Chapter 1 Competing with Operations

DISCUSSION QUESTIONS

1. Answering this question demonstrates that processes underlie all of our jobs. What might be surprising is how many students would put their job in the category of "other," suggesting that many jobs do not fall neatly into any one functional area. Perhaps many in the "other" category might best be called "operations" on further reflection. Customers, both internal and external, are part of each process, and the goal is to manage the processes to add the most value for them.

2. Some responsibilities generally supported will include responsibilities to stockholders, to customers, to the environment, to provide safe working conditions, and to pay taxes. More debatable are responsibilities to provide medical care, maternity leave, child care, retirement, and minimum wages and responsibilities to the community other than paying taxes.

3. The problems of unions faced with international competition are still in the news. Does lifting trade barriers expose workers to competition from workers in undeveloped economies? Or does increased opportunity to compete result in more exports and more jobs? With decreased tariffs, are multinationals moving operations elsewhere to escape unions and environmental regulations? Students should recognize that effective operations management is a key to favorable outcomes.

4. Amazon.ca offers a very broad range of products and services at competitive prices, with particular emphasis on "small" easily shipped products like books and DVDs (in contrast, Amazon.com carries a broader range of electronics, clothes, etc.). Its competitive priorities would include fast delivery time, on-time delivery, customization, and low-cost operations. As a business, Amazon.ca is actually assembling a customized basket of goods that must be delivered in a short window of time in a dependable fashion. Low-cost operations are needed to remain competitive. To remain in business, Amazon.ca needs to maintain high volumes of traffic. Operations strategy must focus on stock availability and quick, economical, and dependable delivery.

5. The hospital's mission *to provide attention to patients arriving to the emergency unit in less than 15 minutes and never to turn away patients who need to be hospitalized* implies that the facility must be designed to have extra capacity in both beds and emergency room facilities. It must plan on having extra personnel in the emergency room and also plan on having additional emergency personnel on call to take care of unprecedented heavy loads. In line with the mission statement,

maximum utilization of the facilities (i.e., beds and emergency room personnel) would not be one of the performance objectives for the hospital.

6. Purolator has traditionally competed on the basis of fast, dependable delivery. Before the development of many Internet applications, businesses primarily relied on Purolator to get documents and packages to other businesses overnight. Now, this has started to evolve as sophisticated systems are being installed to assist companies in moving information electronically. As a result, dot-com companies are adding more demands for ground deliveries to specific customer doors, at low cost. To remain competitive with companies such as FedEx, Purolator must continue to develop the door-to-door delivery business, as well as better integrate with its parent, Canada Post. Doing so will require changes to this company's competitive priorities, with greater emphasis on personalized, easy to use service for consumer, in addition to business, deliveries.

7. *Customer benefit bundle* consists of a core product or service and a set of peripheral products or services.
   a. For an automobile insurance policy, the core of the customer benefit bundle includes the coverage provided. The peripherals would include the courtesy and the promptness of the agent and the service personnel in tailoring the policy and the coverage to match the customer's needs, expeditious and hassle-free processing of the claims, ease of access to the agent, convenient payment plans, information of discounts available for driver improvement courses, safety features on the automobiles, etc.
   b. For dental work to get a crown installed, the core includes a crown that fits well and is comfortable. The peripherals would include the courtesy and the pleasant demeanor of the dentist and the dentist's staff in making the process as painless as possible, the ambiance of the dentist's office, the efficiency of the staff in handling special provisions, if any, with the patient's insurance company, etc.
   c. For an airline flight, the core of the customer benefit bundle includes a convenient and quick transportation from one location to another. The peripherals would include the convenience (i.e., distances from parking lots, ground transportation, availability of carts, baggage-handling facilities) of getting around the airport and the terminal for departure and arrival, the courtesy of airline personnel, the reputation of the airline for safety and punctuality, for pleasant and enjoyable on-board service, etc.

8. Technology Management. To identify a market segment, we need to determine answers to questions such as: Which colleges and departments within colleges currently offer the subject? What do instructors desire in the way of textbook support? Is there a trend toward Technology Management courses? Are there other Technology Management texts? Some needs assessment can be accomplished by survey, but response rate may be low. A high-investment strategy would be to ask or hire instructors to review and critique a list of topics, then an outline, then a draft. The core benefit is education about the subject in the form of a textbook. Peripheral services include instructor support in the form of ancillary publications.

9. It is not a good idea for a company to try to excel in all of the competitive priorities because it is generally impossible to do so. Mediocrity is a predictable result.

The choice and the minimum level of one or more of the competitive priorities are set by the order qualifiers for the particular product or service. The choice of the competitive priorities that the company should emphasize is usually governed by the company's strategy driven by its mission statement and the core competencies that the company wants to harness to seek the best competitive advantage.

10. The fast-food restaurant making hamburgers to stock is recognizable as the old-style (pre-2000) McDonald's (this is further discussed in Chapter 9, "Lean Systems"). Service-clerk duties included taking customer orders, filling entire orders from stock, and collecting payment. Short product shelf lives required close finished-goods inventory management. When a trademark sandwich was ordered without the special sauce, customers are asked to "Please step aside." Meanwhile, materials committed to a similar sandwich in stock (but with sauce) may expire and have to be thrown away. Volume flexibility was handled by opening and closing service lanes.

    An alternative operation the new "Made for You" system, deployed in Canada in 2000, which assembles hamburgers to order. When materials are held at the stage just before final assembly, they can be used to complete a wide variety of different sandwiches. Because no finished-goods stock exists, when customers say, "Hold the sauce," there is no delay or waste of materials. Service clerks specialize. One clerk takes orders and payment. Others fill portions of the order. Ideally, capacity is restricted by transactions at the cash register—the bottleneck. At busy times, capacity is increased by adding more staff to assemble orders (in addition to more customer service lanes). This new design for operations has some characteristics of assembly lines and a product focus. Therefore, the impact of new menu items on the production operations must be carefully considered.

11. Grandmother's Chicken.
    a. Kathryn Shoemaker's strategic plans include the following:
        - ❑ Product and service plans: Should the new location offer a new mix?
        - ❑ Competitive priorities: If the product mix and service mix are different at the new location, the thrust could be on low volumes and high quality.
        - ❑ Positioning strategy: Again, depending on the competitive priorities and a new location, the process could be product focused or process focused.
        - ❑ Quality management: Should the goal be reliability or top-of-the-line quality?
        - ❑ Process design: What processes will be needed to make chicken dinners in the addition?
        - ❑ New technologies: Is it time to automate? Is this why there is a problem in service times?
        - ❑ Capacity: How large should the addition or new facility be?
        - ❑ Location: Should we locate in Uniontown or expand in Middlesburg?

    b. Attitudes toward nutrition could change the demand for fried chicken. Competitors such as KFC may be planning to move to Uniontown or even Middlesburg. There may be a trend toward demands for ever-faster service, which cannot be supported by the processes specified in the "unique recipe." The economy of Uniontown might not be supportive of restaurant services. Shoemaker should also consider the availability of key resources, such as servers, whole chickens, spices, and cooking oil. Will Uniontown labor organize?
    c. The possible distinctive competencies at Grandmother's Chicken Restaurant include the "unique recipe," the homey atmosphere, and friendly, prompt service.

