Pearson New International Edition

Managing Business Process Flows

Anupindi Chopra Deshmukh
Van Mieghem Zemel

Third Edition

Pearson New International Edition

Managing Business Process Flows

Anupindi Chopra Deshmukh
Van Mieghem Zemel

Third Edition

PEARSON

The theoretical flow time of the process, which represents the total activity time required to process a flow unit, can itself be broken down into two components as follows:

Theoretical flow time = Value-adding flow time + Non-value-adding flow time

Reducing non-value-adding flow time is often a powerful way to save time and money. This topic is discussed in detail in Section 5.2.

The following example summarizes several of the points covered in this chapter:

EXAMPLE 6

Valley of Hope Hospital has been under recent pressure from stakeholders to improve cost efficiency and customer service. In response, the hospital has undertaken a series of process-improvement initiatives. One of the first processes targeted for improvement was the X-ray service. A major concern identified by both physicians and patients has been the amount of time required to obtain an X-ray. In addition, management would like to make sure that available resources are utilized efficiently.

A process-improvement team was set up to study the X-ray service process and recommend improvements. The team identified the point of entry into the process as the instant that a patient leaves the physician's office to walk to the X-ray lab. The point of exit was defined as the instant that both the patient and the completed X-ray film are ready to enter the physician's office for diagnosis. The unit of flow is a patient.

To determine the flow time of the existing process, a random sample of 50 patients was observed over a two-week period. For each patient, the team recorded times of entry and exit from the X-ray service process. The difference between these two times was then used as a measure of flow time for each patient. The average of the 50 data points was 154 minutes. This figure, then, serves as an estimate of the average flow time for the X-ray service process.

To further study process flow time, the team examined the entire process in detail and broke it down into the constituent activities identified in Table 5 as value-added (VA) or non-value-added (NVA).

The corresponding process flowchart is shown in Figure 2. It depicts all activities and the precedence relationships among them. For example, Activity 2 must be completed before Activity 3 can begin. Meanwhile, Activity 1 can be carried out simultaneously with Activities 2 and 3. Note that the classification of activities to VA and NVA is somewhat subjective, and may depend on the specific details of the situation:

The team analyzing the process flowchart identified four activity paths:

Path 1: Start → 1 → 4 → 5 → 6 → 7 → 8 → 9 → 10 → End

Path 2: Start → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9 → 10 → End

Path 3: Start → 1 → 4 → 5 → 6 → 7 → 8 → 11 → End

Path 4: Start → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 11 → End

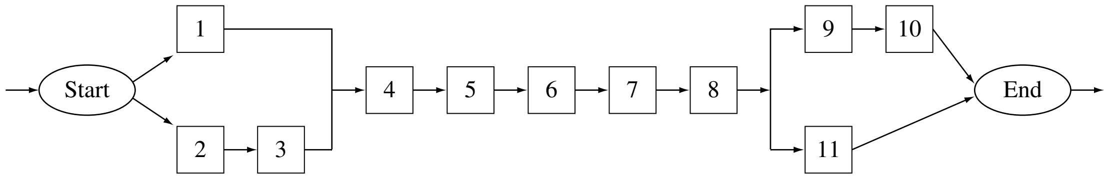

FIGURE 2 Flowchart for the X-Ray-Service Process at Valley of Hope Hospital

Table 5 The X-Ray-Service Process at Valley of Hope Hospital

Activity/Event	Description	Type
Start	Patient leaves the physician's office.	
1	Patient walks to the X-ray lab.	NVA
2	The X-ray request travels to the X-ray lab by a messenger.	NVA
3	An X-ray technician fills out a standard form based on the information supplied by the physician.	NVA
4	The receptionist receives from the patient information concerning insurance, prepares and signs a claim form, and sends to the insurer.	NVA
5	Patient undresses in preparation for X-ray.	NVA
6	A lab technician takes X-rays.	VA
7	A darkroom technician develops X-rays.	VA
8	A lab technician prepares X-rays for transfer.	NVA
9	Patient puts on clothes and gets ready to leave lab.	NVA
10	Patient walks back to the physician's office.	NVA
11	The X-rays are transferred to the physician by a messenger.	NVA
End	Patient and X-rays arrive at the physician's office.	

Next, another sample of 50 patients was studied over a two-week period. For each patient, the activity time required to perform each activity was recorded. These are listed in Table 6:

The theoretical flow time along these four paths are

$$\text{Path } 1 = 50 \text{ minutes}$$
$$\text{Path } 2 = 69 \text{ minutes}$$
$$\text{Path } 3 = 60 \text{ minutes}$$
$$\text{Path } 4 = 79 \text{ minutes}$$

Table 6 Work Content in X-Ray-Service Process Activities

Activity	Activity Time (minutes)
Start	—
1	7
2	20
3	6
4	5
5	3
6	7.5
7	15
8	2.5
9	3
10	7
11	20
End	—

Path 4, therefore, is the critical path, yielding a theoretical flow time of the process as 79 minutes.

What is the flow-time efficiency of the process?

