. Processes are core technologies of all organizations for producing and delivering products (including goods and services) aimed at satisfying customer needs. Processes involve transforming inputs into outputs by means of capital and labor resources that carry out a set of interrelated activities. Process management strategy involves establishing competitive priorities about product attributes to provide, and matching the process capabilities with the targeted product attributes.

Part II, Process Flow Measurement, examines key process measures, their relationships, and managerial levers for controlling them. In particular, flow time, flow rate, and inventory are three operational measures that affect the financial measures of process performance. Flow time can be decreased by shortening critical activity times, flow rates can be increased by increasing the process capacity, and inventory can be decreased by reducing the batch sizes. Throughout this part, our focus will be on the average values, ignoring for now the impact of uncertainty in process performance. The average values of flow time, flow rate, and inventory are related through the *Little's Law*.

Part III, Process Flow Variability, studies the effect of uncertainty in flows on the process performance, and the managerial levers to plan for and control it. Safety inventory is used to maintain material and product availability in spite of variability in inflows and outflows. Safety capacity is used to minimize flow times due to variability in inflows and processing times. Safety time is used to provide a reliable estimate of response time to serve a customer. Finally, feedback control is used to monitor and adjust the process performance dynamically over time.

Finally, Part IV, Process Integration, concludes with principles of synchronization of flows of materials and information through a network of processes most economically. The ideal is to eliminate waste in form of excess costs, defects, delays, and inventories. Instead of responding to the economies of scale and variability in flows, the long term approach is to reduce the need for such responses by making processes lean, flexible and predictable. It requires continual exposure and elimination of sources of inefficiency, rigidity, and variability, and use of information technology to integrate various subprocesses. The goal is to design and control the process for continuous flows without waits, inventories, and defects. We conclude with different philosophies of process improvement.

The Appendices contain

- a summary of the "levers" to manage business processes. It is hoped that MBPF Checklist will be useful to the action-oriented reader.
- some background material in probability and statistics. A reader of this book is assumed to have knowledge of these concepts.

Finally, a student version of the simulation software ProcessModel is enclosed with the book. ProcessModel can be used to design, simulate and communicate processes. The capabilities of the software include flowcharting components, simulation logic and animation. Additional features of the software include hierarchical modeling (to develop levels of detail) and layering capability (to organize complex charts), statistical distribution generator, an extensive library of built-in flowcharting graphics, built-in business diagram templates, statistical process control charting capability, and a state of the art flowcharting package. The software comes complete with a built-in comprehensive training program and an online manual.

Several problem sets from the book chapters have been modeled using ProcessModel. These can be accessed from the book web site located at:

http://www.prenhall.com/anupindi

This book has evolved from a set of notes written by the authors and used in teaching the core Operations Management class at the Kellogg Graduate School of Management. We are grateful to the students in the full-time (MM), the part-time (TMP), and the executive masters program (EMP) at Kellogg for their patience and support with the early versions of this manuscript. In addition, several schools other than Kellogg have used the manuscript in its custom published form. We are particularly indebted to Larry Robinson at Cornell University and George Monahan at the University of Illinois at Champaign Urbana, for several in-depth comments on the manuscript that have resulted in significant improvements. At Kellogg, in addition to us, Krishnan Anand has used the manuscript to teach the TMP students. His suggestions and comments, especially the Loan Application Flow example in chapter 3, are greatly appreciated. We are also grateful to several reviewers of early versions of the manuscript for their constructive suggestions.

In addition, we appreciate the efforts of several people at Prentice Hall. The manuscript has benefited significantly from extensive and meticulous reviews from Ronald Librach, our developmental editor, and Carey Lange, our copy editor. Evyan Jengo was our patient and quality-inspiring production manager; she masterfully incorporated our mass of last-minute changes in the manuscript. We appreciate the efforts of Tom Tucker, our editor, in patiently coordinating the entire project. We acknowledge Scott Baird, CEO of ProModel Corporation, for developing some of the exercises in the problem sets using ProcessModel software.

Finally, all of us have been influenced in various ways by how we were taught operations at our respective alma maters. Parts of the book reflect what each of us imbibed from the various classes we took. So, we thank our mentors and other faculty at Northwestern University, Carnegie Mellon University, Stanford University, State University of New York at Stony Brook, and University of California at Berkeley. Last, but not least, we would like to thank our families for their support during this effort.