12. Russell's Pharmacy probably should not move to Large Island.

a. Russell's strategic plans should include the following:
   - ❑ Product and service plans: Should new services be offered?
   - ❑ Competitive priorities: How could Russell respond to price competition in Large Island?
   - ❑ Quality management: Will accurate prescriptions justify higher prices?
   - ❑ Capacity: How large would the Large Island facility be?
   - ❑ Location: Should Russell move to Large Island?

b. Environmental factors include a declining and aging population in River City and strong price competition in larger markets. An aging population indicates increased demand for prescription drugs. Russell might consider offering in-home services needed by older clients.

c. Russell's distinctive competency is knowing his customers and their health histories and accurate, if occasionally slow or costly, service. If he moves to Large Island, he would not know his customers, who would be less forgiving of slow or costly service.

13. Wild West is similar to many of the provincial and regional telephone companies in Canada that have tried to adapt to new opportunities.
    a. Strategic plans include reducing overhead, reengineering operations, and investing in new technologies to meet competition. The "do-nothing" option of remaining a local monopoly telephone company is not viable because of competition from cable systems and wireless systems that are capable of business and personal communication. If the mission is too broad, Wild West might avoid such unrelated areas as financial services and commercial real-estate. Those businesses do not match their distinctive competencies.
    b. One environmental issue is whether communication, like health care, will be viewed as a "right" and therefore should be free. A significant portion of Wild West's business is governed by regulatory agencies. Customer service in their core business is essential to maintaining a favorable regulatory environment. Some business opportunities, such as manufacturing, are less likely to draw on their competitive strengths. In conctrast, information services provides a value-added opportunity.
    c. Wild West's distinctive competency is in connecting people (or machines) for the purpose of communication. A weakness is high overhead inherited from the era of telecommunication monopoly.

14. *Order qualifiers* that would guide the choice of a bank might include:
    a. Convenient location
    b. Convenient hours of operation
    c. Widespread network of bank's automated teller machines
    d. Phone/PC banking facilities
    e. Access to human tellers and loan officers

15. Although the answers may vary depending on the "niche" elements of the business, the competitive priorities would include on-time delivery, low-cost operations, and customization. The latter competitive priority comes from the capability to assemble unique "baskets" of food items for each customer. There may be a need to coordinate a given basket between two different stores. Capabilities to develop would include information systems and Web page design, efficient scheduling of delivery trucks (which must first collect the items in the basket and then deliver them to the customer's door), and an adequate fleet of trucks with drivers.

16. *Volume flexibility* will be significant to an operations facility that faces large fluctuations in demand in either the short term, such as a day or a week, or the long term, such as several months or years, or both. Specifically, LFKHS would have a greater need for volume flexibility because the demands on the hospital for its services are unpredictable and subject to wide swings over different time periods. The ability to change the daily staffing levels to match the daily workload requirements is a high priority. This ability is derived from volume flexibility.

17. The *core competencies* of Chaparral Steel may be identified as follows:
    a. An ability to transform technology into new products and services
    b. An ability to build on the best existing knowledge and cutting-edge technology
    c. A propensity for constant experimentation, employee education, and change

    The company has harnessed these core competencies in performing well with respect to the competitive priorities it emphasizes in many ways. For example, Chaparral prides itself on providing good prices, fast delivery, and consistent quality. In the steel industry, which has traditionally been labor and energy industry, Chaparral has been more capital intensive and innovative in its choice of technologies to provide its customers with high quality at low cost. This is evidenced by the fact that Chaparral is able to standardize on 50 grade, a higher grade than the normal A36 grade and make it at a lower cost than what it takes most mills to make A36.

CASE: CHAD'S CREATIVE CONCEPTS*

A. Synopsis

This case describes a small furniture manufacturing company that has gained a reputation for creative designs and quality by focusing on producing custom-designed furniture. As its reputation grew it began to sell some standard furniture pieces to retail outlets. The overall growth in sales volume and the diversification into the production of standard furniture pieces have caused a number of issues to arise concerning both the internal manufacturing operations and its relationship to the other functional areas of the company.

B. Purpose

This case is designed to be used as either a "cold-call" case for class discussion or an assigned homework reading. Major points to be brought out in the discussion include:

1. The range of decisions that are made in designing and operating processes
2. The impact that these operating decisions have on the organization as a whole, such as on marketing and finance
3. The impact that decisions made in other functional areas of the organization have on the operating function
4. The need to go beyond the "functional silo" mentality and manage in an integrative manner

* This case was prepared by Dr. Brooke Saladin, Wake Forest University, as a basis for classroom discussion.

C. Analysis

1. What kind of operating decisions must Chad make that are of a short-term nature?
   The students should be able to discuss a number of short-term-oriented decisions that are facing Chad Thomas. These should include:
   a. How to set priorities and schedule different orders. Chad is receiving orders for both custom-made, low-volume furniture pieces and higher-volume, standard pieces. Sales have increased, but the amount of equipment and the production capacity of the company have not. Different orders with different manufacturing requirements are now competing for the same productive capacity.
   b. What orders to accept and how long of a lead time to plan for in promising a delivery date.
   c. What type of work policies should be maintained for his employees. Decisions such as the number and type of employees to employ, the number of hours to work per day, and the amount of overtime to allow are all work policy decisions that impact the available capacity level.
   d. The allocation of resources, equipment, labor, and money to each product line.
   e. The level of inventory to maintain at various stages of the production process for both the custom and standard furniture lines (i.e., raw material, WIP, finished goods). These decisions are linked to the longer-term, total inventory-investment decision.

   Examples of longer-term decisions that face Chad Thomas include:
   a. Amount of money to tie up in the total inventory investment.
   b. The type of equipment to invest in to support efficient production. At what point should more specialized equipment be purchased to manufacture high-volume, standard furniture pieces more efficiently?
   c. What should be the overall workforce level to maintain, and what should be the proper mix of skills and capabilities?
   d. How should the facilities be laid out to accommodate the two different product lines? This gets the students into a whole range of capacity and equipment allocation decisions to include size, type, and configuration.

   In these decisions it is important that the students see the significance of consistency of both strategic and operating decisions across functional areas.
2. How did sales and marketing impact operations when they began to sell standard pieces to retail outlets?

   Standard furniture pieces compete on a different set of competitive priorities than custom-designed pieces. Timely delivery and low costs are much more important than product flexibility. Quality may also be defined differently. The existing facilities are set up to provide flexibility with its job-shop orientation and general-purpose equipment. By introducing a standard line with what should be manufactured on a flow line with some dedicated, more specialized equipment, a conflict has developed, and scheduling problems have resulted.
3. How has the move to producing standard furniture pieces affected the financial structure of the company?

