Pie charts are useful for showing data from *a group of factors* that can be represented as percentages totaling 100 percent.

Each of the tools for improving quality may be used independently, but their power is greatest when they are used together. In solving a process-related problem, managers often must act as detectives, sifting data to clarify the issues involved and deducing the causes. We call this process *data snooping*. Example 4.4 demonstrates how the tools for improving quality can be used for data snooping.

A simulation model goes one step further than data analysis tools, because it can show how the process dynamically changes over time. **Process simulation** is the act of reproducing the behavior of a process, using a model that describes each step. Once the process is modeled, the analyst can make changes in the model to measure the impact on certain metrics, such as response time, waiting lines, resource utilization, and the like. To learn more about how simulation works, see MyOMLab Supplement E, "Simulation". A more advanced capability is possible using SimQuick, found in MyOMLab (**www.nd.edu/~dhartvig/simquick/top.html**). Other software packages include Extend (**http://www.extendsim.com//**), SIMPROCESS (**www.caciasl.com**), ProModel (**www.promodel.com**), and Witness (**www.lanner.com**).

**process simulation**
The act of reproducing the behavior of a process, using a model that describes each step.

MyOMLab

# Redesigning the Process

A doctor pinpoints an illness after a thorough examination of the patient, and then the doctor recommends treatments based on the diagnosis; so it is with processes. After a process is documented, metrics data collected, and disconnects identified, the process analyst or design team puts together a set of changes that will make the process better. At this step, people directly involved in the process are brought in to get their ideas and inputs.

## Generating Ideas: Questioning and Brainstorming

Sometimes, ideas for reengineering or improving a process become apparent after documenting the process and carefully examining the areas of substandard performance, handoffs between departments, and steps where customer contact is high. Example 4.4 illustrates how such documentation pointed to a better way of handling the fiber boards through better training. In other cases, the better solution is less evident. Ideas can be uncovered (because there is always a better way) by asking six questions about each step in the process, and about the process as a whole:

1. *What* is being done?
2. *When* is it being done?
3. *Who* is doing it?
4. *Where* is it being done?
5. *How* is it being done?
6. *How* **well** does it do on the various metrics of importance?

Answers to these questions are challenged by asking still another series of questions. *Why* is the process even being done? *Why* is it being done where it is being done? *Why* is it being done when it is being done?

Creativity can also be stimulated by **brainstorming**, letting a group of people knowledgeable about the process propose ideas for change by saying whatever comes to mind. A facilitator records the ideas on a flipchart, so that all can see. Participants are discouraged from evaluating any of the ideas generated during the session. The purpose is to encourage creativity and to get as many ideas as possible, no matter how far-fetched the ideas may seem. The participants of a brainstorming session need not be limited to the design team as long as they have seen or heard the process documentation. A growing number of big companies, such as Sun Life Financial and Georgia-Pacific, are taking advantage of the Internet and specially designed software to run brainstorming sessions that allow people at far-flung locations to "meet" online and hash out solutions to particular problems. The technology lets employees see, and build on, one another's ideas, so that one person's seed of a notion can grow into a practical plan.

**brainstorming**
Letting a group of people, knowledgeable about the process, propose ideas for change by saying whatever comes to mind.

**EXAMPLE 4.4** **Identifying Causes of Poor Headliner Process Failures**

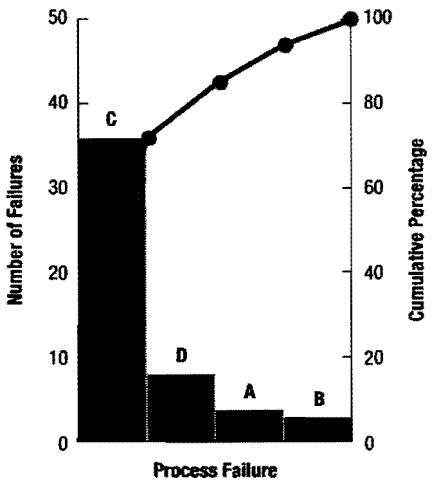
The Wellington Fiber Board Company produces headliners, the fiberglass components that form the inner roof of passenger cars. Management wanted to identify which process failures were most prevalent and to find the cause.