Flow-time efficiency = Theoretical flow time/Average flow time = 79/154 = 51%

This means that waiting corresponds to roughly half the time in this process. Obviously, the challenge this poses to the management of Valley of Hope Hospital is whether some of this waiting can be eliminated. Also, note that of the 79 minutes of theoretical flow time, the only activities which are value adding are Activities 6 and 7. Thus the value adding time of the process is 7.5 + 15 = 22.5 minutes, which is less than 15 percent of the average flow time. Indeed, Valley of Hope has ample opportunities to improve the process!

5 LEVERS FOR MANAGING THEORETICAL FLOW TIME

How can managers reduce the flow time of a process? As we have seen, the only way to reduce the flow time is to shorten the length of every critical path. We have also seen that the flow time is the sum of two components—waiting time and activity time. Because these two components arise from different sources, the levers available for managing each are naturally distinct. The main levers for reducing waiting time in a process are:

(i) Managing the effects of congestion
(ii) Reducing batch sizes
(iii) Reducing safety buffers
(iv) Synchronizing flows

In this section, however, we examine the levers available for managing the activity part of the flow time—the theoretical flow time.

There are five basic approaches to shortening a critical path:

(i) Move work content off the critical path ("work in parallel")
(ii) Eliminate non-value-adding activities ("work smarter")
(iii) Reduce the amount of rework ("do it right the first time")
(iv) Modify the product mix ("do the quickest things first")
(v) Increase the speed of operation ("work faster")

There are significant differences between these five approaches. The first approach is one of *restructuring:* It leaves the total amount of work per unit unaffected, but manages the sequencing of the various activities in order to reduce the length of the critical path. The second approach is one of *elimination.* It leaves the network structure of the process as is, but reduces the total amount of work required for activities along the critical path. The third approach depends on setting a robust *quality management system*. The fourth approach is one of *prioritization.* It gives priority to flow units that can be processed faster—to the extent allowed by the market. The fifth approach relies on working at a *faster* rate. Naturally, for each specific situation, the relative merits of these five approaches will vary.

It is critical to remember, that whatever approach we take, it must be directed towards the critical path: Reducing the work content of noncritical activities does *not* reduce the theoretical flow time. However, such reduction may still be useful for other reasons, such as decreasing total processing costs, increasing process capacity, and reducing the potential for errors and defects. In the following section, we examine each of these approaches more fully.

5.1 Moving Work Off the Critical Path

One of the best ways to reduce the theoretical flow time is by moving work off the critical path and into paths that do not affect process flow time. This task can be accomplished in one of two ways:

1. Move work off the critical path to a noncritical activity.
2. Move work off the critical path to the "outer loop" (pre- or postprocessing).

In either case, the work must still be done, but the critical path is shortened.

Moving work from a critical to a noncritical path means redesigning the process so that critical activities are performed in parallel rather than sequentially. Consider, for example, the conventional approach to software development, which consists of five steps in sequence: specification, design, development, documentation, and testing. Clearly, testing and documentation can be carried out in parallel. Moreover, it is often not necessary to complete the development of the software in order to start preparing the user manual. Thus, it is possible to perform some aspects of software design, development, testing, and documentation in parallel.

For another example, consider the contemporary practice of concurrent engineering. Traditionally, activities such as product design, process planning, and prototyping are performed sequentially. By modifying the process to increase parallelism we can speed the process considerably.

Moving activities to the so-called outer loop means performing them either before the countdown for the process starts or after it ends, as defined by the process boundary, an approach that is also called pre- or postprocessing. For example, in the case of the hospital admission process, it is often possible to accomplish work such as verifying insurance, preparing and signing consent forms, and listing of allergies even before the patient shows up at the hospital. As another example, consider the process of changing a "make-to-order" production system into a "make-to-stock" system. Instead of assembling a complete hamburger after receiving a customer order, it may be possible to precook beef patties and keep them ready prior to the lunchtime rush. As far as customer flow is concerned, theoretical flow time will be reduced because the production of the beef patty has been moved to the outer loop of the "order-fulfillment process." Note, however, that because it produces units prior to demand, this strategy affects the "material flow process" in the opposite fashion. In case of hamburgers, of course, it may also affect taste and quality.

5.2 Reduce Non-Value-Adding Activities

It is a common observation that some of the work done by individuals and organizations is not essential for the product or service produced. The idea that such nonessential work should be systematically eliminated—saving time and money—can be traced to the scientific management approach used by Frederic Taylor (1911), Frank Gilbreth (1911), and their followers. Originally, the approach was used for optimizing work by individual workers, typically in manual tasks, such as laying bricks, loading coal, or typing a manuscript. However, the core ideas of this approach are still valid today in the much broader context of a general business process, both in service and in manufacturing.

Value-adding activities *are those activities that increase the economic value of a flow unit from the perspective of the customer (that is the customer values such activities, and is willing to pay for them).* Performing surgery, flying an airplane, serving meals in a restaurant, manufacturing an item in a factory, and dispensing a loan by a bank are examples of activities which are typically value-adding.

Non-value-adding activities *are activities that do not directly increase the value of a flow unit.* For example moving work or workers among various locations, setting up machines, scheduling activities or personnel, sorting, storing, counting, filling out forms, participating in meetings, obtaining approvals or maintaining equipment are typically non-value-adding.