   Inventory investment and operating costs are rising because of the frequent changeovers to accommodate the two different product lines and their scheduling conflicts.

   Profit margins for the standard line are smaller, which puts pressure on manufacturing to increase productivity and reduce costs. There may also be an issue concerning the assignment of overhead costs to each product line.

Finally, the potential need to rent warehouse space to store either WIP or finished-goods inventory cuts into the profit margin for the standard furniture line.

4. What kind of operating decisions are facing Chad Thomas' business today?

   Chad needs to address issues relating to functional areas. Make sure the student is able to identify decisions that relate to more than one functional area. Examples include the following:

Operations Function

1. Monitoring capacity and utilization of facilities
2. Formulating inventory policies—dollars, items, and unit levels
3. Setting scheduling policies and priorities
4. Maintaining product line quality

Marketing

1. Accurately forecasting orders for standard pieces
2. Defining market segments and customer needs
3. Determining what delivery schedules can be promised to customers

Finance

1. Deciding level and type of investment
2. Investigating the effect of capacity investment decisions on ROI

Distribution/Logistics

1. Managing distribution and pipeline inventory
2. Comparing cost and advantages of various transportation modes
3. Meeting delivery lead times
4. What might Chad have done differently to help avoid some of these problems?

Three possible avenues that students may focus on are:

a. Establishing a plan for a more controlled growth. Part of this plan would be the development of the appropriate infrastructure to manage a controlled growth as to what markets to enter, what product lines to develop, and how to develop the proper manufacturing capabilities.
b. Maintaining the company focus on custom-designed furniture only. This alternative presents a whole different set of issues and decisions pertaining to future growth, but it would have avoided the issues of mixed competitive priorities and scheduling conflicts.
c. Realizing the different requirements for each product line and focused the manufacturing facilities into two separate sets of production facilities designed to cater to each product line's specific needs.

D. Recommendations

This case is not designed to be a decision-making case per se but rather a vehicle to get students thinking about the types and the integrated nature of decisions that operations managers face. The students may, indeed, have suggestions as to what should be done to help out Chad Thomas. These recommendations will more than likely follow the alternatives already discussed. As recommendations are provided by students, make sure you push them to understand

the implications of their recommendations with respect to the company as a whole and the other functional areas.

E. Teaching Strategy

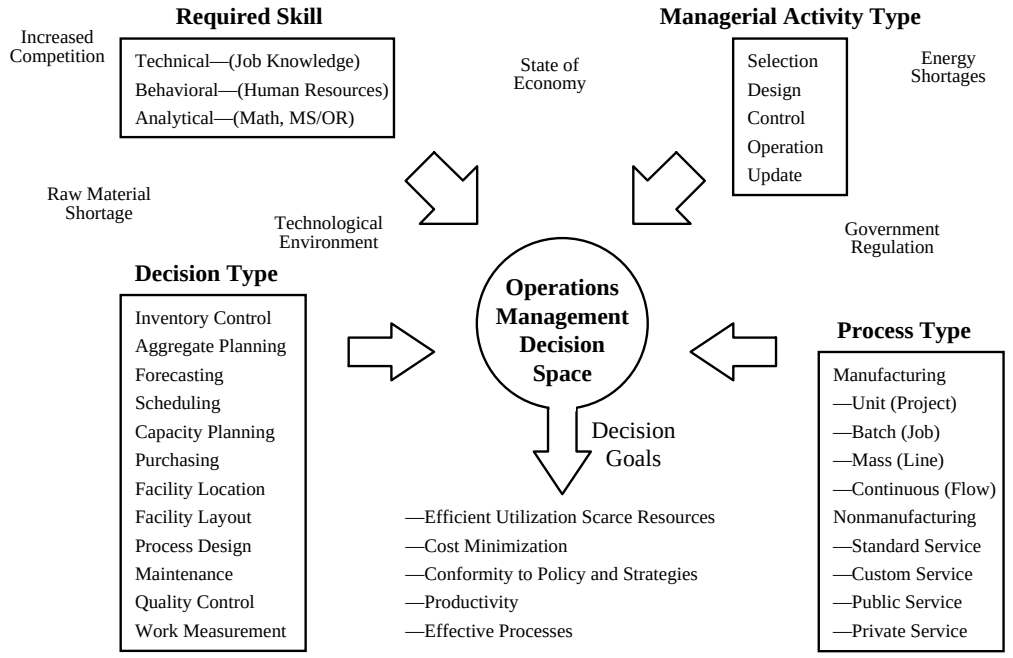
This case can be effectively discussed in 20 to 30 minutes by following the discussion questions provided at the end. The questions are interconnected and somewhat redundant on purpose to reinforce the interrelatedness of decisions made in various functional areas of the company. The intent is to have the students understand the range of decisions that face managers in the operating function and to realize that different types of products competing in different markets place different demands on the operating function. Therefore, productive systems will take on a variety of configurations.

Exhibit TN.1 lays out a sample table to be written on the board displaying important issues in the class discussion. Each column can be used to compare and contrast the differences in the requirements imposed by custom versus standard furniture for each area.

EXHIBIT TN.1 Board Plan

Important Issues	Custom Furniture	Standard Furniture
Marketing		
Quality level and quality control		
Process equipment		
Process flow		
Production scheduling system		
Purchasing		
Type of inventory and inventory control system		
Type of engineering		
Type of labor and supervision needed		
Wage/reward system		
Layout		

EXHIBIT TN.2 A Conceptual Model Depicting the Scope of Operations Management



CASE: BSB, INC.: Pizza Wars Come to Campus *

A. Synopsis

BSB, Inc. presents the situation where launching a pizza service at a food service operation on a college campus turns out to be very successful. As the manager of the food service operation is contemplating an expansion of the service, an announcement by the university that a new food court will soon be opening in the new student union causes some concern. The new food court will contain, for the first time on campus, other food service companies, including a new Pizza Hut kiosk. This causes the manager of BSB, Inc. to reevaluate the competitive environment and her own competitive priorities.

B. Purpose

BSB, Inc. provides the students an opportunity to discuss a number of strategically focused issues to include the following:

1. *Mission statements:* Mission statements describe the fundamental purpose for which the organization exists. The university decided that a focus on food service operations was not part of its primary mission, so it contracted the service out to BSB, Inc. Students should be

* This case was prepared by Dr. Brooke Saladin, Wake Forest University, as a basis for classroom discussion.

able to describe a mission statement for BSB, Inc. This statement will help in discussing the second major focus of this case.

2. *Comparison of competitive priorities:* When the pizza service was launched a year ago, the competitive priorities were to expand the product line to offer pizza that could be delivered quickly at a reasonable price.

   Costs were kept low, and turnaround time was short due to the limited combination of toppings available.

