LEARNING OBJECTIVES
After completing this chapter, you should be able to:
1. Explain how job design can increase productivity.
2. Use the techniques and charts of methods analysis.
3. Explain and use methods of work measurement.
4. Explain several compensation systems.

INTRODUCTION TO JOB DESIGN

Prior to the well-known “Hawthorne Studies” conducted at Western Electric Company’s plant in Chicago from 1924 on, no one thought productivity could be influenced by employees’ feelings about their jobs. Today, we know that this can actually be one of the major determinants of productivity. As a result, the way jobs are designed has changed.

Traditionally, job design was concerned with specifying the tasks to be performed by a worker and the way in which those tasks were to be done. For example, a person responsible for “ringing up” customers’ purchases in a grocery store often has no other tasks to perform. Details about opening and closing the register and how each purchase is to be entered are all specified. Additionally, the exact way that a checkout person is to perform the job may be documented. Such documentation might indicate the procedure for approving customers’ checks or for verifying the price of an item so that those tasks can be done as quickly as possible and with the least amount of effort.

For many years, job design has also been involved with the physical environment of a job. Although this often means specifying the allowable levels of noise, dirt, temperature, and so forth, it can also be concerned with the layout of facilities. For example, the checkout area in a grocery store is designed so the person ringing up purchases has everything within easy reach and can operate efficiently with minimum effort and no wasted motion.

Today, job design has expanded to include the social and psychological environment by considering what are called sociopsychological factors related to a job. Such factors include not only how a job is done, but also how the employee feels about that job. For instance, research has shown that most employees become dissatisfied if their job provides no opportunities for recognizing their self-worth or for interacting with other people. Thus, job design goes far beyond just a set of methods and procedures that specify a set of...
tasks. It must also take into account how easily or quickly a person may perform a job and how she or he will react emotionally to that job and the environment in which it is performed. How a person feels about her or his job is often called quality of work life (QWL).

**Specifying the Tasks and Responsibilities of a Job**

A job is defined by the **tasks** that make up that job. For example, a secretary's job can include the tasks of typing letters, answering the telephone, and making copies. At one time, the emphasis in job design was on **job specialization**, in which each employee performs only a particular narrowly defined task. You can see this philosophy applied in company typing pools in which employees are concerned only with typing, not with answering the telephone or making copies. Job specialization has both advantages and disadvantages. On the one hand, job specialization can lead to increased efficiency and productivity. For instance, most individuals in professional sports specialize in a particular sport or even a particular position, such as shortstop or quarterback. This allows those individuals to use their unique talents and abilities to the greatest advantage and to concentrate specifically on improving their performance in one set of tasks. Through specialization, individuals can become expert at a given activity.

On the other hand, too much specialization can lead to boredom and job dissatisfaction. One of the best examples of this occurs in assembly lines, where, for example, a particular worker may be responsible only for fastening a certain bolt. In this case, the worker can quickly become expert with little effort. The result is a lack of challenge and job dissatisfaction.

To overcome the disadvantages of specialization, while still enjoying some of its benefits, many companies have used **job enlargement**, **job rotation**, and **job enrichment**. Job enlargement and job rotation are strategies that give workers an increased number or variety of tasks to perform. The rationale is that if workers are allowed to perform more than one task, the boredom and dissatisfaction that result from overspecialization will not occur.

The approach taken in job rotation is periodically to shift workers from one job to another. In this way, workers can learn new skills and face new challenges as they change jobs. With job enlargement, an employee's job is expanded to include several tasks. The idea here is to allow a person to see that he or she is making a meaningful contribution to an entire product—not just putting a bolt into a hole. Another purpose of job enlargement is to avoid boredom by providing new challenges in much the same way as job rotation.

A common criticism of job enlargement and job rotation is that giving a person two boring tasks to perform instead of one will not lead to job satisfaction. Job enlargement and job rotation focus only on the horizontal expansion of work by giving a person more tasks or more jobs to perform, as shown in Exhibit 22.1. Instead, many experts argue that job satisfaction depends on a vertical expansion of the job description.

This vertical expansion, or vertical loading, emphasizes giving workers responsibility for planning many of their own activities and, to some extent, allowing them to make decisions related to the job they are performing.

**Ethical Considerations in Job Design**

Each year, hundreds of thousands of employees are injured on the job, some seriously enough to result in death. Many of these deaths and injuries could have been prevented. Although all work involves some degree of risk, much of that risk can be reduced by specifying proper work methods and laying out facilities so that employees are not placed in highly dangerous situations.
In the past, many companies have not paid enough attention to the safety of their employees. As a consequence, state and federal governments have stepped in with various regulations. Of these, the best known is the Occupational Safety and Health Act (OSHA), which set up a federal agency to oversee safety standards for all types of work. OSHA standards relate to everything from allowable noise levels to design of equipment, and federal inspectors can fine companies for noncompliance.

However, well-run companies realize they have an ethical obligation to provide safe and healthful working conditions for their employees, regardless of government regulations. As we said before, employees are a company’s most valuable asset, and it is smart business for a company to protect and preserve those assets.

**METHODS ANALYSIS TO IMPROVE PRODUCTIVITY**

Several techniques can be used to identify the most productive way of performing a specific task. In general, such techniques are often grouped under the headings of methods improvement, **methods analysis**, or work improvement. These techniques are concerned only with the physiological aspects of a task—how easy the task is to do or how quickly the person can work.

