month, but he will achieve the same output (an increase to 1,875) as the change in labor-hours. Which is the better decision?

a) Show the productivity change, in loaves per dollar, with an increase in labor cost (from 640 to 800 hours).
b) Show the new productivity, in loaves per dollar, with only an increase in investment ($100 per month more).
c) Show the percent productivity change for labor and investment.

**•••1.15** Refer to Problems 1.13 and 1.14. If Charles Lackey's utility costs remain constant at $500 per month, labor at $8 per hour, and cost of ingredients at $0.35 per loaf, but Charles does not purchase the blender suggested in Problem 1.14, what will the productivity of the bakery be? What will be the percent increase or decrease?

**••1.16** In December, General Motors produced 6,600 customized vans at its plant in Detroit. The labor productivity at this plant is known to have been 0.10 vans per labor-hour during that month. 300 laborers were employed at the plant that month.

a) How many hours did the average laborer work that month?
b) If productivity can be increased to 0.11 vans per labor-hour, how many hours would the average laborer work that month?

**••1.17** Susan Williams runs a small Flagstaff job shop where garments are made. The job shop employs eight workers. Each worker is paid $10 per hour. During the first week of March, each worker worked 45 hours. Together, they produced a batch of 132 garments. Of these garments, 52 were "seconds" (meaning that they were flawed). The seconds were sold for $90 each at a factory outlet store. The remaining 80 garments were sold to retail outlets at a price of $198 per garment. What was the labor productivity, in dollars per labor-hour, at this job shop during the first week of March?

**Refer to MyOMLab for this additional homework problem: 1.18.**



# CASE STUDIES

## ☆ National Air Express

National Air is a competitive air-express firm with offices around the country. Frank Smith, the Chattanooga, Tennessee, station manager, is preparing his quarterly budget report, which will be presented at the Southeast regional meeting next week. He is very concerned about adding capital expense to the operation when business has not increased appreciably. This has been the worst first quarter he can remember: snowstorms, earthquakes, and bitter cold. He has asked Martha Lewis, field services supervisor, to help him review the available data and offer possible solutions.

**Service Methods**

National Air offers door-to-door overnight air-express delivery within the U.S. Smith and Lewis manage a fleet of 24 trucks to handle freight in the Chattanooga area. Routes are assigned by area, usually delineated by zip code boundaries, major streets, or key geographical features, such as the Tennessee River. Pickups are generally handled between 3:00 P.M. and 6:00 P.M., Monday through Friday. Driver routes are a combination of regularly scheduled daily stops and pickups that the customer calls in as needed. These call-in pickups are dispatched by radio to the driver. Most call-in customers want as late a pickup as possible, just before closing (usually at 5:00 P.M.).

When the driver arrives at each pickup location, he or she provides supplies as necessary (an envelope or box if requested) and must receive a completed air waybill for each package. Because the industry is extremely competitive, a professional, courteous driver is essential to retaining customers. Therefore, Smith has always been concerned that drivers not rush a customer to complete his or her package and paperwork.

**Budget Considerations**

Smith and Lewis have found that they have been unable to meet their customers' requests for a scheduled pickup on many occasions in the past quarter. Although, on average, drivers are not handling any more business, they are unable on some days to arrive at each location on time. Smith does not think he can justify increasing costs by $1,200 per week for additional trucks and drivers while productivity (measured in shipments per truck/day) has remained flat. The company has established itself as the low-cost operator in the industry but has at the same time committed itself to offering quality service and value for its customers.

### Discussion Questions

1. Is the productivity measure of shipments per day per truck still useful? Are there alternatives that might be effective?
2. What, if anything, can be done to reduce the daily variability in pickup call-ins? Can the driver be expected to be at several locations at once at 5:00 P.M.?
3. How should package pickup performance be measured? Are standards useful in an environment that is affected by the weather, traffic, and other random variables? Are other companies having similar problems?

*Source:* Adapted from a case by Phil Pugliese under the supervision of Professor Marilyn M. Helms, University of Tennessee at Chattanooga. Reprinted by permission.

## ☆ Frito-Lay: Operations Management in Manufacturing

Video Case

Frito-Lay, the massive Dallas-based subsidiary of PepsiCo, has 38 plants and 48,000 employees in North America. Seven of Frito-Lay's 41 brands exceed $1 billion in sales: Fritos, Lay's Cheetos, Ruffles, Tostitos, Doritos, and Walker's Potato Chips. Operations is the focus of the firm—from designing products for new markets, to meeting changing consumer preferences, to adjusting to rising commodity costs, to subtle issues involving flavors and preservatives—OM is under constant cost, time, quality, and market pressure. Here is a look at how the 10 decisions of OM are applied at this food processor.

In the food industry, product development kitchens experiment with new products, submit them to focus groups, and perform test marketing. Once the product specifications have been set, processes capable of meeting those specifications and the necessary quality standards are created. At Frito-Lay, quality begins at the farm, with onsite inspection of the potatoes used in Ruffles and the corn used in Fritos. Quality continues throughout the manufacturing process, with visual inspections and with statistical process control of product variables such as oil, moisture, seasoning, salt, thickness, and weight.

Additional quality evaluations are conducted throughout shipment, receipt, production, packaging, and delivery.