   With the addition of the food court and Pizza Hut on campus, competitive priorities may change. Delivery may still be a differentiating competitive priority, but product flexibility (variety) and volume flexibility (large order sizes) may become more important. BSB, Inc. may not be able to compete on low cost when compared to Pizza Hut's operations.
3. *The impact changing competitive priorities has on operating decisions:* Students need to discuss the potential impact that different competitive priorities have on process design and operating systems. If product flexibility and volume flexibility become more important, then there are implications for:
   a. Equipment needs—conventional oven versus continuous chain drive
   b. Capacity requirements—order size and delivery cycle
   c. Inventory issues—inventory needed to support product flexibility
4. *Product life cycles:* Demand for pizza on campus has leveled off. Why? Has it reached its mature, steady state? What will be the impact of new competition? What can be done to reposition pizza into a growth stage? These are questions that should be asked of students to get them to think about pizza's product life cycle.

C. Analysis

A good analysis of the situation can be performed by going through the five questions at the end of the case. The following is what you can expect from a first-year MBA student given the case as a take-home assignment to read and to respond to the questions at the end.

Question 1: How would you describe the mission of BSB, Inc. on this campus? Does BSB, Inc. enjoy any competitive advantages or distinctive competencies?

BSB's broad mission is to provide a variety of meals on campus at a reasonable price for the students and staff. Pizza delivery enhances the mission by adding variety to the menu. A narrower mission, with respect to pizza, is to provide quick delivery at a reasonable price.

BSB's competitive advantage is close proximity to the customers. Though 43 percent of meals are eaten off campus, 57 percent of meals are still eaten at BSB's facilities. For pizza delivery the close proximity is critical, as it allows for quicker delivery. In addition, delivery can be done at a lower cost because bikes can be used.

BSB's distinctive competencies are the location of facilities and market know-how. Being on campus, BSB can provide delivery service quicker and at a lower cost. In addition, by being on campus, BSB is closer to the customer base, which allows Kershaw, the manager, to be more knowledgeable of her customer's needs. She employs environmental scanning, such as the customer surveys, to keep abreast of her market.

Question 2: Initially, how did Renee Kershaw choose to compete with her pizza operations? What were her competitive priorities?

Initially, Kershaw chose to compete on delivery service and price. She used quick delivery as a key selling point. In addition, without a reasonable price, she could not compete with the off-campus pizza companies. In effect, her order qualifier was price, and her order winner was service.

Her initial competitive priorities for pizza were delivery speed and price. Her on-campus location and limited standard toppings make these priorities possible. Unfortunately, this policy limits the variety of pizzas available. The increased requests for additional topping combinations and the leveling of sales suggest this policy may be hurting BSB.

Question 3: What impact will the new food court have on Kershaw's pizza operations? What competitive priorities might she choose to focus on now?

The new food court introduces new competition that has the same on-campus advantage as BSB. In addition, these companies can also provide products at reasonable prices, but unlike BSB, they have brand names. Her direct competitor, Pizza Hut, can probably provide a similar price. Most likely Pizza Hut will also have limited varieties; however, BSB still maintains its delivery advantage.

The most likely new competitive priorities for BSB will be expanded product variety and longer service hours. The increased requests for alternate toppings show a customer interest in variety, and the expanded hours will enable BSB to offer service when the Pizza Hut is closed or when students are in their dorm rooms.

Question 4: If Kershaw were to change the competitive priorities for the pizza operation, how might this impact her operating processes and capacity decisions?

An increase in product variety will affect both service and cost. Kershaw probably cannot have as many premade pizzas ready to throw into the oven. She will also need to stock additional toppings. If she wants to maintain service, she will need to hire additional workers. She will inevitably have some trade-off between service and price if she adds product flexibility.

Kershaw will also need to add capacity. At present, she is near capacity with her pizza ovens. She may even have to consider a new location, as there seems to be limited space at the grill location. Clearly she will need to determine the viability of pizza service before she takes this step.

Question 5: Can you outline a positioning strategy for Kershaw's operation on campus?

If she chooses to stay in the pizza business, delivery will remain important. Food, most likely pizza, delivered from off campus, is a significant competitor. These competitive companies likely offer many pizza combinations. Therefore, BSB will need to increase variety to remain competitive. The key to this strategy is to maintain quality and to innovate on product offerings. Kershaw must use her proximity to the customer to maintain her competitive advantage in determining their pizza delivery needs.

The other strategy would be total price competition. This would require her to keep the limited menu and to push to keep costs at a bare minimum. Unfortunately this means maintaining the same basic strategy she has now. However, this strategy will most likely lead to an inevitable

decline in market share. This strategy seems best if she decides to exit the market, but it gives her the opportunity to milk the market before exiting.

In reviewing the student responses the instructor should note the following:

1. Students have a tendency to describe missions in terms of goals or objectives. The BSB, Inc. mission might be closer to ". . . be the food server of choice on the campus . . ." with the objectives/goals of providing a variety of meals for students and staff and quick delivery service.

   Much of this mission statement is just semantics, but students should be shown the difference between a mission and how that mission is to be accomplished.

2. The student in question three overlooks the continued importance of convenient, quick delivery. The other food services do not provide this service.

3. Students tend to hedge on question five. They should be pressured into putting together a positioning strategy as opposed to describing alternative choices only.

   There are a number of positions Kershaw may take. What is important, however, is to look for consistency in the strategies that students provide.

D. Teaching Strategy

This case is best assigned as a take-home assignment. Have the students focus on responding to the questions at the end of the case. Tell them to pay particular attention to the last question. The first four questions all lead up to the last one where students should describe a positioning strategy for pizza operations of BSB, Inc. Tell students you want them to settle on a specific strategy they can support.

In class, start with the first question and cycle through to the final question, which describes their positioning strategies. It is helpful to try to get two or three different strategies on the board to compare and contrast approaches. It is important that students see that there are a number of good alternative strategies and not just one best one.

A thorough discussion of this case will take 45 minutes to an hour, especially if alternative strategies are discussed.

EXPERIENTIAL EXERCISES: MIN-YO GARMENT COMPANY

A. Synopsis

The Min-Yo Garment simulation case is intended to be used in conjunction with Chapter 1 of Ritzman/Krajewski/Klassen, *Fundamentals of Operations Management*. The case describes a company that has established a sound reputation in the garment industry but has not established a consistent market strategy. The company is opportunistic, trying to maintain the make-to-stock business on which it had built its reputation while branching out into more lucrative markets. Its manufacturing strategy is to build flexibility in the production process. This was accomplished by investing in a machine that can produce every product the firm manufactures. However, the machine is not a perfect match for any of the markets the firm is pursuing. Profits are declining, and delivery performance is deteriorating. The company must do a better job of aligning its market strategy with its manufacturing strategy.

Because the case is a simulation involving teams, it can be used at the beginning of the introductory course in operations management to emphasize the need for collaboration between the marketing and manufacturing functions. Team members can represent Marketing, Manufacturing, and Accounting/Finance. It could also be used at the end of the course to emphasize the interrelatedness of manufacturing strategy, inventory management, and master scheduling. The case provides the basis for a discussion of contribution margins and how they can be used to identify the markets the manufacturing system can best support.