**Flow Process Charts**

The **flow process chart** is used for analyzing the movements of a worker or the flow of materials through a process. In general, the flow process chart will be specified by the product and process designs, which are discussed in Chapters 6 and 8.

The flow process chart is especially useful in identifying ways of improving the process by eliminating unnecessary idle time, minimizing the distances things must be moved, or rearranging tasks for greater efficiency.
Five symbols are used to describe the actions of a worker or the processing of a part or product, as shown in Exhibit 22.2.

1. Circle—indicates that some operation is being performed, either by the worker or on the part.
2. Arrow—represents either transportation of material or movement of the employee from one location to another.
3. Square—represents an inspection operation.
4. Capital D—indicates a delay or wait.
5. Triangle—indicates storage of material, parts, etc.

The flow process chart can be used to design a new task or to improve an existing one. In the first case, the flow process chart will help to identify possible problems that may occur or indicate ways that performance of the task can be improved. For an existing task, the first step is usually to chart the task as it is performed now. After that, the flow process chart is examined to identify possible areas for improvement. The following questions provide some guidelines:

- Is there any unnecessary idle time? If necessary idle time exists, could it be used to perform another activity?
- Can distances be shortened to decrease or eliminate time for movement of the worker or materials?
- Can efficiency be improved by rearranging activities?
- Can the work area be rearranged to improve efficiency?
- Is it possible to reduce the number of times a part or product must be handled?

Exhibit 22.2 is the flow process chart for an existing job. As you can see, each of the symbols has been used to indicate the activity a worker is performing at each step of the process. The time for each delay is indicated, as is the distance that the person must travel in performing the task. Can you see any possible improvements in the process shown in Exhibit 22.2?

One possible way of improving the process would be to use a drink dispenser that shuts off automatically when the cup is full and have the employee get the french fries while the drink dispenser is filling the cup. In this way, the .25 minutes previously spent waiting can be used to perform another activity. The process chart for this revised method is shown in Exhibit 22.3. Notice that this one slight change has saved 10 feet of walking distance and eliminated the .25-minute delay. The process can be improved in several other ways; you should be able to spot at least a few.

The design of a product can greatly influence the productivity of workers who must make that product. Honda realized that and so assembled a group of fifty workers from its Marysville, Ohio, plant to live in Japan for two to three years while the 1994 Honda Accord was being designed. Working together with Japanese designers, the U.S. employees, who will have to make the Accord, suggested design changes that would make their jobs easier.

For example, Japanese designers realized customers want cars that are quiet and so had designed a noise-reducing pad to go under the rear floor. That pad would melt slightly when the car went through the paint ovens, and thus attach itself to the floorboard. However, the original design called for adhesive to hold the pad in place until the car got to the ovens. Applying that adhesive and putting the pad in place would take time on the assembly line.
The U.S. assembly team determined that if the pad were made a little bigger it could be held in place by another part and would not need adhesive, thus saving time. Additionally, the reduction in cost achieved by eliminating the adhesive more than made up for the additional cost of a larger pad, and the larger pad cut noise even more.

**Multiple Activity Charts**

Flow process charts are used to study the actions of one worker or the movement of one product. However, if you need to study more than one employee and their interactions with either machines or customers, you need either a **worker-machine chart** or a **worker-customer chart**. In reality, both charts are essentially the same; both are used to chart the activities of each unit of interest (worker, machine, or customer) during a given period of time. Exhibit 22.4 is a worker-customer chart for dock workers and customers picking up their furniture at the loading dock of a warehouse outlet furniture store. The primary purpose of any multiple activity chart is to identify idle time that can be eliminated. For instance, in Exhibit 22.4 you can see that the two workers have very little idle time. What idle time they do have might be used by having them perform other activities in the warehouse. However, customers appear to spend considerable time waiting at the loading docks. This may indicate the need for another employee, or possibly the need to bring employees from other areas to help with loading when the loading docks are especially busy.

**MEASUREMENT OF WORK**

**Work measurement** is the activity of determining how much time it should ordinarily take to perform a certain task or job. As a result, work measurement is one way of keeping score in continuous improvement to determine whether a new procedure takes less time than the old one. The standardized time for a task or activity is usually referred to as the **time standard** or **standard time**.

**EXAMPLE**

NUMMI, which stands for New United Motor Manufacturing, Inc., is a joint venture between General Motors and Toyota. The company is located in Fremont, California, in a former GM plant that had been shut down. It makes both the Toyota Corolla and the Chevrolet Prizm.

Employees at NUMMI work in teams, and each team is responsible for developing and documenting standards for doing their work. They begin by timing each other with a stopwatch, trying different ways to do a job. Those results are compared with similar testing done by teams on other shifts. The safest, most efficient way to do the job is then written up as detailed specifications that become the standard for everyone performing that job.

By standardizing, NUMMI reaps many advantages, including improved safety, higher quality, and greater flexibility. However, the most important advantage is that it provides a starting point for continuous improvement. As one manager stated, “You can’t improve a process you don’t understand.”