The production process at Frito-Lay is designed for large volumes and small variety, using expensive special-purpose equipment, and with swift movement of material through the facility. Product-focused facilities, such as Frito-Lay's, typically have high capital costs, tight schedules, and rapid processing. Frito-Lay's facilities are located regionally to aid in the rapid delivery of products because freshness is a critical issue. Sanitary issues and necessarily fast processing of products put a premium on an efficient layout. Production lines are designed for balanced throughput and high utilization. Cross-trained workers, who handle a variety of production lines, have promotion paths identified for their particular skill set. The company rewards employees with medical, retirement, and education plans. Its turnover is very low.

The supply chain is integral to success in the food industry; vendors must be chosen with great care. Moreover, the finished food product is highly dependent on perishable raw materials. Consequently, the supply chain brings raw material (potatoes, corn, etc.) to the plant securely and rapidly to meet tight production schedules. For instance, from the time that potatoes are picked in St. Augustine, Florida, until they are unloaded at the Orlando plant, processed, packaged, and shipped from the plant is under 12 hours. The requirement for fresh product requires on-time, just-in-time deliveries combined with both low raw material and finished goods inventories. The continuous-flow nature of the specialized equipment in the production process permits little work-in-process inventory. The plants usually run 24/7. This means that there are four shifts of employees each week.

Tight scheduling to ensure the proper mix of fresh finished goods on automated equipment requires reliable systems and effective maintenance. Frito-Lay's workforce is trained to recognize problems early, and professional maintenance personnel are available on every shift. Downtime is very costly and can lead to late deliveries, making maintenance a high priority.

### Discussion Questions*

1. From your knowledge of production processes and from the case and the video, identify how each of the 10 decisions of OM is applied at Frito-Lay.
2. How would you determine the productivity of the production process at Frito-Lay?
3. How are the 10 decisions of OM different when applied by the operations manager of a production process such as Frito-Lay versus a service organization such as Hard Rock Cafe (see the Hard Rock Cafe video case below)?

*You may wish to view the video that accompanies this case before addressing these questions.

## ☆ Hard Rock Cafe: Operations Management in Services

Video Case

In its 42 years of existence, Hard Rock has grown from a modest London pub to a global power managing 150 cafes, 13 hotels/casinos, and live music venues. This puts Hard Rock firmly in the service industry—a sector that employs over 75% of the people in the U.S. Hard Rock moved its world headquarters to Orlando, Florida, in 1988 and has expanded to more than 40 locations throughout the U.S., serving over 100,000 meals each day. Hard Rock chefs are modifying the menu from classic American—burgers and chicken wings—to include higher-end items such as stuffed veal chops and lobster tails. Just as taste in music changes over time, so does Hard Rock Cafe, with new menus, layouts, memorabilia, services, and strategies.

At Orlando's Universal Studios, a traditional tourist destination, Hard Rock Cafe serves over 3,500 meals each day. The cafe employs about 400 people. Most are employed in the restaurant, but some work in the retail shop. Retail is now a standard and increasingly prominent feature in Hard Rock Cafes (since close to 48% of revenue comes from this source). Cafe employees include kitchen and wait staff, hostesses, and bartenders. Hard Rock employees are not only competent in their job skills but are also passionate about music and have engaging personalities. Cafe staff is scheduled down to 15-minute intervals to meet seasonal and daily demand changes in the tourist environment of Orlando. Surveys are done on a regular basis to evaluate quality of food and service at the cafe. Scores are rated on a 1-to-7 scale, and if the score is not a 7, the food or service is a failure.

Hard Rock is adding a new emphasis on live music and is redesigning its restaurants to accommodate the changing tastes. Since Eric Clapton hung his guitar on the wall to mark his favorite bar stool, Hard Rock has become the world's leading collector and exhibitor of rock 'n' roll memorabilia, with changing exhibits at its cafes throughout the world. The collection includes 70,000 pieces, valued at $40 million. In keeping with the times, Hard Rock also maintains a Web site, www.hardrock.com, which receives over 100,000 hits per week, and a weekly cable television program on VH1. Hard Rock's brand recognition, at 92%, is one of the highest in the world.

### Discussion Questions*

1. From your knowledge of restaurants, from the video, from the *Global Company Profile* that opens this chapter, and from the case itself, identify how each of the 10 OM strategy decisions is applied at Hard Rock Cafe.
2. How would you determine the productivity of the kitchen staff and wait staff at Hard Rock?
3. How are the 10 OM strategy decisions different when applied to the operations manager of a service operation such as Hard Rock versus an automobile company such as Ford Motor Company?

*You may wish to view the video that accompanies this case before addressing these questions.

• **Additional Case Study:** Visit **www.myomlab.com** or **www.pearsonhighered.com/heizer** for this free case study: Zychol Chemicals Corp.: The production manager must prepare a productivity report, which includes multifactor analysis.

# CASE STUDIES

## ☆ Minit-Lube

A substantial market exists for automobile tune-ups, oil changes, and lubrication service for more than 250 million vehicles on U.S. roads. Some of this demand is filled by full-service auto dealerships, some by Walmart and Firestone, and some by other tire/service dealers. However, Minit-Lube, Mobil-Lube, Jiffy-Lube and others have also developed strategies to accommodate this opportunity.