B. Simulation

The simulation is designed for one class period. The number of weeks the simulation can cover is up to the instructor, depending on the time available. The recommended procedure is to assign the case and make the team assignments the session before the simulation is to be conducted, asking the students to read the case and think about the possible strategies that might be successful. On class day, the introduction to the case and review of exhibits will take about 20 minutes. The first period of play takes the longest time, with each successive period requiring less time. Be prepared to answer many questions about the details of the simulation in the first few periods. The analysis of the results will take another 20 minutes, depending on the depth the instructor wants to discuss. All together, a simulation of 6 weeks should take about 100 minutes, including introduction and analysis. If 100 minutes is too long, consider discussing the analysis in the following period.

If your class is only 75 minutes long, consider making the team assignments the class before the simulation day. Go through the first four points listed following to preserve time for specific questions and game play. The assignment for the teams is to prepare the first week's production schedule before game day.

The following is a suggested outline for the simulation, including six periods of demand/order information.

1. *Review the game instructions in the case*. Assign students to teams if you have not already done so. Get each member of the team to play one of the following roles: Marketing,

Manufacturing, or Accounting/Finance. Teams of three are ideal, but four members are fine. Rather than using teams with five members, consider using teams of two and three.

2. *Distribute the company reports to each team*. The company report contains the changeover times for each product on the garment maker. There are two forms of the report: 1-A and 1-B. Report 1-A has the changeover times for Dragon Shirts high, thereby making Dragon Shirts a bad choice for Min-Yo. Report 1-B has lower changeover times for Dragon Shirts, making them a lucrative choice depending on the order size. The instructor can choose one report or the other to keep the strategies pure from term to term. Alternatively, the instructor can give half of the teams Report 1-A, and the other half Report 1-B, to further dramatize the importance of linking the market strategy with the manufacturing capability right in the class. Half of the class would be better off with the make-to-stock market, the other half with the custom shirts market. The reason for waiting until class day to hand out the reports is to maximize this discovery in class by avoiding interteam discussions on this aspect before class.

3. *Review Exhibit TN.1, Exhibit TN.2, and Exhibit TN.3 with the class*. Make sure everyone is comfortable with the mechanics of working with the Profit & Loss statement and the Production Schedule. Go through the P&L for week 0, emphasizing the production decisions and the calculations for the revenues and costs. Remind the students that they have $440 to add to next week's contribution to profits. Show where the ending inventory or past due for week 0 carries over to the P&L statement for week 1. Show how the production decisions on Exhibit 3 in week 0 transfer to the P&L statement for week 0 and explain the sequencing decisions made in week 0. Note that the total production time required was less than the number of hours of capacity on the garment maker.

4. *Explain the importance of the open order file in Exhibit TN.4.* Any order entered in the file is considered a commitment by the firm and must be honored. The file also has a row for the actual demands for Muscle Shirts. These demands are announced after the teams have committed to a production schedule for the week. Presently there is a past due demand of 200 Thunder Shirts due in week 1. Other points to make at this time include:
   a. Enter only the orders you want to accept in the week they are due. Transfer them to the P&L statement as demands in the proper week.
   b. Cross off the order from the file once it has been shipped.
   c. Excess demand for Muscle Shirts are merely lost sales with no penalties. No backorder possibilities exist. However, extended poor performance will force the licenser to find another manufacturer to work with.
   d. Because each order for Dragon Shirts is unique, Min-Yo cannot use inventory from overproducing one order to satisfy the demand for another order. However, an order for Dragon shirts can be started one week and finished the following week to take advantage of changeover times and excess capacity in a particular week.
   e. Orders for Dragon Shirts cannot be shipped until all shirts have been produced. However, partial shipments are possible for Muscle Shirts (that is, satisfy only a portion of the total demand in a week with the excess demand being lost sales) and Thunder Shirts (penalty charge just for the past due portion of the shipment).
   f. If Min-Yo ever refuses to accept an order for Thunder Shirts, it no longer is in the Thunder Shirt business. Prior commitments must still be honored, however.

5. *Start the simulation*. The following is a week-by-week suggestion for the demands and order sizes for Thunder Shirts and Dragon Shirts. Dragon Shirt opportunities will be announced using an "order number" to emphasize that each order is different. Min-Yo does not have to accept any of these orders, but decisions to accept or reject them must be made. Because order opportunities are known at the start of a week, some orders for Dragon Shirts will manifest themselves in the same week they are due.
   a. Week 1.
      (1) New orders for Dragon Shirts

Order 1	100	Due week 1
Order 2	200	Due week 1
Order 3	150	Due week 2
Order 4	75	Due week 2

      (2) New orders for Thunder Shirts

	200	Due week 2
	200	Due week 3

      (3) Agree on the orders to accept and complete the production schedule.
      (4) Enter the production decisions on the P&L statement for week 1. (Teams are now committed.)
      (5) Announce the actual demand for Muscle Shirts in week 1: 700 shirts.
      (6) Complete the P&L for week 1.

Note: Steps 3, 4, and 6 are the same for each period and will not be repeated. However, the instructor must be sure that the teams have committed to production decisions before announcing the actual demands for Muscle Shirts.

   b. Week 2.
      (1) New orders for Dragon Shirts

Order 5	200	Due week 2
Order 6	180	Due week 2
Order 7	300	Due week 3

      (2) No new orders for Thunder Shirts
      (5) Announce actual demand for Muscle Shirts in week 2: 600 shirts.

   c. Week 3.
      (1) New orders for Dragon Shirts

Order 8	50	Due week 3
Order 9	125	Due week 3
Order 10	150	Due week 4
Order 11	100	Due week 4

      (2) New orders for Thunder Shirts

	100	Due week 4
	300	Due week 5

(5) Announce actual demand for Muscle Shirts in week 3: 800 shirts.

d. Week 4.

(1) New orders for Dragon Shirts

Order 12	75	Due week 4
Order 13	220	Due week 4
Order 14	150	Due week 5

(2) New Order for Thunder Shirts

Expedite Order	200	Due week 5

This order is over and above the regular order for week 5. If it is rejected, Min-Yo is out of the Thunder Shirt business.

(5) Announce the actual demand for Muscle Shirts: 1000 shirts.

e. Week 5.

(1) New orders for Dragon Shirts

Order 15	200	Due week 5
Order 16	100	Due week 5
Order 17	80	Due week 6

(2) New orders for Thunder Shirts

250	Due week 6
150	Due week 7

(5) Announce actual demand for Muscle Shirts: 1100 shirts.

f. Week 6

(1) New orders for Dragon Shirts

Order 18	100	Due week 6
Order 19	150	Due week 6
Order 20	130	Due week 6

(2) No new orders for Thunder Shirts

(5) Announce actual demands for Muscle Shirts: 1200 shirts.