**PROBLEM**

Suppose that records have been kept and we know that the average mail-order operator takes 510 calls in a forty-hour week. To determine the average time per order, we can use the formula
## Flow Process Chart for Fast-Food Restaurant Counter

<table>
<thead>
<tr>
<th>DIST IN FEET</th>
<th>TIME IN MINS.</th>
<th>CHART SYMBOLS</th>
<th>PROCESS DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>5</td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Take order and receive money</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Walk to bag storage area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Get proper size bag for order</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Walk to hamburger chute</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Place hamburger in bag</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Return to counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Check order for next item</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Walk to fry vat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Scoop fries into serving container</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Place serving container into bag</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Return to counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Check order for next item</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Walk to drink dispenser</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Obtain proper size cup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Start cup filling</td>
</tr>
<tr>
<td>.25</td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Wait for cup to fill</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Walk to counter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>○ ○ ○ ○ ○ ○</td>
<td>Hand order to customer</td>
</tr>
<tr>
<td>48</td>
<td>.25</td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

### SUMMARY

<table>
<thead>
<tr>
<th></th>
<th>PRESENT METHOD</th>
<th>PROPOSED METHOD</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportations</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inspections</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delays</td>
<td>○</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance traveled in feet</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Revised Flow Process Chart for Fast-Food Restaurant Counter

<table>
<thead>
<tr>
<th>DIST IN FEET</th>
<th>TIME IN MINS.</th>
<th>CHART SYMBOLS</th>
<th>PROCESS DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td>Take order and receive money</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Walk to bag storage area</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Get proper size bag for order</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>Walk to hamburger chute</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>Place hamburger in bag</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Return to counter</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Check order for next item</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Walk to drink dispenser</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Obtain proper size cup</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Start cup filling</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Walk to fry vat</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Scoop fries into serving container</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Place serving container into bag</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Return to drink dispenser</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Walk to counter</td>
</tr>
<tr>
<td>38</td>
<td>.0</td>
<td></td>
<td>Hand order to customer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
</tr>
</tbody>
</table>

### SUMMARY

<table>
<thead>
<tr>
<th></th>
<th>PRESENT METHOD</th>
<th>PROPOSED METHOD</th>
<th>DIFFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operations</td>
<td>8</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Transportations</td>
<td>7</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Inspections</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Delays</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Distance traveled in feet</td>
<td>48</td>
<td>38</td>
<td>10</td>
</tr>
</tbody>
</table>
Since we want this in terms of minutes per order, we must divide the number of minutes in a week by the average number of calls handled per week.

\[
\text{Average time per order} = \frac{\text{total time}}{\text{number of orders}}
\]

Since we want this in terms of minutes per order, we must divide the number of minutes in a week by the average number of calls handled per week.

\[
\frac{40 \text{ hours}}{\text{week}} \times \frac{60 \text{ minutes}}{\text{hour}} = 2,400 \text{ minutes per week}
\]

\[
\text{Average time per order} = \frac{2,400 \text{ minutes}}{510 \text{ orders}} = 4.7 \text{ minutes per order}
\]

The time calculated above is called the standard time and is usually expressed in terms of time per unit (e.g., 3.75 minutes per part) or units per time period (e.g.,
sixteen parts per hour). This represents the time it should take to perform a task under ordinary conditions, allowing for rest periods, fatigue, and other unavoidable delays. There are several different ways in which this standard time can be obtained other than the one demonstrated above.

**Historical Data**

One of the easiest ways to develop a time standard is by using historical data, as was done in the preceding example. However, the main disadvantage of historical data is that they include past inefficiencies. Therefore, historical data can be used as a starting point and as a basis for comparison, but other methods may be better for identifying possible improvements.

**Time Studies**

The most common way of developing the standard time for a task is through a time study, usually done with a stopwatch. During a time study, an experienced worker performs the task repeatedly. Each repetition of the task is termed a work cycle. The stopwatch time recorded for each cycle is used to develop a standard time that represents how long it should take an average worker to perform that same activity.

The stopwatch time study is usually performed in a series of steps, beginning with evaluation of the task and proceeding through a series of calculations until the standard time is obtained. We will briefly summarize those steps here so that you can be aware of the basic procedure.

1. Make sure that all procedures specified in the company’s labor agreement are followed. This often requires that the supervisor and the worker—and sometimes the union representative—be informed before the time study begins.
2. Observe the task, and make any improvements in the operator’s performance of the task.
3. Record information about the task and how it is being performed for future reference in case the standard is questioned.
4. Break the task into elements such that each has unique starting and ending points but is long enough to be timed easily. Starting and ending points can be when a part is picked up or put down or when a machine is started or stopped.
5. Time enough work cycles to be assured of a reasonable sample. It is possible to determine sample size statistically, but most companies are more concerned with the cost of performing a time study. Usually, between five and fifteen cycles are timed.
6. Average the observed times. The result is usually called the cycle time or selected time. This represents the average time it took the worker being observed to perform the task.
7. Adjust the cycle time for the efficiency and speed of the worker who was observed. The person performing the time study must estimate, based on past experience, how fast or slow that worker performed the task in relation to an average worker. This produces a rating factor. A worker who performed the task 25 percent faster than average would be assigned a rating factor of 125 percent. Using this rating factor and the cycle time, a normal time is calculated.

\[
\text{Normal time (NT)} = \text{cycle time (CT)} \times \text{rating factor}
\]
8. Make further adjustments. It is not reasonable to expect employees to work continuously without time for rest. Delays may also occur when the worker must wait for more material. These factors must also be entered into the calculation through an allowance. The standard time, which includes allowance for personal time, rest, and delays, is calculated as follows:

\[ \text{Standard time (ST)} = \text{normal time (NT)} \times \text{allowance} \]

The allowance is calculated as 1.00 plus the percentage of normal time allocated for allowances.

Suppose that State Farm Insurance Company wants to determine the standard time for one step in processing an insurance claim form. They perform a stopwatch time study, obtain the following information, and perform the following calculations:

Ten work cycles are timed, and the information shown below obtained.