Non-value-adding activities come in two types: (i) Non-value-adding work that is necessary to support the current process and (ii) Non-value-adding work that does not. Obviously, non-value-adding activities of the second type should be eliminated outright. However, activities of the first type can also be eliminated if the process is redesigned. For example, a process that is rife with high fractions of defectives may require a sorting station to separate the defective from the good units. The sorting activity is a non-value-adding activity, but is necessary given the process. However, if the process capability is increased so that no defectives are produced, the sorting activity becomes unnecessary, and, therefore, one that could be eliminated. As another example, consider the accounts-payable process. The primary value-adding activity of this process is paying the bills in an accurate and timely fashion. However, the accounts-payable department typically spends much of its time performing other activities, such as reconciling contradictory information, verifying, matching documents, and investigating discrepancies. Such activities do not add value but are still necessary, given the process utilized. They can be eliminated, however, if the process is modified. Hammer and Champy (1993), for instance, report that the accounts-payable department at Ford was reengineered to eliminate unnecessary steps with a dramatic reduction in flow time and cost. One of the innovations introduced was the elimination of issuing and processing invoices and the rejection of any shipment that does not conform exactly to the purchase order. For details, see Hammer and Champy (1993).

5.3 Reduce the Amount of Rework

Decreasing the amount of repeat work can often be achieved by process-improvement techniques such as statistical process control, design for manufacturability, process fool-proofing, and workforce training. In data-rich environments, the key principle is to strive toward a process that "touches" any particular data input just once since the common custom of entering the same data over and over again adds time (as well as cost and errors). The effect of rework on flow time is explored in Appendix 3.

5.4 Modifying the Product Mix

Most processes involve a mix of products, characterized by different flow times for the various units of flow. If we give priority to flow units that move through the process faster, the overall flow time of the process will decrease. Of course, product mix is often dictated by the market, and even when the organization has some control over it, there may be other relevant factors, such as profitability, resource-utilization issues, and market considerations. Nevertheless, modifying the mix and serving more customers or jobs that could be handled faster is sometimes an effective way to reduce average flow time.

5.5 Increase the Speed of Operations

The speed at which an activity is performed can be improved by acquiring faster equipment, increasing allocated resources, or offering incentives for faster work. Such steps often require either financial investment in faster equipment or modified incentives for labor resources. Consider, for instance, a manual checkout counter at a local grocery store. The speed of this operation can be increased by any of the following methods:

using bar codes with a scanner, adding a second worker to bag products, or instituting proper incentives, coupled with training and better equipment so that checkout personnel work faster, without increasing error rates or jeopardizing service quality. In a research-and-development laboratory, the so-called dedicated teams that concentrate fully on one activity rather than working on several projects simultaneously can increase the speed at which a particular research activity is carried out.

5.6 Zhang & Associates Revisited

We close with a more detailed description of the process improvement activities undertaken by Zhang & Associates introduced earlier in the chapter. As mentioned in the introduction, the company provides comprehensive financial advisory and asset management services to high-net-worth individuals. The company has redesigned its new client process and cut the flow time from six to four weeks and in some cases, considerably more, to two weeks. We now review how Zhang & Associates was able to achieve these results, utilizing some of the levers mentioned previously.

THE OLD PROCESS

The point of entry into the old process was when a new client arrived to meet the adviser for the introductory meeting. During the meeting, the adviser took notes about the client's financial information and listed details such as the client's stocks, life insurance policies, and bank accounts. After the meeting, the adviser reviewed the notes with a staff member of the planning department, called a "paraplanner." The paraplanner typed the information into financial planning software and prepared a general financial plan. At this stage, the paraplanner often found that the adviser had neglected to obtain all the relevant information during the first meeting. In such cases, the paraplanner contacted the adviser, who in turn contacted the client to obtain the necessary information.

Some clients had advanced planning needs, such as estate planning, in which case the completed general financial plan was forwarded to the advanced planning department. The professionals in the advanced planning department, often attorneys or certified public accountants, reviewed the general financial plan and discussed the client situation with the adviser before providing recommendations. After the financial plan was completed, the adviser conducted a second meeting with the client to go over the plan. The client took the plan home for detailed review. If the plan was acceptable to the client, a third meeting was scheduled to finalize the plan and sign the necessary documents. If the client was not satisfied with the plan, another cycle of consultations with the staff of the advanced planning department was initiated. The process was completed when the plan was approved by the customer and finally implemented.

The process typically required one month to one-and-a-half months for completion. The time could be substantially longer if the client's situation was complicated, requiring a fourth or even a fifth meeting.

THE NEW PROCESS

Zhang & Associates has recently implemented a new process. The key differences from the old process can be summarized as follows.

A "homework" package is sent to the client and is completed by the client before the first meeting. This set of forms reveals critical personal and financial information. Clients can obtain assistance to complete the forms by calling the adviser's office.

The first meeting involves everyone required for devising the financial plan, including the adviser, the paraplanner, and all the relevant advanced planning professionals. By the end of the meeting, everyone understands all the issues involved and will be able to work on their parts of the plan simultaneously.