Minit-Lube stations perform oil changes, lubrication, and interior cleaning in a spotless environment. The buildings are clean, painted white, and often surrounded by neatly trimmed landscaping. To facilitate fast service, cars can be driven through three abreast. At Minit-Lube, the customer is greeted by service representatives who are graduates of Minit-Lube U. The Minit-Lube school is not unlike McDonald's Hamburger University near Chicago or Holiday Inn's training school in Memphis. The greeter takes the order, which typically includes fluid checks (oil, water, brake fluid, transmission fluid, differential grease) and the necessary lubrication, as well as filter changes for air and oil. Service personnel in neat uniforms then move into action. The standard three-person team has one person checking fluid levels under the hood, another assigned interior vacuuming and window cleaning, and the third in the garage pit, removing the oil filter, draining the oil, checking the differential and transmission, and lubricating as necessary. Precise task assignments and good training are designed to move the car into and out of the bay in 10 minutes. The idea is to charge no more, and hopefully less, than gas stations, automotive repair chains, and auto dealers, while providing better service.

### Discussion Questions

1. What constitutes the mission of Minit-Lube?
2. How does the Minit-Lube operations strategy provide competitive advantage? (*Hint:* Evaluate how Minit-Lube's traditional competitors perform the 10 decisions of operations management vs. how Minit-Lube performs them.)
3. Is it likely that Minit-Lube has increased productivity over its more traditional competitors? Why? How would we measure productivity in this industry?

## ☆ Strategy at Regal Marine

Video Case

Regal Marine, one of the U.S.'s 10 largest power-boat manufacturers, achieves its mission—providing luxury performance boats to customers worldwide—using the strategy of differentiation. It differentiates its products through constant innovation, unique features, and high quality. Increasing sales at the Orlando, Florida, family-owned firm suggest that the strategy is working.

As a quality boat manufacturer, Regal Marine starts with continuous innovation, as reflected in computer-aided design (CAD), high-quality molds, and close tolerances that are controlled through both defect charts and rigorous visual inspection. In-house quality is not enough, however. Because a product is only as good as the parts put into it, Regal has established close ties with a large number of its suppliers to ensure both flexibility and perfect parts. With the help of these suppliers, Regal can profitably produce a product line of 22 boats, ranging from the $14,000 19-foot boat to the $500,000 44-foot Commodore yacht.

"We build boats," says VP Tim Kuck, "but we're really in the 'fun' business. Our competition includes not only 300 other boat, canoe, and yacht manufacturers in our $17 billion industry, but home theaters, the Internet, and all kinds of alternative family entertainment." Fortunately Regal has been paying down debt and increasing market share.

Regal has also joined with scores of other independent boat makers in the American Boat Builders Association. Through economies of scale in procurement, Regal is able to navigate against billion-dollar competitor Brunswick (makers of the Sea Ray and Bayliner brands). The *Global Company Profile* featuring Regal Marine (which opens Chapter 5) provides further background on Regal and its strategy.

### Discussion Questions*

1. State Regal Marine's mission in your own words.
2. Identify the strengths, weaknesses, opportunities, and threats that are relevant to the strategy of Regal Marine.
3. How would you define Regal's strategy?
4. How would each of the 10 operations management decisions apply to operations decision making at Regal Marine?

*You may wish to view the video that accompanies the case before addressing these questions.

*Source:* Pearson video.

## ☆ Hard Rock Cafe's Global Strategy

Video Case

Hard Rock brings the concept of the "experience economy" to its cafe operation. The strategy incorporates a unique "experience" into its operations. This innovation is somewhat akin to mass customization in manufacturing. At Hard Rock, the experience concept is to provide not only a custom meal from the menu but a dining event that includes a unique visual and sound experience not duplicated anywhere else in the world. This strategy is succeeding. Other theme restaurants have come and gone while Hard Rock continues to grow. As Professor C. Markides of the London Business School says, "The trick is not to play the game better than the competition, but to develop and play an altogether different game."* At Hard Rock, the different game is the experience game.

From the opening of its first cafe in London in 1971, during the British rock music explosion, Hard Rock has been serving food and rock music with equal enthusiasm. Hard Rock Cafe has 40 U.S. locations, about a dozen in Europe, and the remainder scattered throughout the world, from Bangkok and Beijing to Beirut. New construction, leases, and investment in remodeling are long term; so a global

*Constantinos Markides, "Strategic Innovation," *MIT Sloan Management Review* 38, no. 3 (Spring 1997): 9.

Chapter 2



strategy means special consideration of political risk, currency risk, and social norms in a context of a brand fit. Although Hard Rock is one of the most recognized brands in the world, this does not mean its cafe is a natural everywhere. Special consideration must be given to the supply chain for the restaurant and its accompanying retail store. About 48% of a typical cafe's sales are from merchandise.

The Hard Rock Cafe business model is well defined, but because of various risk factors and differences in business practices and employment law, Hard Rock elects to franchise about half of its cafes. Social norms and preferences often suggest some tweaking of menus for local taste. For instance, Hard Rock focuses less on hamburgers and beef and more on fish and lobster in its British cafes.

Because 70% of Hard Rock's guests are tourists, recent years have found it expanding to "destination" cities. While this has been a winning strategy for decades, allowing the firm to grow from one London cafe to 162 facilities in 57 countries, it has made Hard Rock susceptible to economic fluctuations that hit the tourist business hardest. So Hard Rock is signing a long-term lease for a new location in Nottingham, England, to join recently opened cafes in Manchester and Birmingham—cities that are not standard tourist destinations. At the same time, menus are being upgraded. Hopefully, repeat business from locals in these cities will smooth demand and make Hard Rock less dependent on tourists.

### Discussion Questions*

1. Identify the strategy changes that have taken place at Hard Rock Cafe since its founding in 1971.
2. As Hard Rock Cafe has changed its strategy, how has its responses to some of the 10 decisions of OM changed?
3. Where does Hard Rock fit in the four international operations strategies outlined in Figure 2.9? Explain your answer.