<table>
<thead>
<tr>
<th>Cycle no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (sec.)</td>
<td>9.8</td>
<td>10.2</td>
<td>9.3</td>
<td>9.8</td>
<td>10.1</td>
<td>10.2</td>
<td>9.6</td>
<td>9.9</td>
<td>9.5</td>
<td>10.0</td>
</tr>
</tbody>
</table>

By averaging these times, we obtain an average cycle time.

\[ \text{CT} = \frac{98.4}{10} = 9.84 \text{ seconds per unit} \]

The time-study operator has determined that the worker being timed was working 10 percent faster than average, so a 110 percent rating factor is used, and normal time is calculated as

\[ \text{NT} = \text{CT} \times \text{rating factor} \]
\[ = 9.84 \times 1.10 = 10.82 \text{ seconds per unit} \]

Allowances for this job equal 20 percent of normal time. Thus, after adjusting for allowances, the standard time will be

\[ \text{ST} = \text{NT} \times \text{allowance} \]
\[ = 10.82 \times 1.20 = 12.98 \text{ seconds per unit} \]

This is the standard time that would be used in production planning and in employee compensation, if relevant.

**Predetermined Time Standards**

In analyzing any kind of manual task, it is possible to break that task into a series of movements, such as reaching, grasping, and carrying, among others. Researchers have been able to develop standard times for each of these basic movements. By breaking any task into the appropriate basic movements, it is possible to develop a standard time for the entire task by adding up the standard times for each individual movement.

This approach is especially useful in developing time standards for a new job that has not yet been implemented. Because predetermined time standards are based on thousands of observations made under controlled conditions, individual workers are not being timed, and there is less room for disagreement about the results. For these reasons, quite a few companies use predetermined standards, although the stopwatch time study approach is still more common.

**Methods-Time Measurement (MTM)**

One of the best-known predetermined time systems is methods-time measurement (MTM), which was developed by H. B. Maynard. In this system, each movement has been determined to take a certain number of time measurement units (TMUs). Each TMU is
equal to .00001 hour, or .036 second. For example, the standard time to reach a distance of one foot to an object in a fixed location is 9.6 TMUs—about .35 second. Specific MTM standards applicable to services have been developed in the form of MTM-HC for health care and MTM-C for clerical activities.

**Maynard Operation Sequence Technique (MOST)**

A recent simplification of MTM is called MOST® which stands for Maynard Operation Sequence Technique. MOST is based on MTM, but is much faster and easier to use. After studying extensive MTM data, researchers found that nearly all operations involved the same set of basic motions performed in the same sequence. As a result, three fundamental sequence models were developed: the General Move Sequence, the Controlled Move Sequence, and the Tool Use/Equipment Use Sequence.

For example, a General Move involves moving objects manually from one location to another. The General Move Sequence consists of the following subactivities:

- **A**—Action distance (mainly horizontal motion)
- **B**—Body motion (mainly vertical)
- **G**—Gain control
- **P**—Place

Putting these subactivities in the order they are usually performed, the General Move Sequence is

A B G A B P A

Based on the distance an object must be moved, its weight, and other factors, an index may be assigned to each subactivity. Exhibit 22.5 shows the index values for the General Move Sequence.

**EXHIBIT 22.5**  
Index Values for MOST General Move Sequence

<table>
<thead>
<tr>
<th>Index</th>
<th>A</th>
<th>B</th>
<th>G</th>
<th>P</th>
<th>General move</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action distance</strong></td>
<td><strong>Body motion</strong></td>
<td><strong>Gain control</strong></td>
<td><strong>Place</strong></td>
<td><strong>Index</strong></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>≤ 2 in.</td>
<td>Hold</td>
<td>Toss</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Within reach</td>
<td>Light object</td>
<td>Lay aside</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1–2 steps</td>
<td>Bend and arise</td>
<td>Non simo Heavy or bulky Blind or obstructed Disengage Interlocked Collect Adjustments Light pressure Double</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3–4 steps</td>
<td>Bend and arise</td>
<td>Care or precision Heavy pressure Blind or obstructed Intermediate moves</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>5–7 steps</td>
<td>Sit or stand</td>
<td></td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>8–10 steps</td>
<td>Through door Climb on or off</td>
<td></td>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>
Move Sequence. When an activity is studied, the index number corresponding to each sub-
activity is written as a subscript to that activity, as shown below.

\[ A_1 B_0 G_1 A_{16} B_6 P_1 A_{16} \]

Each index number corresponds to ten TMUs. Thus, the time in TMUs for the above activity would be

\[(1 + 0 + 1 + 16 + 6 + 1 + 16) \times 10 = 410 \text{ TMUs}\]

Since each TMU is .0006 minute, this corresponds to a time of

\[410 \text{ TMU} \times .0006 \text{ minute/TMU} = .246 \text{ minute}\]

It should be noted that the times calculated based on the index values will be normal times. They must be adjusted for allowances to obtain standard times. An application to a clerical job is shown in Exhibit 22.6.

**Work Sampling**

Many jobs involve activities that are not repetitive. For example, secretaries may spend part of their time typing letters, answering the telephone, or greeting visitors. Police officers also perform many different and varied activities, which are not done repetitively and do not always take the same amount of time. In these cases, it is not reasonable to perform the type of time study discussed previously. Instead, the job designer usually wants to develop an estimate of the percentage of each workday spent on different activities.