End of Simulation

C. Discussion and Analysis of Results

The discussion and analysis could be as brief as merely finding the team with the greatest total contribution to profits and asking them to characterize their strategy in light of the material in Chapter 2 or as involved as using the experience as a motivator to learn about the fit of manufacturing processes to market strategies. This latter use of the simulation can be realized by introducing the concept of contribution margin and how the process (in this case, represented by the changeover times) plays a role in identifying the most lucrative markets for the firm. This discussion could also be a lead in for Chapter 3, which discusses process design and process choice. The following guidelines assume the more elaborate discussion is preferred.

1. Find the best team, as represented by the greatest total contribution to profits. If both reports 1-A and 1-B were used, find the best team in each category. Ask the team(s) to share their strategy for success. Record the essence of the strategy on the board for later recall.

2. What are the marginal contributions to profit of the three product categories produced by Min-Yo?

   Students will probably respond with the contributions per *unit*:

   Contribution per unit = Price – material

   Muscle Shirts = \$6 – \$4 = \$2

   Thunder Shirts = \$7 – \$4 = \$3

   Dragon Shirts = \$8 – \$4 = \$4

   We have not included labor because it is a sunk cost in our simulation.

3. Why not just produce Dragon Shirts, as they have the largest contributions of the product line?

   The answer is that the changeover times are large. Introduce the concept of contribution per *hour*.

   Contribution per hour = (Contribution per unit * *Q*/ (Changeover time + Production time for *Q* units)

   This measure depends on the order size that is produced. For example, the contributions per hour for each product with an order quantity of 100 shirts and the changeover times in Report 1-A are:

   Muscle Shirts = \$2(100)/(8 + 100(0.10)) = \$11.11

   Thunder Shirts = \$3(100)/(10 + 100(0.10)) = \$15.00

   Dragon Shirts = \$4(100)/(25 + 100(0.10)) = \$11.43

   The implication is that you had better look at the size of the orders in a market before determining if it will be lucrative. Note that the measure assumes that you are able to use all of your capacity and you have no other attendant costs such as past due penalties or inventory holding costs. If these conditions are not met, the contribution per hour overstates the contribution the firm will actually receive.

4. What business should Min-Yo be in?

   It is informative to look at Figure 1, which is a plot of the contribution per hour for various order sizes assuming the changeover time for Dragon Shirts is 25 hours. It is clear that if order sizes are greater than 500, Dragon Shirts are the most lucrative. However, in the market for Dragon Shirts, the average order size is only 142 shirts (the average of orders offered in the simulation). The contribution per hour for Dragon Shirts at order sizes of 142 units is only \$14.49. Contrast this with the situation for Thunder Shirts and Muscle Shirts. Thunder Shirts average 200 units per order and enjoy a contribution per hour of \$20.00. Muscle Shirts, if produced at an average of 800 shirts per week, have a contribution per hour of \$18.18. The market strategy that is in tune with manufacturing capabilities is to pursue the licensed brands and the customer-owned brands.

   If the changeover times in Report 1-B are used, the Dragon Shirt market looks much better. Figure 2 shows the contributions per hour for various order sizes, assuming the changeover time for Dragon Shirts is 15 hours. At an average order size of 142 units, the

contribution per hour for Dragon Shirts is now $19.45, which is better than the $18.18 generated by Muscle Shirts. With this amount of flexibility, it is best to be in the Dragon Shirt business.

This graphical analysis can also help to develop heuristics for selecting which Dragon Shirt orders to accept. For example, in Figure 1, select orders of 300 or more shirts and reject the others. In Figure 2, the orders would have to be much less than 100 before they are no longer lucrative.

5. What improvements would you suggest for the garment maker?
   Although the answer might depend on the changeover times the instructor used for the simulation, responses would include:
   a. Shorter changeovers
   b. Faster production rates
   c. Continuous improvement programs
   d. Major investments in machines—separate high- from low-volume businesses.

6. Points to remember:
   a. Winning strategies require close collaboration between marketing and manufacturing. Deciding which markets to serve requires an understanding of manufacturing capabilities.
   b. Manufacturing strategy is involved in developing the capability to best serve the markets the company chooses to serve.
   c. Manufacturing has the ability to change the size or timing of production runs, but must recognize capacity limits.

D. Frequently Asked Questions

1. Must I incur a setup charge each time I produce a Dragon Shirt order?
   ANS: Yes. Each Dragon Shirt order is unique. Overproduction for one order cannot be used to satisfy the demand for another order.

2. Can future orders for Thunder Shirts be combined into one production run?
   ANS: Yes. Thunder Shirts can be produced to stock.

3. Are holding costs the same for every product?
   ANS: Yes. The cost is $0.10 per shirt per week. For example, you can produce Dragon Shirts in advance of the delivery date, but you must hold them in inventory until the due date.

4. Can I use some hours at the end of a week to begin a setup that will be completed at the start of the next week?
   ANS: Yes.

5. Can I partially ship a Dragon Shirt order?
   ANS: No. Dragon Shirts must be shipped in their entirety. However, this restriction does not hold for Muscle or Thunder Shirts.

6. Can I ship Dragon or Thunder Shirts before their due date?
   ANS: No. Customers do not want their order early.

REPORT 1-A

1. Changeover Improvement Study

The Engineering Department reports that the efforts to reduce the changeover times of the garment maker machine have produced the following results:

Product	Changeover Time
Muscle Shirts	8 hours
Thunder Shirts	10 hours
Dragon Shirts	25 hours

The Engineering Department continues to work on reducing changeover times, but no further improvements are expected in the near future.

2. Inventory Levels

The Materials Management Department indicates that at present there are 600 Muscle Shirts in stock. The finished goods inventories of all other products have been depleted. The Materials Management Department respectfully reminds the Production Department that there is an order for 200 Thunder Shirts that is past due.

3. Notice of Termination

The Min-Yo Garment Company has been purchased by a large international textile company and will cease all operations at the end of **week 6**. All employees will be reassigned to other duties in the firm. In the meantime, everyone is expected to do whatever they can to maximize the contribution to profits until then. We regret any inconvenience this may impose.

REPORT 1-B

1. Changeover Improvement Study

The Engineering Department reports that the efforts to reduce the changeover times of the garment maker machine have produced the following results:

Product	Changeover Time
Muscle Shirts	8 hours
Thunder Shirts	10 hours
Dragon Shirts	15 hours

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The Materials Management Department indicates that at present there are 600 Muscle Shirts in stock. The finished goods inventories of all other products have been depleted. The Materials Management Department respectfully reminds the Production Department that there is an order for 200 Thunder Shirts that is past due.