*You may wish to view the video that accompanies this case before addressing these questions.

## ☆ Outsourcing Offshore at Darden

Video Case

Darden Restaurants, owner of popular brands such as Olive Garden and Red Lobster, serves more than 300 million meals annually in over 1,700 restaurants across the U.S. and Canada. To achieve competitive advantage via its supply chain, Darden must achieve excellence at each step. With purchases from 35 countries, and seafood products with a shelf life as short as 4 days, this is a complex and challenging task.

Those 300 million meals annually mean 40 million pounds of shrimp and huge quantities of tilapia, swordfish, and other fresh purchases. Fresh seafood is typically flown to the U.S. and monitored each step of the way to ensure that 34°F is maintained.

Darden's purchasing agents travel the world to find competitive advantage in the supply chain. Darden personnel from supply chain and development, quality assurance, and environmental relations contribute to developing, evaluating, and checking suppliers. Darden also has seven native-speaking representatives living on other continents to provide continuing support and evaluation of suppliers. All suppliers must abide by Darden's food standards, which typically exceed FDA and other industry standards. Darden expects continuous improvement in durable relationships that increase quality and reduce cost.

Darden's aggressiveness and development of a sophisticated supply chain provide an opportunity for outsourcing. Much food preparation is labor intensive and is often more efficient when handled in bulk. This is particularly true where large volumes may justify capital investment. For instance, Tyson and Iowa Beef prepare meats to Darden's specifications much more economically than can individual restaurants. Similarly, Darden has found that it can outsource both the cutting of salmon to the proper portion size and the cracking/peeling of shrimp more cost-effectively offshore than in U.S. distribution centers or individual restaurants.

### Discussion Questions*

1. What are some outsourcing opportunities in a restaurant?
2. What supply chain issues are unique to a firm sourcing from 35 countries?
3. Examine how other firms or industries develop international supply chains as compared to Darden.
4. Why does Darden outsource harvesting and preparation of much of its seafood?

*You may wish to view the video that accompanies this case study before answering these questions.

• **Additional Case Study:** Visit **www.myomlab.com** or **www.pearsonhighered.com/heizer** for this free case study:
**Outsourcing to Tata:** The Indian outsourcing firm is hired by New Mexico.

a) Draw a network diagram for the project.
b) Mark the critical path and state its length.
c) If the Tesla 6 had to be completed 2 days earlier, would it help to:
   i) Buy preassembled transmissions and drivetrains?
   ii) Install robots to halve engine-building time?
   iii) Speed delivery of special accessories by 3 days?
d) How might resources be borrowed from activities on the non-critical path to speed activities on the critical path? Px

Refer to MyOMLab for these additional homework problems: 3.27–3.33



# CASE STUDIES

## ☆ Southwestern University: (A)*

Southwestern University (SWU), a large state college in Stephenville, Texas, 30 miles southwest of the Dallas/Fort Worth metroplex, enrolls close to 20,000 students. In a typical town–gown relationship, the school is a dominant force in the small city, with more students during fall and spring than permanent residents.

A longtime football powerhouse, SWU is a member of the Big Eleven conference and is usually in the top 20 in college football rankings. To bolster its chances of reaching the elusive and long-desired number-one ranking, in 2006, SWU hired the legendary Phil Flamm as its head coach.

One of Flamm's demands on joining SWU had been a new stadium. With attendance increasing, SWU administrators began to face the issue head-on. After 6 months of study, much political arm wrestling, and some serious financial analysis, Dr. Joel Wisner, president of Southwestern University, had reached a decision to expand the capacity at its on-campus stadium.

Adding thousands of seats, including dozens of luxury skyboxes, would not please everyone. The influential Flamm had argued the need for a first-class stadium, one with built-in dormitory rooms for his players and a palatial office appropriate for the coach of a future NCAA champion team. But the decision was made, and *everyone*, including the coach, would learn to live with it.

The job now was to get construction going immediately after the 2012 season ended. This would allow exactly 270 days until the 2013 season opening game. The contractor, Hill Construction (Bob Hill being an alumnus, of course), signed his contract. Bob Hill looked at the tasks his engineers had outlined and looked President Wisner in the eye. "I guarantee the team will be able to take the field on schedule next year," he said with a sense of confidence. "I sure hope so," replied Wisner. "The contract penalty of $10,000 per day for running late is nothing compared to what Coach Flamm will do to you if our opening game with Penn State is delayed or canceled." Hill, sweating slightly, did not need to respond. In football-crazy Texas, Hill Construction would be *mud* if the 270-day target was missed.

Back in his office, Hill again reviewed the data (see Table 3.6) and noted that optimistic time estimates can be used as crash times. He then gathered his foremen. "Folks, if we're not 75% sure we'll finish this stadium in less than 270 days, I want this project crashed! Give me the cost figures for a target date of 250 days—also for 240 days. I want to be *early*, not just on time!"

### Discussion Questions

1. Develop a network drawing for Hill Construction and determine the critical path. How long is the project expected to take?
2. What is the probability of finishing in 270 days?
3. If it is necessary to crash to 250 or 240 days, how would Hill do so, and at what costs? As noted in the case, assume that optimistic time estimates can be used as crash times.