**Work sampling** is used in developing an estimate of the percentages of time a worker spends on different activities. The idea behind work sampling is to observe a worker at random times throughout the work period, recording what the worker is doing each time. For example, a work sampling study of a secretarial job would involve the random selection of times when the secretary will be observed. At each observation, a record is kept of what the secretary was doing at that particular moment in time. Over a long enough period of time, a profile of activities performed and their relative frequency can be developed. That profile might look like this:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage of Time Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typing</td>
<td>50%</td>
</tr>
<tr>
<td>Answering telephone</td>
<td>20%</td>
</tr>
<tr>
<td>Greeting visitors</td>
<td>15%</td>
</tr>
<tr>
<td>Stocking supplies</td>
<td>5%</td>
</tr>
<tr>
<td>Taking dictation</td>
<td>5%</td>
</tr>
<tr>
<td>Personal time</td>
<td>3%</td>
</tr>
<tr>
<td>Idle</td>
<td>2%</td>
</tr>
</tbody>
</table>

While work sampling's primary advantage is in studying nonrepetitive activities, it can also be used to develop time standards for repetitive, cyclical jobs. However, in such cases, several hundred observations are often required to achieve acceptable accuracy. Also, it is not possible to develop the detailed elemental information through work sampling that is available from a stopwatch time study.

**Compensation**

Procedures for compensating employees, which must be standardized and documented, are often based on standard times calculated through work measurement. However,
EXHIBIT 22.6
Application of MOST to a Clerical Operation

<table>
<thead>
<tr>
<th>Area</th>
<th>Collections</th>
<th>MOST-calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>12/7/03</td>
<td></td>
</tr>
<tr>
<td>Sign.</td>
<td>A.M.G.</td>
<td></td>
</tr>
<tr>
<td>Page</td>
<td>1/1</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>/101/6013405</td>
<td></td>
</tr>
</tbody>
</table>

**Activity**

**Assemble checks in inside collections**

**Conditions**

<table>
<thead>
<tr>
<th>No.</th>
<th>Method</th>
<th>No.</th>
<th>Sequence Model</th>
<th>Fr</th>
<th>TMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Get check and notice</td>
<td>1</td>
<td>A1 B0 G1 A1 B0 P0 A0</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>Remove and set aside</td>
<td>3</td>
<td>A0 B0 G0 A1 B0 P1 A0</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>paper clip</td>
<td>4</td>
<td>A1 B0 G1 A1 B0 P0 A0</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>Place check and notice on desk</td>
<td>5</td>
<td>A1 B0 G1 A0 P1 A0</td>
<td>3</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6</td>
<td>A0 B0 G0 A1 B0 P1 A0</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>Pick up form</td>
<td>7</td>
<td>A1 B0 G1 A1 B0 P0 A0</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8</td>
<td>A1 B0 G1 A0 P1 A0</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>5</td>
<td>Remove carbon and set aside</td>
<td>9</td>
<td>A1 B0 G1 A1 B0 P1 A0</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>Place notice on desk</td>
<td>10</td>
<td>A1 B0 G1 A1 B0 P0 A0</td>
<td>3</td>
<td>180</td>
</tr>
<tr>
<td>7</td>
<td>Place top copy of notice on check</td>
<td>11</td>
<td>A0 B0 G0 A1 B0 P1 A0</td>
<td>3</td>
<td>60</td>
</tr>
<tr>
<td>8</td>
<td>Get check and notice and staple</td>
<td>12</td>
<td>A1 B0 G1 A1 B0 P0 A0</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>

**TIME= .6540 minutes (min.)**

compensation can also play an important role in productivity improvement as it provides one form of motivation for employees to be more productive. In most companies “hourly” employees are paid at a certain wage rate per hour while “salaried” employees are paid a certain annual salary without regard to hours actually worked. But both groups of employees can be eligible to receive bonuses or other forms of extra compensation as a reward for extra productivity. Such compensation can be based either on individual output or the output of a group or the entire organization. We briefly describe a few of the more common systems here.

**Individual Rewards**

**Piece-Rate Plans**

Employees working under **piece-rate plans** are paid a certain amount per unit of production. For instance, a farmhand might be paid a set amount per bushel of produce picked. The advantage of this system is its simplicity. The employee can easily calculate how much he or she has earned at any given point in time, and to a large extent, the employee has control over his or her own earnings.

The piece-rate system was much more popular before minimum-wage laws went into effect. Today, either the piece rate must be set so that it enables employees to earn at least the minimum wage, or there must be a base pay rate that is earned if the piece rate would place the employee below minimum wage.

**Standard-Hour Plans**

The **standard-hour system** is another incentive plan that is used much more frequently today than the piece-rate system. Under the standard-hour system, each job has a standard time assigned to it. An employee performing that job is paid based on the standard time—regardless of how long it actually took to do the job. For instance, a plumber might be paid on the basis of one standard hour to fix a leaky faucet. Even if it actually takes only thirty minutes to complete the job, the plumber is still paid for one hour’s work. As with the piece-rate system, a base determines the minimum pay a person will receive, usually based on the hours actually worked.

An example of a standard-hour system with which you may be familiar is the flat-rate system used by auto mechanics. Under this system, any repair job is given a standard time. Usually the customer is charged, and the employee paid, based on that standard time, regardless of how long the job actually took.