**Step 1.** Checklist

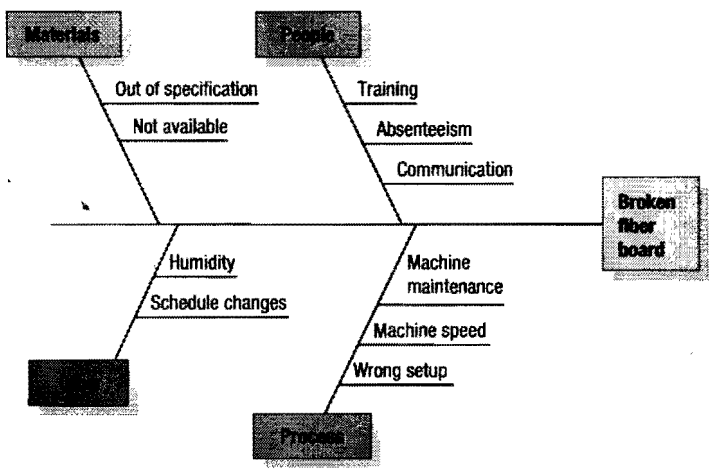
**Headliner failures**

| Process failure | Tally | Total |
|---|---|---|
| A. Tears in fabric | IIII | 4 |
| B. Discolored fabric | III | 3 |
| C. Broken fiber board | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 I | 36 |
| D. Ragged edges | 𝍸 II | 7 |
| | | Total 50 |

**Step 2.** Pareto Chart

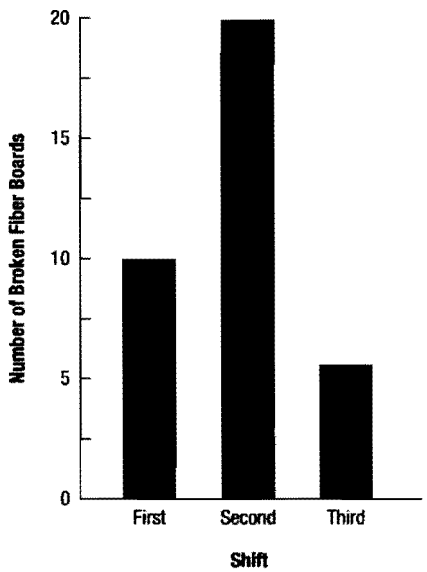



**Step 3.** Cause-and-Effect Diagram




**Step 4.** Bar Chart






▲ **FIGURE 4.13**
Application of the Tools for Improving Quality

**SOLUTION**

Figure 4.13 shows the sequential application of several tools for improving quality.

**Step 1:** A checklist of different types of process failures was constructed from last month's production records.

**Step 2:** A Pareto chart prepared from the checklist data indicated that broken fiber board accounted for 72 percent of the process failures.

**Step 3:** A cause-and-effect diagram for broken fiber board identified several potential causes for the problem. The one strongly suspected by the manager was employee training.

**Step 4:** The manager reorganized the production reports into a bar chart according to shift because the personnel on the three shifts had varied amounts of experience.

**DECISION POINT**

The bar chart indicated that the second shift, with the least experienced workforce, had most of the process failures. Further investigation revealed that workers were not using proper procedures for stacking the fiber boards after the press operation, which caused cracking and chipping. The manager set up additional training sessions focused on board handling. Although the second shift was not responsible for all the process failures, finding the source of many of the failures enabled the manager to improve the performance of her operations.

After the brainstorming session is over, the design team moves into the "get real" phase: They evaluate the different ideas. The team identifies the changes that give the best payoffs for process redesign. The redesign could involve issues of capacity, layout, technology, or even location, all of which are discussed in more detail in the following chapters.

The redesigned process is documented once again, this time as the "after" view of the process. Expected payoffs are carefully estimated, along with risks. For changes involving investments, the time value of money must be considered (see MyOMLab Supplement F, "Financial Analysis,"). The impact on people (skills, degree of change, training requirements, and resistance to change) must also be factored into the evaluation of the new design.

MyOMLab

Managerial Practice 4.1 describes how Baptist Memorial Hospital analyzed its processes to solve its capacity problem and improve patient satisfaction at the same time without any addition of new resources.

## Benchmarking

Benchmarking can be another valuable source for process redesign. **Benchmarking** is a systematic procedure that measures a firm's processes, services, and products against those of industry leaders. Companies use benchmarking to better understand how outstanding companies do things so that they can improve their own processes.

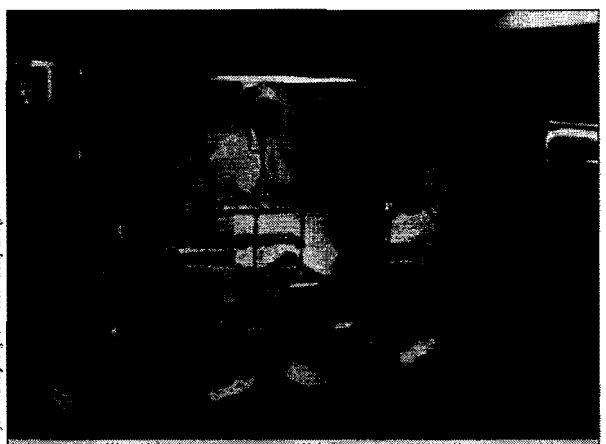
**benchmarking**

A systematic procedure that measures a firm's processes, services, and products against those of industry leaders.