**TABLE 3.6** Southwestern University Project

| ACTIVITY | DESCRIPTION | PREDECESSOR(S) | TIME ESTIMATES (DAYS) | | | CRASH COST/DAY |
|---|---|---|---|---|---|---|
| | | | OPTIMISTIC | MOST LIKELY | PESSIMISTIC | |
| A | Bonding, insurance, tax structuring | — | 20 | 30 | 40 | $1,500 |
| B | Foundation, concrete footings for boxes | A | 20 | 65 | 80 | 3,500 |
| C | Upgrading skybox stadium seating | A | 50 | 60 | 100 | 4,000 |
| D | Upgrading walkways, stairwells, elevators | C | 30 | 50 | 100 | 1,900 |
| E | Interior wiring, lathes | B | 25 | 30 | 35 | 9,500 |
| F | Inspection approvals | E | 0.1 | 0.1 | 0.1 | 0 |
| G | Plumbing | D, F | 25 | 30 | 35 | 2,500 |
| H | Painting | G | 10 | 20 | 30 | 2,000 |
| I | Hardware/AC/metal workings | H | 20 | 25 | 60 | 2,000 |
| J | Tile/carpet/windows | H | 8 | 10 | 12 | 6,000 |
| K | Inspection | J | 0.1 | 0.1 | 0.1 | 0 |
| L | Final detail work/cleanup | I, K | 20 | 25 | 60 | 4,500 |

*This integrated study runs throughout the text. Other issues facing Southwestern's football expansion include (B) forecasting game attendance (Chapter 4); (C) quality of facilities (Chapter 6); (D) break-even analysis for food services (Supplement 7 Web site); (E) location of the new stadium (Chapter 8 Web site);

Chapter 3

## Project Management at Arnold Palmer Hospital

Video Case

The equivalent of a new kindergarten class is born every day at Orlando's Arnold Palmer Hospital. With more than 13,000 births in the mid-2000s in a hospital that was designed 15 years earlier for a capacity of 6,500 births a year, the newborn intensive care unit was stretched to the limit. Moreover, with continuing strong population growth in central Florida, the hospital was often full. It was clear that new facilities were needed. After much analysis, forecasting, and discussion, the management team decided to build a new 273-bed building across the street from the existing hospital. But the facility had to be built in accordance with the hospital's Guiding Principles and its uniqueness as a health center dedicated to the specialized needs of women and infants. Those Guiding Principles are: *Family-centered focus, a healing environment where privacy and dignity are respected, sanctuary of caring that includes warm, serene surroundings with natural lighting, sincere and dedicated staff providing the highest quality care, and patient-centered flow and function.*

The vice president of business development, Karl Hodges, wanted a hospital that was designed from the inside out by the people who understood the Guiding Principles, who knew most about the current system, and who were going to use the new system, namely, the doctors and nurses. Hodges and his staff spent 13 months discussing expansion needs with this group, as well as with patients and the community, before developing a proposal for the new facility. An administrative team created 35 user groups, which held over 1,000 planning meetings (lasting from 45 minutes to a whole day). They even created a "Supreme Court" to deal with conflicting views on the multifaceted issues facing the new hospital.

Funding and regulatory issues added substantial complexity to this major expansion, and Hodges was very concerned that the project stay on time and within budget. Tom Hyatt, director of facility development, was given the task of onsite manager of the $100 million project, in addition to overseeing ongoing renovations, expansions, and other projects. The activities in the multiyear project for the new building at Arnold Palmer are shown in Table 3.7.

### Discussion Questions*

1. Develop the network for planning and construction of the new hospital at Arnold Palmer.
2. What is the critical path and how long is the project expected to take?
3. Why is the construction of this 11-story building any more complex than construction of an equivalent office building?
4. What percent of the whole project duration was spent in planning that occurred prior to the proposal and reviews? Prior to the actual building construction? Why?

*You may wish to view the video accompanying this case before addressing these questions.



**TABLE 3.7** Expansion Planning and Arnold Palmer Hospital Construction Activities and Times[a]

| ACTIVITY | SCHEDULED TIME | PRECEDENCE ACTIVITY(IES) |
|---|---|---|
| 1. Proposal and review | 1 month | — |
| 2. Establish master schedule | 2 weeks | 1 |
| 3. Architect selection process | 5 weeks | 1 |
| 4. Survey whole campus and its needs | 1 month | 1 |
| 5. Conceptual architect's plans | 6 weeks | 3 |
| 6. Cost estimating | 2 months | 2, 4, 5 |
| 7. Deliver plans to board for consideration/decision | 1 month | 6 |
| 8. Surveys/regulatory review | 6 weeks | 6 |
| 9. Construction manager selection | 9 weeks | 6 |
| 10. State review of need for more hospital beds ("Certificate of Need") | 3.5 months | 7, 8 |
| 11. Design drawings | 4 months | 10 |
| 12. Construction documents | 5 months | 9, 11 |
| 13. Site preparation/demolish existing building | 9 weeks | 11 |
| 14. Construction start/building pad | 2 months | 12, 13 |
| 15. Relocate utilities | 6 weeks | 12 |
| 16. Deep foundations | 2 months | 14 |
| 17. Building structure in place | 9 months | 16 |
| 18. Exterior skin/roofing | 4 months | 17 |
| 19. Interior buildout | 12 months | 17 |
| 20. Building inspections | 5 weeks | 15, 19 |
| 21. Occupancy | 1 month | 20 |

[a]This list of activities is abbreviated for purposes of this case study. For simplification, assume each week = .25 months (i.e., 2 weeks = .5 month, 6 weeks = 1.5 months, etc.).