**Gainsharing**

Instead of rewarding employees for their individual efforts, most companies today are moving toward rewards based on performance of a group or even the entire organization. The process of awarding bonuses or extra compensation because of productivity improvements made by a group is known as **gainsharing**. Although there are many variations of gainsharing plans, all share the following characteristics:

- Performance is compared against some historical base period.
- Gains are shared based on a predetermined agreement.
- The bonus is paid periodically (from weekly to annually).
- The bonus is awarded based on group performance.
A list of the factors favorable to success of gainsharing plans is shown in Exhibit 22.7. One of the best-known incentive plans is the **Scanlon plan**. Named after Joseph Scanlon, a union president at the Lapointe Machine Tool Company, the Scanlon plan is an example of what can be accomplished when union, labor, and management all work together toward a common goal.

The Scanlon plan attempts to forge labor and management into a team whose objective is to increase productivity. Production committees review suggested methods to improve operations. If a particular suggestion does not involve another department and requires no capital expenditure, then the committee can approve implementation. For suggestions that cannot be approved by a production committee, a screening committee of company employees and top management makes the implementation decision.

Under a Scanlon plan, employees are rewarded for their cost-reduction efforts. Any reduction in the labor cost per unit of output is reflected in an employee bonus, which is based on a ratio of total labor costs to the value of output. This ratio must be renegotiated from time to time due to changes in other costs, such as materials and overhead.

**Problem**

The public accounting firm of Hardwick and Mitchell pays bonuses to its tax accountants based on a Scanlon plan, using total value of billings as a measure of output. For the base period, total labor costs were $120,000 on billings of $240,000. Thus, the profit-sharing ratio is

$$\text{Profit-sharing ratio} = \frac{\text{base period labor costs}}{\text{value of output}}$$

$$= \frac{120,000}{240,000} = .50$$

In a recent year, labor costs were $150,000 for billings of $320,000. Using the profit-sharing ratio, the allowed payroll would be

$$\text{Allowed payroll} = \text{profit-sharing ratio} \times \text{value of output}$$

$$= .50 \times 320,000 = 160,000$$

**Exhibit 22.7**

Factors Favorable for Gainsharing Programs

- A skilled, interested work force
- Fair and equitable pay rates
- Perceived job security
- Employees who want to develop themselves
- Work that requires a high degree of cooperation
- A belief that rewards are based on performance
- Willingness to create a more open management climate
- Willingness to listen and use employee ideas—and a formal process for doing so
- Ability to set up management systems for sharing information and tracking performance
- Workable labor relations
- Effective production control and accounting procedures
- Willingness to give supervisors a key role in the process
- Willingness to involve the union in the design of the program
- Relatively stable product lines or an ability to develop a stable formula
- Consistency between the reward system and the basic management philosophy

Since actual labor costs were below the allowed payroll, the difference is distributed as a bonus.

\[
\text{Bonus} = \text{allowed payroll} - \text{labor costs} = $160,000 - $150,000 = $10,000
\]

International Aspects of Employee Compensation

Many companies in the United States use piece-rate and bonus plans to reward individual employees for high productivity. However, the culture in other countries often is more oriented toward groups, downplaying the importance of an individual. For example, in Japan, the norm is that a group is always more important than an individual.

Because of this sort of cultural difference, employee compensation in countries such as Japan often focuses on group performance, rather than on individual performance. Thus, group compensation plans such as the Scanlon plan may be more appropriate than individual rewards.

A further difference may relate to nonwage forms of compensation. While many companies in the United States provide health insurance and retirement plans for their employees, companies in Japan often provide housing, food, recreation, and even a company hospital. For example, Toyota City is a company town for Toyota employees. Within this town, Toyota provides inexpensive housing, a high school, and a hospital for its employees and even makes low-cost loans to employees so they can purchase houses through the company’s Toyota Home subsidiary.

According to a recent survey, more than a third of all companies surveyed now offer incentive pay to employees other than executives. However, moving from straight hourly or salary pay to a system in which individual pay is linked to performance requires careful consideration. The following are some guidelines:

- Set attainable targets for measures employees can influence, such as customer satisfaction.
- Use measures that are meaningful to, and understood by, employees.
- Give employees a say in developing a new system and phase the system in gradually.
- Change targets as conditions change.
- Be sure the desired behavior is being rewarded.

American Express followed the preceding guidelines when implementing a new pay system for employees in its consumer-card and consumer-lending groups. A pilot program was tried first for a year. From this pilot, AmEx found it needed to communicate more information about the program to employees and to decrease the number of performance measures used. The plan is now being used with all employees in both groups. It links pay to customer satisfaction, employee productivity, and shareholder wealth creation.

SUMMARY

- Job design can affect productivity by influencing an employee’s social and psychological environment.
- A flow process chart is used to analyze either the movements of a worker or the flow of materials. A multiple activity chart is used to analyze the interactions of workers and machines or workers and customers.
The result of a stopwatch time study is a cycle time. This is adjusted by a rating factor and allowances to obtain standard time. Predetermined time standards can be used to combine predetermined times for individual parts of a task. Work sampling is used when a job is not repetitive.

Employees may be rewarded for individual efforts through piece-rate or standard-hour systems. Gainsharing systems reward them for results achieved by a group.

### KEY TERMS

- allowance
- normal time
- time measurement units (TMUs)
- cycle time
- piece-rate plans
- time standard
- flow process chart
- quality of work life (QWL)
- time study
- gainsharing
- rating factor
- work cycle
- job enlargement
- scanlon plan
- worker-customer chart
- job enrichment
- selected time
- worker-machine chart
- job rotation
- sociopsychological factors
- work measurement
- job specialization
- standard-hour system
- work sampling
- methods analysis
- standard time
- tasks
- methods-time measurement (MTM)

### SOLVED PROBLEMS

1. A time study of an airline reservations clerk determined that the cycle time was 1.35 minutes, with a performance rating of 105 percent. The allowance factor is 20 percent of normal time. Determine the standard time for this task.