Ravi Anupindi
Sunil Chopra
Sudhakar D. Deshmukh
Jan A. Van Mieghem
Eitan Zemel

Kellogg Graduate School of Management
Northwestern University

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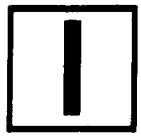

Process Management and Strategy

CHAPTER

1

Products, Processes, and Performance

All organizations have business processes that produce and deliver products to satisfy customer needs. These processes transform inputs into outputs by means of capital and labor resources. This transformation involves a flow of work through a network of activities performed by available resources. The resulting outputs are products, which may be physical goods, services performed, or both. Products differ in attributes that customers value such as product cost, quality, variety and delivery-response time. The ability to provide desired product attributes from given inputs depends highly on corresponding process attributes such as processing cost, quality, flexibility and flow time. Processes differ along these four attributes, falling along a continuum—from job shops that produce high-variety/low-volume customized products to flow shops that produce low-variety/high-volume standardized products.

Finally, to assess and improve the performance of a process, we must measure it in concrete, quantifiable terms. The process manager needs both external measures of customer satisfaction, as well as internal measures. Performance may be evaluated frequently in operational terms necessary for day-to-day process management, or infrequently, in the aggregate financial terms that interest mainly the company's stockholders. Managing business processes requires both long-term strategic planning and short-term adaptive control.

1.1 INTRODUCTION

The success of every organization—manufacturing or service, private or public, for-profit or nonprofit—depends on its ability to attract and retain customers. It does so by providing them with products that satisfy their needs, desires, and expectations. Even park districts, postal services, tax-collection agencies, and houses of worship must produce services that satisfy customer needs, whether physical (comfort, safety, convenience), psychological (relaxation, peace of mind), social, or spiritual. Otherwise, unsatisfied customers will seek alternative sources, resulting in a loss to the service provider of both revenue and reputation as an effective organization.

Organizations attract and retain customers by providing products that may be either physical goods (cars, shampoo, computers, food, drugs) or services performed (transporting passengers, performing surgery, giving a sermon, providing consultation, entertaining). In fact, products are often bundles of goods *and* services. An automobile manufacturer, for instance, sells not only cars but also financing and emergency road services. Airlines provide not only transportation but also meals, beverages, and other in-flight services.

Organizations produce and deliver goods and services by means of business processes that transform inputs into outputs. Outputs in the form of finished goods, processed information, and services performed for customers may require a large set of inputs, including raw materials, component parts, energy, data, and customers in need of service. This transformation is achieved by means of organizational resources. *Resources* are tangible assets that are usually divided into two categories: *capital* and *labor.*

In this book, we will see how organizations manage business processes to produce and deliver products that satisfy customer needs, wants, and expectations. In this chapter, we introduce *the process view* of organizations and some fundamental concepts of business processes. The process view, with the strategic role of operations that we discuss in chapter 2, will be our two key approaches to evaluating and improving business process. In section 1.2 we characterize any organization as *a process through which inputs flow and exit as outputs.* Processing involves a flow of work through a network of activities performed by organizational resources. In section 1.3 we identify *product attributes that customers value* such as product cost, quality, variety and delivery-response time. We also examine the similarities and differences between processes that provide goods and processes that provide services.

In section 1.4 we study the corresponding *process attributes* that managers can control: processing cost, quality, flexibility, and flow time. We also outline the differences between *two types of processes:* job shop and flow shop. In section 1.5 we describe *process performance measures* that help managers to assess and improve processes. In particular, we distinguish between external and internal measures and between financial and operational measures of performance. In section 1.6 we conclude by distinguishing between *process planning* and *process control decisions* that are discussed in detail in the rest of the book.

1.2 THE PROCESS VIEW OF ORGANIZATIONS

Any organization, or any of its parts, can be viewed as a process. A **process** is a transformation of inputs into outputs and can be represented, at the highest level of abstraction, as a black box (see Figure 1.1). To evaluate and improve the performance of a process—the two key objectives of this book—we must look inside the black box and examine the input-output transformation in greater detail.