## Managing Hard Rock's Rockfest

Video Case

At the Hard Rock Cafe, like many organizations, project management is a key planning tool. With Hard Rock's constant growth in hotels and cafes, remodeling of existing cafes, scheduling for Hard Rock Live concert and event venues, and planning the annual Rockfest, managers rely on project management techniques and software to maintain schedule and budget performance.

"Without Microsoft Project," says Hard Rock Vice-President Chris Tomasso, "there is no way to keep so many people on the same page." Tomasso is in charge of the Rockfest event, which is attended by well over 100,000 enthusiastic fans. The challenge is pulling it off within a tight 9-month planning horizon. As the event approaches, Tomasso devotes greater energy to its activities. For the first 3 months, Tomasso updates his Microsoft Project charts monthly. Then at the 6-month mark, he updates his progress weekly. At the 9-month mark, he checks and corrects his schedule twice a week.

Early in the project management process, Tomasso identifies 10 major tasks (called level-2 activities in a work breakdown structure, or WBS):[†] talent booking, ticketing, marketing/PR, online promotion, television, show production, travel, sponsorships, operations, and merchandising. Using a WBS, each of these is further divided into a series of subtasks. Table 3.8 identifies 26 of the major activities and subactivities, their immediate predecessors, and time estimates. Tomasso enters all these into the Microsoft Project software.[‡] Tomasso alters the Microsoft Project document and the time line as the project progresses. "It's okay to change it as long as you keep on track," he states.

The day of the rock concert itself is not the end of the project planning. "It's nothing but surprises. A band not being able to get to the venue because of traffic jams is a surprise, but an 'anticipated' surprise. We had a helicopter on stand-by ready to fly the band in," says Tomasso.

On completion of Rockfest in July, Tomasso and his team have a 3-month reprieve before starting the project planning process again.

[†]The level-1 activity is the Rockfest concert itself.

[‡]There are actually 127 activities used by Tomasso; the list is abbreviated for this case study.



**TABLE 3.8** Some of the Major Activities and Subactivities in the Rockfest Plan

| ACTIVITY | DESCRIPTION | PREDECESSOR(S) | TIME (WEEKS) |
|---|---|---|---|
| A | Finalize site and building contracts | | 7 |
| B | Select local promoter | A | 3 |
| C | Hire production manager | A | 3 |
| D | Design promotional Web site | B | 5 |
| E | Set TV deal | D | 6 |
| F | Hire director | E | 4 |
| G | Plan for TV camera placement | F | 2 |
| H | Target headline entertainers | B | 4 |
| I | Target support entertainers | H | 4 |
| J | Travel accommodations for talent | I | 10 |
| K | Set venue capacity | C | 2 |
| L | Ticketmaster contract | D, K | 3 |
| M | On-site ticketing | L | 8 |
| N | Sound and staging | C | 6 |
| O | Passes and stage credentials | G, R | 7 |
| P | Travel accommodations for staff | B | 20 |
| Q | Hire sponsor coordinator | B | 4 |
| R | Finalize sponsors | Q | 4 |
| S | Define/place signage for sponsors | R, X | 3 |
| T | Hire operations manager | A | 4 |
| U | Develop site plan | T | 6 |
| V | Hire security director | T | 7 |
| W | Set police/fire security plan | V | 4 |
| X | Power, plumbing, AC, toilet services | U | 8 |
| Y | Secure merchandise deals | B | 6 |
| Z | Online merchandise sales | Y | 6 |

Chapter 3

### Discussion Questions[§]

1. Identify the critical path and its activities for Rockfest. How long does the project take?
2. Which activities have a slack time of 8 weeks or more?
3. Identify five major challenges a project manager faces in events such as this one.
4. Why is a work breakdown structure useful in a project such as this? Take the 26 activities and break them into what you think should be level-2, level-3, and level-4 tasks.

[§]You may wish to view the video accompanying this case before addressing these questions.



• **Additional Case Study:** Visit **www.myomlab.com** or **www.pearsonhighered.com/heizer** for this free case study: **Shale Oil Company:** This oil refinery must shut down for maintenance of a major piece of equipment.

Chapter 4



# CASE STUDIES

## ☆ Southwestern University: (B)*

Southwestern University (SWU), a large state college in Stephenville, Texas, enrolls close to 20,000 students. The school is a dominant force in the small city, with more students during fall and spring than permanent residents.

Always a football powerhouse, SWU is usually in the top 20 in college football rankings. Since the legendary Phil Flamm was hired as its head coach in 2006 (in hopes of reaching the elusive number 1 ranking), attendance at the five Saturday home games each year increased. Prior to Flamm's arrival, attendance generally averaged 25,000 to 29,000 per game. Season ticket sales bumped up by 10,000 just with the announcement of the new coach's arrival. Stephenville and SWU were ready to move to the big time!

The immediate issue facing SWU, however, was not NCAA ranking. It was capacity. The existing SWU stadium, built in 1953, has seating for 54,000 fans. The following table indicates attendance at each game for the past 6 years.

One of Flamm's demands upon joining SWU had been a stadium expansion, or possibly even a new stadium. With attendance increasing, SWU administrators began to face the issue head-on. Flamm had wanted dormitories solely for his athletes in the stadium as an additional feature of any expansion.

SWU's president, Dr. Joel Wisner, decided it was time for his vice president of development to forecast when the existing stadium would "max out." The expansion was, in his mind, a given. But Wisner needed to know how long he could wait. He also sought a revenue projection, assuming an average ticket price of $50 in 2013 and a 5% increase each year in future prices.