   **SOLUTION**
   
   \[
   NT = CT \times \text{rating factor} = 1.35 \text{ minutes} \times 1.05 = 1.42 \text{ minutes}
   \]
   
   \[
   ST = NT \times \text{allowance} = 1.42 \text{ minutes} \times 1.20 = 1.70 \text{ minutes}
   \]

2. A company wants to use MOST to develop the standard time for a certain job. Part of the job involves walking three steps, climbing onto a platform, picking up a light object, climbing off the platform, and walking back three steps. What is the time, in TMUs, for this part of the job?

   **SOLUTION**
   
   Using the general move sequence of ABGABA and relating the actions described above to the index numbers we obtain the following. Because there is no action distance immediately after picking up the light object the index for the second A is zero, as is the index on P because there is no “place” in this part of the job.

   \[
   A_6 \ B_{16} \ G_1 \ A_0 \ B_{16} \ P_0 \ A_6
   \]
   
   The sum of index numbers is 6 + 16 + 1 + 0 + 16 + 0 + 6 = 45
   
   \[
   45 \times 10 = 450 \text{ TMUs}
   \]

3. A company that uses the Scanlon plan had base period labor costs of $520,000 on sales of $3,500,000. In the most recent year labor costs were $600,000 and sales were $5,000,000. What bonus would be paid this year?
**SOLUTION**

The profit-sharing ratio is base period labor divided by base period sales, or

\[
\text{Profit-sharing ratio} = \frac{\$520,000}{\$3,500,000} = .14857
\]

For the most recent year, allowed payroll is profit-sharing ratio times sales, or

\[
\text{Allowed payroll} = .14857 \times \$5,000,000 = \$742,850
\]

Then the bonus is allowed payroll minus labor costs, or

\[
\text{Bonus} = \$742,850 - \$600,000 = \$142,850.
\]

**QUESTIONS**

1. Examine Exhibit 22.2 and indicate some ways you would change the process to make it more efficient. Think not only about the worker’s activities, but also about equipment that could reduce the time for this job.

2. Differentiate between job design and work measurement. How are they related?

3. What is ergonomics, and how does it relate to job design?

4. Describe some situations in which poor design of the physical environment leads to low productivity, worker dissatisfaction, or other undesirable outcomes.

5. Describe the purpose of a flow process chart and how it is used to improve efficiency.

6. Exhibit 22.4 shows a worker-customer chart. Suggest ways that the operation could be improved to reduce idle time.

7. In other courses, you have probably studied Maslow’s Hierarchy or other sociopsychological models. Use those, or your own ideas, to explain why workers are usually happier working in teams than working individually.

8. Differentiate among job specialization, job enlargement, and job enrichment.

9. Why does breaking a task into individual movements often lead to improvements in efficiency?

10. What are the disadvantages of using work sampling to develop time standards for standard, repetitive operations?

11. Define the following terms:
   a. Cycle time
   b. Normal time
   c. Standard time
   d. Allowances

12. Why are time standards important in managing operations?

13. Explain how work sampling differs from time study. In what type of situation is each most appropriate?

14. What are the advantages and disadvantages of methods such as MOST and MTM?

15. List the steps you would follow in setting a time standard for data entry clerks in an insurance company.
16. Select a country other than the United States, and explain whether its employees are rewarded on the basis of individual or group output and whether nonwage compensation is used.

INTERNET QUESTIONS

1. Visit the Web site for OSHA (www.osha.gov), then click on the link for “ergonomics.” From there, go to “Ergonomic eTools,” then “Computer Workstations.” Use the information there to analyze your own work on a computer. Are there things you should probably change to avoid risking a musculoskeletal disorder?

2. Go to the National Institute for Occupational Safety and Health Web site (www.cdc.gov/niosh/homepage.html). Click on the link for “musculoskeletal disorders.” Summarize (do not plagiarize) the results of research regarding back belts and prevention of lifting injuries.

3. At the Web site for the H. B. Maynard and Company (http://www.hbmaynard.com/default.asp), explore the “Maynard Workforce Performance Model.” Summarize its ideas about the relationships between time standards and a wage system.

PROBLEMS

1. Make a flow process chart for your school’s course registration system based on the student’s viewpoint.
   a. Identify ways the system could be changed to reduce the time you spend waiting in line and walking from one location to another.
   b. Suppose the school wants to minimize idle time for its registration employees, but is not concerned about waiting or traveling time for students. How would you change the system?

2. In a stopwatch time study, it is found that the cycle time for a certain task is 4.30 minutes. The rating factor is evaluated as 90 percent, and allowances are equal to 10 percent of normal time. Determine the standard time.

3. A job has been studied and found to have the following times for each cycle:

<table>
<thead>
<tr>
<th>Cycle</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min.)</td>
<td>4.71</td>
<td>4.54</td>
<td>4.89</td>
<td>4.76</td>
<td>4.83</td>
<td>4.61</td>
</tr>
</tbody>
</table>

   The time-study operator estimates that the rating factor is 95 percent. Allowances for this job account for 15 percent of normal time. Determine the standard time.