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FIGURE 1
Contributions Per Hour When Dragon Shirt Changeovers are 25 Hours

Figure 1

	Muscle Shirt	Thunder Shirt	Dragon Shirt
100	11.11	15.00	11.42
200	14.29	20.00	17.78
300	15.79	22.50	21.82
500	17.24	25.00	26.67
800	18.18	26.67	30.48
1,000	18.52	27.27	32.00

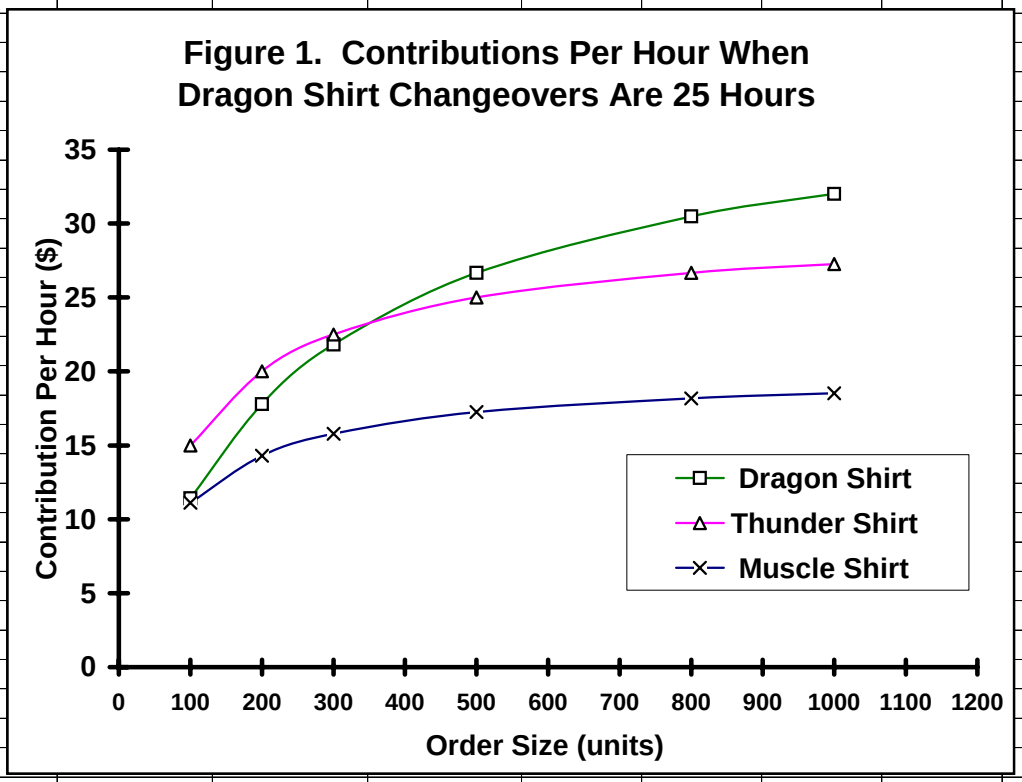

FIGURE 1 *continued*

Contributions Per Hour When Dragon Shirt Changeovers are 25 Hours

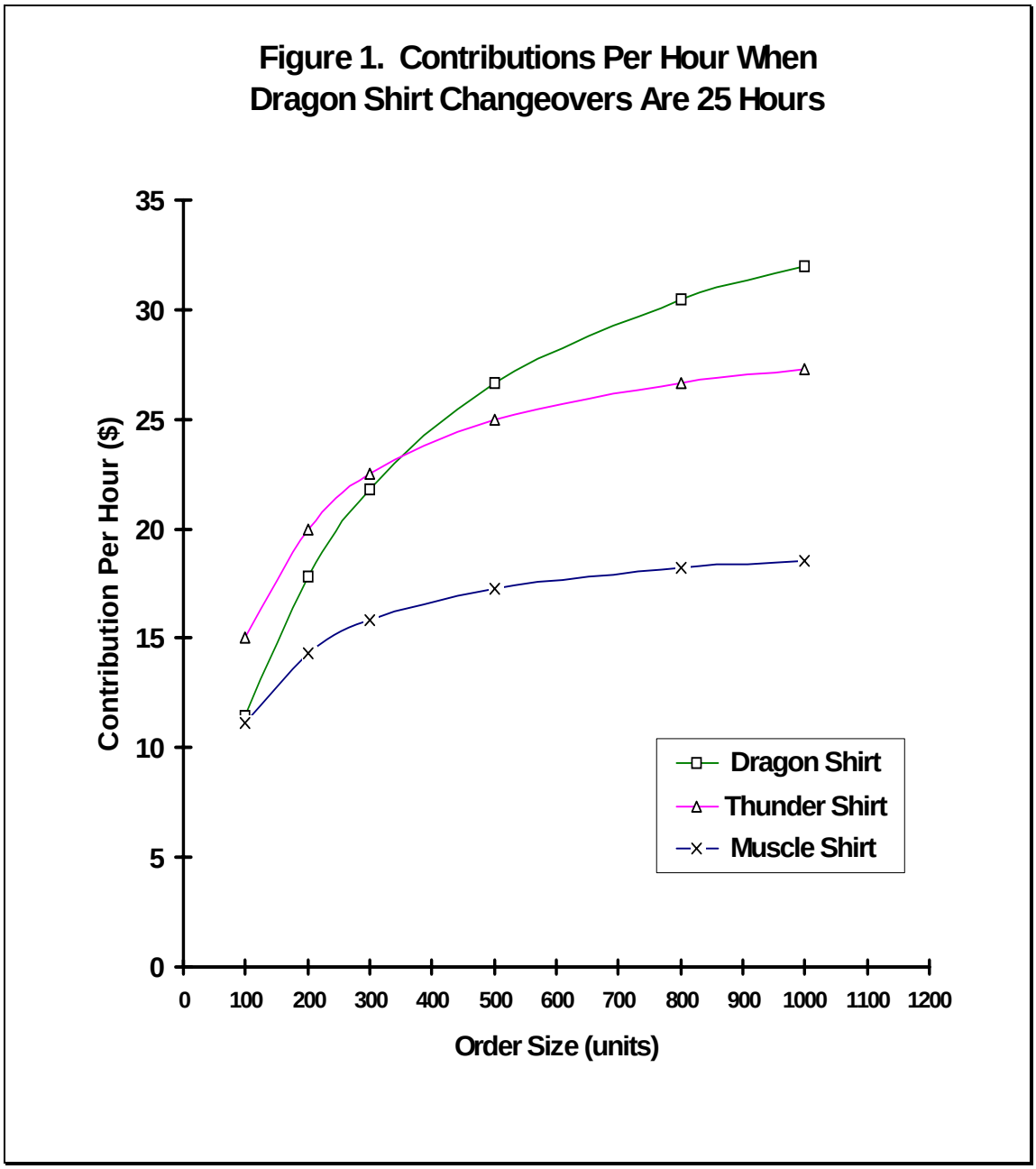

FIGURE 2
Contributions Per Hour When Dragon Shirt Changeovers are 15 Hours

Figure 2

	Muscle Shirt	Thunder Shirt	Dragon Shirt
100	11.11	15.00	16.00
200	14.29	20.00	22.86
300	15.79	22.50	26.67
500	17.24	25.00	30.77
800	18.18	26.67	33.68
1,000	18.52	27.27	34.78