### Discussion Questions

1. Develop a forecasting model, justifying its selection over other techniques, and project attendance through 2014.
2. What revenues are to be expected in 2013 and 2014?
3. Discuss the school's options.

*This integrated case study runs throughout the text. Other issues facing Southwestern's football stadium include (A) managing the stadium project (Chapter 3); (C) quality of facilities (Chapter 6); (D) break-even analysis of food services (Supplement 7 Web site); (E) locating the new stadium (Chapter 8 Web site); (F) inventory planning of football programs (Chapter 12 Web site); and (G) scheduling of campus security officers/staff for game days (Chapter 13 Web site).



**Southwestern University Football Game Attendance, 2007–2012**

| | 2007 | | 2008 | | 2009 | |
|---|---|---|---|---|---|---|
| GAME | ATTENDEES | OPPONENT | ATTENDEES | OPPONENT | ATTENDEES | OPPONENT |
| 1 | 34,200 | Rice | 36,100 | Miami | 35,900 | USC |
| 2[a] | 39,800 | Texas | 40,200 | Nebraska | 46,500 | Texas Tech |
| 3 | 38,200 | Duke | 39,100 | Ohio State | 43,100 | Alaska |
| 4[b] | 26,900 | Arkansas | 25,300 | Nevada | 27,900 | Arizona |
| 5 | 35,100 | TCU | 36,200 | Boise State | 39,200 | Baylor |

| | 2010 | | 2011 | | 2012 | |
|---|---|---|---|---|---|---|
| GAME | ATTENDEES | OPPONENT | ATTENDEES | OPPONENT | ATTENDEES | OPPONENT |
| 1 | 41,900 | Arkansas | 42,500 | Indiana | 46,900 | LSU |
| 2[a] | 46,100 | Missouri | 48,200 | North Texas | 50,100 | Texas |
| 3 | 43,900 | Florida | 44,200 | Texas A&M | 45,900 | South Florida |
| 4[b] | 30,100 | Central Florida | 33,900 | Southern | 36,300 | Montana |
| 5 | 40,500 | LSU | 47,800 | Oklahoma | 49,900 | Arizona State |

[a]Homecoming games.

[b]During the fourth week of each season, Stephenville hosted a hugely popular southwestern crafts festival. This event brought tens of thousands of tourists to the town, especially on weekends, and had an obvious negative impact on game attendance.

## Forecasting Ticket Revenue for Orlando Magic Basketball Games

Video Case

For its first 2 decades of existence, the NBA's Orlando Magic basketball team set seat prices for its 41-game home schedule the same for each game. If a lower-deck seat sold for $150, that was the price charged, regardless of the opponent, day of the week, or time of the season. If an upper-deck seat sold for $10 in the first game of the year, it likewise sold for $10 for every game.

But when Anthony Perez, director of business strategy, finished his MBA at the University of Florida, he developed a valuable database of ticket sales. Analysis of the data led him to build a forecasting model he hoped would increase ticket revenue. Perez hypothesized that selling a ticket for similar seats should differ based on demand.

Studying individual sales of Magic tickets on the open Stub Hub marketplace during the prior season, Perez determined the additional potential sales revenue the Magic could have made had they charged prices the fans had proven they were willing to pay on Stub Hub. This became his dependent variable, $y$, in a multiple-regression model.

He also found that three variables would help him build the "true market" seat price for every game. With his model, it was possible that the same seat in the arena would have as many as seven different prices created at season onset—sometimes higher than expected on average and sometimes lower.

The major factors he found to be statistically significant in determining how high the demand for a game ticket, and hence, its price, would be were:

- The day of the week ($x_1$)
- A rating of how popular the opponent was ($x_2$)
- The time of the year ($x_3$)

For the day of the week, Perez found that Mondays were the least-favored game days (and he assigned them a value of 1). The rest of the weekdays increased in popularity, up to a Saturday game, which he rated a 6. Sundays and Fridays received 5 ratings, and holidays a 3 (refer to the footnote in Table 4.2).

Fernado Medina

His ratings of opponents, done just before the start of the season, were subjective and range from a low of 0 to a high of 8. A very high-rated team in that particular season may have had one or more superstars on its roster, or have won the NBA finals the prior season, making it a popular fan draw.

Finally, Perez believed that the NBA season could be divided into four periods in popularity:

- Early games (which he assigned 0 scores)
- Games during the Christmas season (assigned a 3)
- Games until the All-Star break (given a 2)
- Games leading into the play-offs (scored with a 3)

**TABLE 4.2** Data for Last Year's Magic Ticket Sales Pricing Model

| TEAM | DATE* | DAY OF WEEK* | TIME OF YEAR | RATING OF OPPONENT | ADDITIONAL SALES POTENTIAL |
|---|---|---|---|---|---|
| Phoenix Suns | November 4 | Wednesday | 0 | 0 | $12,331 |
| Detroit Pistons | November 6 | Friday | 0 | 1 | $29,004 |
| Cleveland Cavaliers | November 11 | Wednesday | 0 | 6 | $109,412 |
| Miami Heat | November 25 | Wednesday | 0 | 3 | $75,783 |
| Houston Rockets | December 23 | Wednesday | 3 | 2 | $42,557 |
| Boston Celtics | January 28 | Thursday | 1 | 4 | $120,212 |
| New Orleans Hornets | February 3 | Monday | 1 | 1 | $20,459 |
| L. A. Lakers | March 7 | Sunday | 2 | 8 | $231,020 |
| San Antonio Spurs | March 17 | Wednesday | 2 | 1 | $28,455 |
| Denver Nuggets | March 23 | Sunday | 2 | 1 | $110,561 |
| NY Knicks | April 9 | Friday | 3 | 0 | $44,971 |
| Philadelphia 76ers | April 14 | Wednesday | 3 | 1 | $30,257 |

*Day of week rated as 1 = Monday, 2 = Tuesday, 3 = Wednesday, 4 = Thursday, 5 = Friday, 6 = Saturday, 5 = Sunday, 3 = holiday.