The transformation is clearly defined by the **process architecture,** or **structure,** which incorporates five elements:

1. Inputs and outputs,
2. Flow units,
3. A network of activities and buffers,
4. Resources and
5. Information structure.

Inputs and Outputs The first step in viewing an organization as a process is to identify its inputs and outputs, as well as their entry and exit points that define process

FIGURE 1.1
The Process View of an Organization

boundaries. **Inputs** refer to any tangible or intangible items that flow from the environment into the process. **Outputs**—whether information, material, energy, cash, or satisfied customers—flow from the process back into the environment. Thus, inputs and outputs constitute the organization's interaction with its environment.

As inputs are being transformed, they flow through the process and exit as outputs. Thus, raw materials flow through a manufacturing process and exit as finished goods. Passengers waiting in Location A flow through an air-transportation process and exit as passengers at Location B; along the way, the jet fuel is transformed into energy and pollution. Similarly, data flow through an accounting process and exit as financial statements. Invoiced dollars (accounts receivable) flow through a billing and collection process and exit as collected dollars (cash).

Flow Units The second step in developing a process view is a clear definition of the **flow units,** the units of flow being analyzed. Depending on the process, the flow unit may be a unit of input (e.g., a customer), a unit of output (e.g., a finished product), a unit of an intermediate product (e.g., a seat in an auto assembly plant), or even a set of inputs or outputs in a multiproduct process (e.g., a set of subassembled components needed for the final assembly). Although the definition of the flow units is quite important for process-performance evaluation or analysis, it is also important when designing the process because (as we shall see later in this book) it directly affects capacity and investment levels. Table 1.1 lists some generic business processes and identifies the flow units that move through the input-output transformation.

A Network of Activities and Buffers As a third step in adopting the process view, we must identify the various flows *inside* a process that constitute the transformation. In a multiproduct organization, there are typically multiple flows within the process, each associated with one product. To identify these various flows and to understand how they can be managed, we examine the input-output transformation in greater detail. This transformation is achieved by flows through networks of activities that are performed by the various resources at the organization's disposal.

TABLE 1.1 Some Generic Business Processes

Process	*Flow Unit*	*Input-Output Transformation*
Order fulfillment	Orders	From the receipt of an order to the delivery of the product
Production	Products	From the receipt of materials to the completion of the finished product
Outbound logistics	Products	From the end of production to the delivery of the product to the customer
Supply cycle	Supplies	From issuing of a purchase order to the receipt of the supplies
Customer service	Customers	From the arrival of a customer to the departure
New product development	Projects	From the recognition of a need to the launching of a product
Cash cycle	Cash	From the expenditure of funds (costs) to the collection of revenues

Activities are building blocks of processes. An **activity** is the simplest form of transformation that we need to consider. It is a mini-process in itself, but for our process-evaluation and -improvement purposes, we are not concerned with further details of any specific activity. In other words, the "art" of process analysis and design is to choose an appropriate level of detail in given activities that define the entire process. Thus, a black box view of activities themselves will suffice. For example, when studying a supply chain (the interorganizational process that includes consumers, suppliers, manufacturers, distributors, and retailers), it suffices to view each organization (plant, warehouse, or store) as one activity or black box. When studying each organization more fully, however, we must study its particular transformation process in more detail by looking closely at its specific activities. At this level, activities include spot welding sheet metal to auto chassis, checking in passengers at airport terminals, entering cost data in accounting information systems, and receiving electronic fund transfers at collection agencies.

Activities are ordered so that the output of one becomes an input into another—hence the term a **network of activities.** This network describes the specific **precedence relationships** among activities—the sequential relationships according to which one activity must be finished before another one can begin. As we will see later, the precedence relationships embodied in network structure heavily influence the time performance of the process. Again, in multiproduct organizations, each product will have a specific set of precedence relationships. Each network of activities can have multiple "routes," each of which indicates precedence relationships for a specific product.

Often the process allows for *storage* of flow units residing in **buffers** between consecutive activities. Storage could be regarded as a special activity that transforms the time dimension of a flow unit by delaying it. In business processes, storage is called *inventory,* and the amount of inventory in the system is an important process-performance measure that we discuss in detail in chapter 3. From Figure 1.2, a network can be represented graphically as a process flow chart consisting of activities (represented by rectangles), storage buffers (represented by triangles), and the routes or precedence relationships among them (represented by solid arrows).

FIGURE 1.2 A Process as a Network of Activities