### Baptist Memorial Hospital

Baptist Memorial Hospital–Memphis is a 760-bed tertiary care hospital. It had a capacity problem, or so it seemed, with occupancy routinely exceeding 90 percent. However, it solved the problem with process improvement, rather than adding staff or bed capacity. Administration, nurses, and physicians centralized bed assignments and added a new bed-tracking system to provide bed information in real time. They then focused on improving processes at the emergency department (ED). An express admission unit (EAU), a 21-bed dedicated area that processes direct and emergency department admissions, was opened to remove responsibility for a particularly time-intensive activity from busy unit nurses. The new processes were less divergent and had more of a line flow. They then began testing process improvement ideas for change on a small scale, altering processes to improve them, and spreading the processes to other areas when they are successful. They began to fax reports from the ED to the receiving unit, shifted more nurses to work during peak periods, began lab and X-ray diagnostic procedures at triage when the EU was at capacity, took patients directly to a room when one became available with bedside registration, and segmented the urgent care population within the ED.

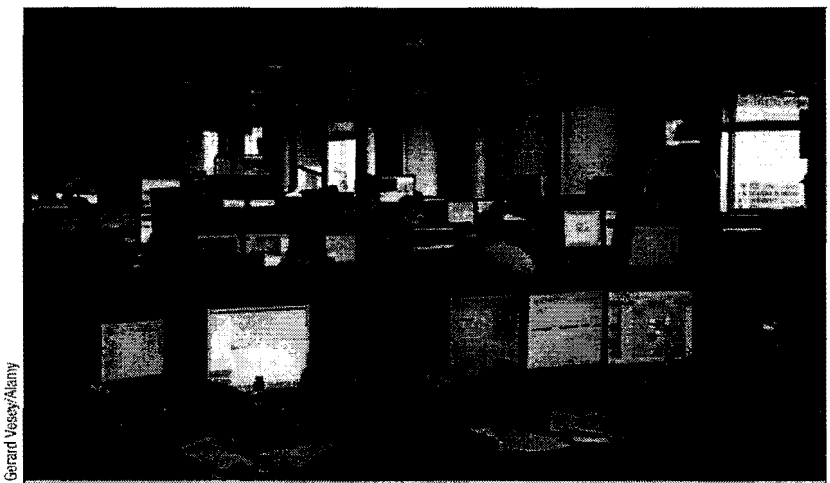
Redesigned processes reduced patient delays. Turnaround time for the overall ED was reduced by 9 percent, even while the ED volume was increasing. Length of stay was reduced by 2 days, the equivalent of building 12 Intensive care unit (ICU) beds. The mortality rate decreased, volume increased by 20 percent, and patient satisfaction improved significantly. What first appeared to be a capacity problem was resolved without adding staff or the number of beds—it was solved with redesigned processes.



Ryan McVay/Digital Vision/Getty Images

Baptist Memorial Hospital in Memphis, Tennessee, holds "huddle meetings" at least three times a day seeking out process improvements. The meetings bring together the hospital's house supervisor, housekeeping supervisor, and key nurses. Improvements have been dramatic. In 2011, the hospital was ranked in the top 5 percent nationally for emergency medicine.

*Source:* Suzanne S. Horton, "Increasing Capacity While Improving the Bottom Line," *Frontiers of Health Services Management,* vol. 20, no. 4 (Summer 2004), pp. 17–23; Richard S. Zimmerman, "Hospital Capacity, Productivity, and Patient Safety—It All Flows Together," *Frontiers of Health Services Management,* vol. 20, no. 4 (Summer 2004), pp. 33–38, *baptistonline.org,* April, 2011.



Gerard Vessey/Alamy

Omgeo is a behind-the-scenes company that settles trades between financial services firms. The process used to involve dozens of scribbled faxes, telexes, and telephone calls made for the typical trade costs from $10 to $12. Now, the process costs only 20 cents to $1 per trade—and investment managers essentially get the service free. A key change was using the Internet and new information technology solutions. Information goes into a central database that the broker, investment manager, and custodian banks all have access to in real time. The details of the trades are automatically compared to eliminate errors.

Benchmarking focuses on setting quantitative goals for improvement. *Competitive* benchmarking is based on comparisons with a direct industry competitor. *Functional* benchmarking compares areas such as administration, customer service, and sales operations with those of outstanding firms in any industry. For instance, Xerox benchmarked its distribution function against L.L. Bean's because L.L. Bean is renowned as a leading retailer in distribution efficiency and customer service.

*Internal* benchmarking involves using an organizational unit with superior performance as the benchmark for other units. This form of benchmarking can be advantageous for firms that have several business units or divisions. All forms of benchmarking are best applied in situations where you are looking for a long-term program of continuous improvement.