4. Operators in the check-processing department of a large bank must manually enter the amount of each check. Based on time studies, the standard time is .03 minute per check. During a typical eight-hour day, operators experience thirty minutes of unavoidable delays and require twenty minutes for personal time. Each operator is allowed three fifteen-minute coffee breaks per day.
   a. How many checks would be processed per day by an operator working at 90 percent of standard?
   b. How many checks would be processed per day by an operator working at 110 percent of standard?
5. A certain task has been broken into elements and each element timed. The performance rating for each element is shown below, and the allowance factor is 20 percent for this job. Combine these element times to calculate a standard time for the entire task.

<table>
<thead>
<tr>
<th>Element</th>
<th>Rating</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain part</td>
<td>95%</td>
<td>.25</td>
<td>.32</td>
<td>.28</td>
<td>.26</td>
<td>.32</td>
</tr>
<tr>
<td>Position</td>
<td>110%</td>
<td>.45</td>
<td>.48</td>
<td>.42</td>
<td>.48</td>
<td>.43</td>
</tr>
<tr>
<td>Drill</td>
<td>90%</td>
<td>.73</td>
<td>.82</td>
<td>.86</td>
<td>.72</td>
<td>.76</td>
</tr>
<tr>
<td>Remove part</td>
<td>105%</td>
<td>.12</td>
<td>.10</td>
<td>.15</td>
<td>.13</td>
<td>.14</td>
</tr>
</tbody>
</table>

6. A certain task involves walking six steps, bending down to pick up a lightweight piece of metal, returning six steps, and carefully inserting the piece of metal into a holding fixture. Use the General Move Sequence of MOST to determine the normal time for this task in minutes.

7. A certain operation requires the operator to grasp a part that is within reach, disengage the part from a holding fixture, move the part to a subassembly that is also within reach, and then carefully insert the part into that subassembly. Allowances for this task are 15 percent of normal time. Determine the standard time, using the MOST General Move Sequence.

8. The business college dean at a large state university complains that she spends too much time dealing with student complaints. Over a one-week period, the dean is observed at random times, and the following data recorded:

<table>
<thead>
<tr>
<th>Day</th>
<th>Times Observed</th>
<th>Times Handling Student Complaints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Tuesday</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>Wednesday</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>Thursday</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Friday</td>
<td>14</td>
<td>9</td>
</tr>
</tbody>
</table>

a. What work measurement method is this?
b. Based on this limited sample, what percentage of the dean’s time is spent handling student complaints?
c. Suggest ways to reduce the time the dean spends on student complaints.

9. The Herkimer Oscilloscope Company uses a Scanlon plan. During the base period, the company’s total labor costs were $4.3 million on sales of $50 million. During this past year, the company reduced its labor costs to $4.0 million on sales of $55 million. What would be the employee bonus for this past year?

MINI-CASES

Elco Industries

Elco Industries manufactures soundproofing material for use in automobiles. This material, which usually is not seen by the average car owner, goes under the carpet, inside the doors, or even inside the wheel wells to insulate passengers from engine and road noises. Elco’s customers are the Big Three automakers—Chrysler, Ford, and General Motors.
Elco's employees have traditionally been paid on a straight wage basis—so much
salary per hour. Therefore, there had never been any interest in the past in developing
time standards. Recently, however, the companies Elco supplies have been demanding delivery
of orders within a specified, narrow time range. This has caused problems for Elco in that
orders are often not ready by the required shipping date. The result has been extensive use
of expediting and air freight, or even air-charter shipments to get orders to the customers
on time. Elco has been considering the implementation of time standards in order to help
it plan operations better and meet its’ customer’s delivery schedules. However, the union
representing Elco’s employees, the UA has not been receptive to this idea. The union sees
it as a way to push employees for more output or even as an excuse to eliminate some jobs.

1. Describe how time standards could be used to help Elco deal with its on-time
delivery problems.
2. How would you deal with union concerns that time studies will lead to higher
output demands being placed on the workers?
3. Could time standards actually benefit the employees?
4. What other benefits could such time studies have for both the company and the
employees?
5. How would you proceed in performing the time studies that would be needed
to set standards?

Magic Airlines

Airlines are faced with deregulation problems, an increased number of mergers and acquisi-
tions, declining fares, and increasing passenger traffic. Magic Airlines has been flying for
more than forty years, but currently it and many other airlines are under tremendous pres-
sure to cut costs. Presently, Magic pays the following average salaries: over $90,000 to air-
line pilots, more than $35,000 to mechanics, and $30,000 to flight attendants. Since
deregulation, new entrants have opted for nonunion shops and have been successful. Some
existing carriers have won concessions from their unions. These low-cost airlines often pay
mechanics and flight attendants $20,000 or less.

In the past, Magic has been very profitable. However, recent dramatic declines in fares
have pushed the company into a loss position. Magic’s executives have tried to bargain
with union leaders to take wage cuts to improve Magic’s competitiveness. These talks have
often lead to unfriendly exchanges between management and labor. Union leaders and the
rank and file are becoming more distressed with management positions. Meanwhile,
Magic’s president has received a 10 percent salary increase, raising his salary to more than
$4,000,000. The company has over forty vice-presidents, carryovers from the days of reg-
ulated airfares. Perks for executives and their families have not been reduced. Faced with
more losses in the coming quarter, how can Magic improve its short- and long- term profit
position?

1. How is Magic’s position different from that of other airlines?
2. Do you think that Magic’s management has treated the unions fairly in putting
most of the blame for high costs on the unions?
3. Devise an approach that would allow Magic to get wage concessions from the
unions.
### SELECTED BIBLIOGRAPHY