The first year Perez built his multiple-regression model, the dependent variable $y$, which was a "potential premium revenue score," yielded an $R^2 = .86$ with this equation:

$$y = 14{,}996 + 10{,}801x_1 + 23{,}397x_2 + 10{,}784x_3$$

Table 4.2 illustrates, for brevity in this case study, a sample of 12 games that year (out of the total 41 home game regular season), including the potential extra revenue per game ($y$) to be expected using the variable pricing model.

A leader in NBA variable pricing, the Orlando Magic have learned that regression analysis is indeed a profitable forecasting tool.

### Discussion Questions*

1. Use the data in Table 4.2 to build a regression model with day of the week as the only independent variable.
2. Use the data to build a model with rating of the opponent as the sole independent variable.
3. Using Perez's multiple-regression model, what would be the additional sales potential of a Thursday Miami Heat game played during the Christmas holiday?
4. What additional independent variables might you suggest to include in Perez's model?

*You may wish to view the video that accompanies this case before answering these questions.



## ☆ Forecasting at Hard Rock Cafe

Video Case

With the growth of Hard Rock Cafe—from one pub in London in 1971 to more than 150 restaurants in 53 countries today—came a corporatewide demand for better forecasting. Hard Rock uses long-range forecasting in setting a capacity plan and intermediate-term forecasting for locking in contracts for leather goods (used in jackets) and for such food items as beef, chicken, and pork. Its short-term sales forecasts are conducted each month, by cafe, and then aggregated for a headquarters view.

The heart of the sales forecasting system is the point-of-sale (POS) system, which, in effect, captures transaction data on nearly every person who walks through a cafe's door. The sale of each entrée represents one customer; the entrée sales data are transmitted daily to the Orlando corporate headquarters' database. There, the financial team, headed by Todd Lindsey, begins the forecast process. Lindsey forecasts monthly guest counts, retail sales, banquet sales, and concert sales (if applicable) at each cafe. The general managers of individual cafes tap into the same database to prepare a daily forecast for their sites. A cafe manager pulls up prior years' sales for that day, adding information from the local Chamber of Commerce or Tourist Board on upcoming events such as a major convention, sporting event, or concert in the city where the cafe is located. The daily forecast is further broken into hourly sales, which drives employee scheduling. An hourly forecast of $5,500 in sales translates into 19 workstations, which are further broken down into a specific number of wait staff, hosts, bartenders, and kitchen staff. Computerized scheduling software plugs in people based on their availability. Variances between forecast and actual sales are then examined to see why errors occurred.

Hard Rock doesn't limit its use of forecasting tools to sales. To evaluate managers and set bonuses, a 3-year weighted moving average is applied to cafe sales. If cafe general managers exceed their targets, a bonus is computed. Todd Lindsey, at corporate headquarters, applies weights of 40% to the most recent year's sales, 40% to the year before, and 20% to sales 2 years ago in reaching his moving average.

An even more sophisticated application of statistics is found in Hard Rock's menu planning. Using multiple regression, managers can compute the impact on demand of other menu items if the price of one item is changed. For example, if the price of a cheeseburger increases from $7.99 to $8.99, Hard Rock can predict the effect this will have on sales of chicken sandwiches, pork sandwiches, and salads. Managers do the same analysis on menu placement, with the center section driving higher sales volumes. When an item such as a hamburger is moved off the center to one of the side flaps, the corresponding effect on related items, say french fries, is determined.

HARD ROCK'S MOSCOW CAFE[a]

| MONTH | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Guest count (in thousands) | 21 | 24 | 27 | 32 | 29 | 37 | 43 | 43 | 54 | 66 |
| Advertising (in $ thousand) | 14 | 17 | 25 | 25 | 35 | 35 | 45 | 50 | 60 | 60 |

[a]These figures are used for purposes of this case study.

### Discussion Questions*

1. Describe three different forecasting applications at Hard Rock. Name three other areas in which you think Hard Rock could use forecasting models.
2. What is the role of the POS system in forecasting at Hard Rock?
3. Justify the use of the weighting system used for evaluating managers for annual bonuses.
4. Name several variables besides those mentioned in the case that could be used as good predictors of daily sales in each cafe.
5. At Hard Rock's Moscow restaurant, the manager is trying to evaluate how a new advertising campaign affects guest counts. Using data for the past 10 months (see the table), develop a least squares regression relationship and then forecast the expected guest count when advertising is $65,000.

*You may wish to view the video that accompanies this case before answering these questions.

• **Additional Case Studies:** Visit **www.myomlab.com** or **www.pearsonhighered.com/heizer** for these free case studies:
**North-South Airlines:** Reflects the merger of two airlines and addresses their maintenance costs.
**Digital Cell Phone, Inc.:** Uses regression analysis and seasonality to forecast demand at a cell phone manufacturer.