Typical measures used in benchmarking include cost per unit, service upsets (breakdowns) per customer, processing time per unit, customer retention rates, revenue per unit, return on investment, and customer satisfaction levels.

Benchmarking consists of four basic steps:

***Step 1.*** Planning. Identify the process, service, or product to be benchmarked and the firm(s) to be used for comparison; determine the performance metrics for analysis; collect the data.

***Step 2.*** Analysis. Determine the gap between the firm's current performance and that of the benchmark firm(s); identify the causes of significant performance gaps.

***Step 3.*** Integration. Establish goals and obtain the support of managers who must provide the resources for accomplishing the goals.

***Step 4.*** Action. Develop cross-functional teams of those most affected by the changes; develop action plans and team assignments; implement the plans; monitor progress; recalibrate benchmarks as improvements are made.

Collecting benchmarking data can sometimes be a challenge. Internal benchmarking data is surely the most accessible. One way of benchmarking is always available—tracking the performance of a process over time. Functional benchmarking data are often collected by professional associations or consulting firms. Several corporations and government organizations have agreed to share and standardize performance benchmarks. The American Productivity and Quality Center, a nonprofit organization, created thousands of measures, as Figure 4.14 illustrates. A full range of metrics can be explored at **www.apqc.org**. Another source is the Supply-Chain Council, which has defined key metrics in its Supply-Chain Operations Reference (SCOR) model (see Chapter 12, "Supply Chain Integration").

## Managing and Implementing Processes

Failure to manage processes is failure to manage the business. Implementing a beautifully redesigned process is only the beginning to continually monitoring and improving processes. Metrics goals must be continually evaluated and reset to fit changing requirements. Avoid the following seven mistakes when managing processes:[2]

1. *Not Connecting with Strategic Issues.* Is particular attention being paid to core processes, competitive priorities, impact of customer contact and volume, and strategic fit during process analysis?

[2]Geary A. Rummler and Alan P. Brache, *Improving Performance*, 2nd ed. (San Francisco: Jossey-Bass, 1995), pp. 126–133.

**Customer Relationship Process**

- Total cost of "enter, process, and track orders" per $1,000 revenue
- System costs of process per $100,000 revenue
- Value of sales order line item not fulfilled due to stockouts, as percentage of revenue
- Percentage of finished goods sales value that is returned
- Average time from sales order receipt until manufacturing or logistics is notified
- Average time in direct contact with customer per sales order line item
- Energy consumed in transporting product
- Total distance travelled for products
- Green house gas emissions

**Order Fulfillment Process**

- Value of plant shipments per employee
- Finished goods inventory turnover
- Reject rate as percentage of total orders processed
- Percentage of orders returned by customers due to quality problems
- Standard customer lead time from order entry to shipment
- Percentage of orders shipped on time
- Use of non-renewable energy sources
- Use of toxic ingredients
- Safe and healthy work environment

**New Service/Product Development Process**

- Percentage of sales due to services/products launched last year
- Cost of "generate new services/products" process per $1,000 revenue
- Ratio of projects entering the process to projects completing the process
- Time to market for existing service/product improvement project
- Time to market for new service/product project
- Time to profitability for existing service/product improvement project

**Supplier Process**

- Cost of "select suppliers and develop/maintain contracts" process per $1,000 revenue
- Number of employees per $1,000 of purchases
- Percentage of purchase orders approved electronically
- Average time to place a purchase order
- Total number of active vendors per $1,000 of purchases
- Percentage of value of purchased material that is supplier certified
- Amount of toxic chemicals used in supplies production process
- Energy consumed in transporting raw materials and parts
- Total distance travelled for raw materials and parts
- Green house gas emissions
- Supplier's use of toxic chemicals in production process
- Percentage of child labor used by supplier

**Support Process**

- Systems cost of finance function per $1,000 revenue
- Percentage of finance staff devoted to internal audit
- Total cost of payroll processes per $1,000 revenue
- Number of accepted jobs as percentage of job offers
- Total cost of "source, recruit, and select" process per $1,000 revenue
- Average employee turnover rate

◀ **FIGURE 4.14**
Illustrative Benchmarking Metrics by Type of Process

2. *Not Involving the Right People in the Right Way.* Does process analysis closely involve the people performing the process, or those closely connected to it as internal customers and suppliers?
3. *Not Giving the Design Teams and Process Analysts a Clear Charter, and then Holding Them Accountable.* Does management set expectations for change and maintain pressure for results? Does it allow paralysis in process improvement efforts by requiring excessive analysis?
4. *Not Being Satisfied Unless Fundamental "Reengineering" Changes are Made.* Is the radical change from process reengineering the expectation? If so, the cumulative effect of many small improvements that could be made incrementally could be lost. Process management efforts should not be limited to downsizing or to reorganization only, even though jobs may be eliminated or the structure changed. It should not be limited to big technological innovation projects, even though technological change occurs often.