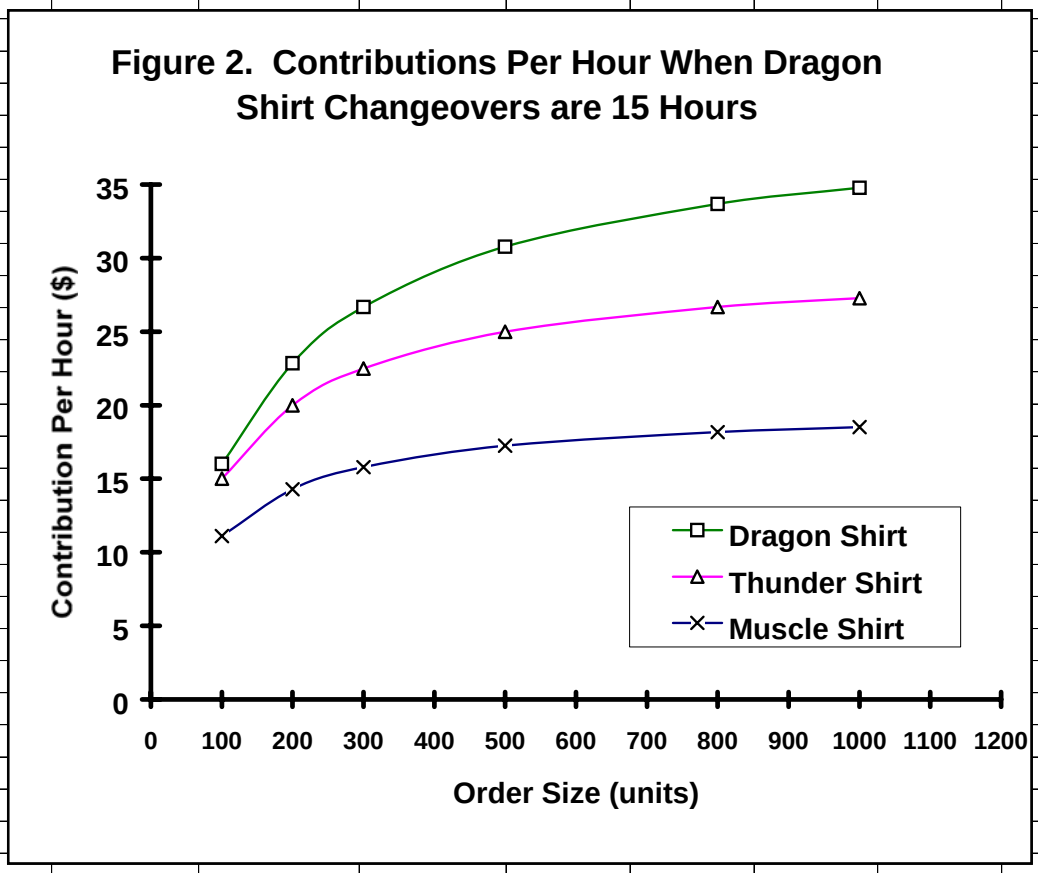

FIGURE 2 *continued*

Contributions Per Hour When Dragon Shirt Changeovers are 15 Hours

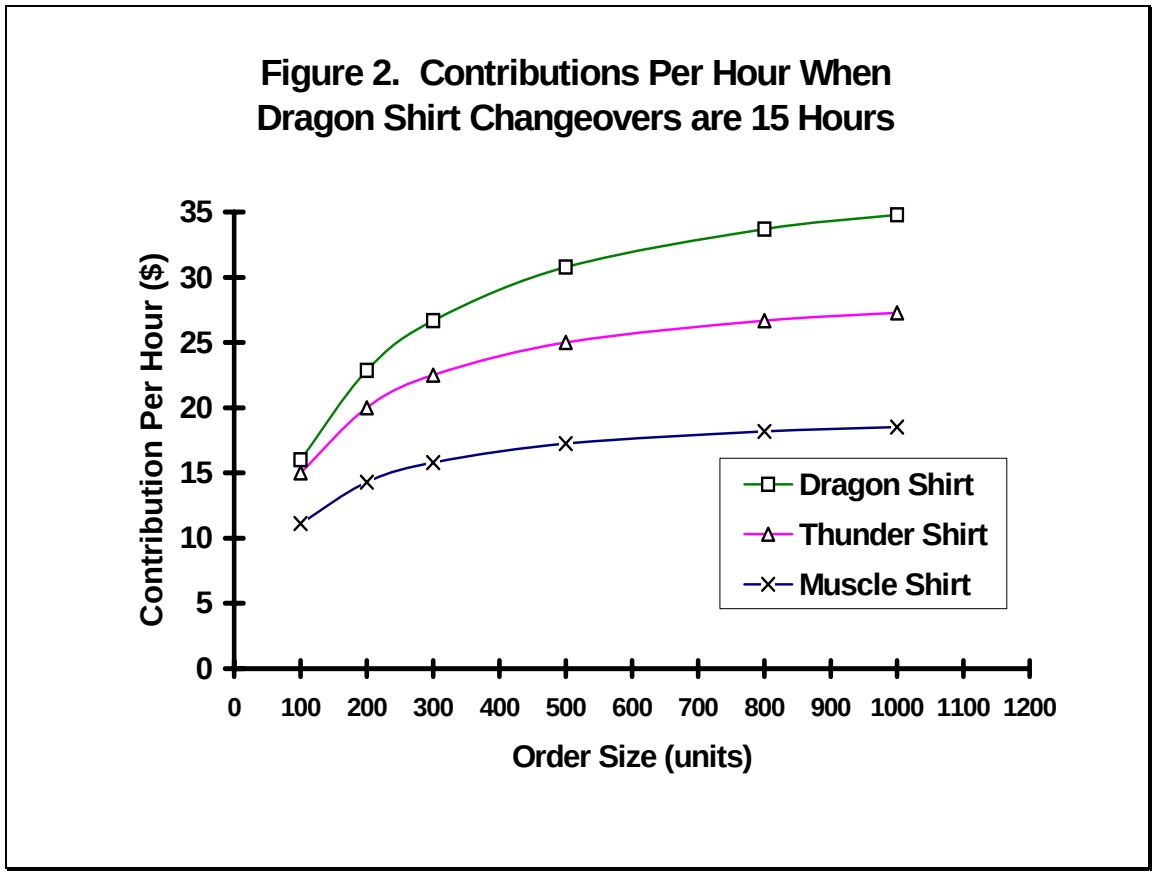

EXHIBIT TN.1 P&L Statement (week 0) for Min-Yo Garment Company

1 Product	2 Price	3 Beg. Inv.	4 Production	5 Available[2]	6 Demand	7 Sales[3]	8 End. Inv.[1] (Past Due)	9 Inv./Past Due Costs[4]
Muscle	$6	550	800	1,350	750	$ 4,500	600	$ 60
Thunder	$7	—	200	200	400	1,400	(200)	200
Dragon	$8	—	—	—	—	—	—	—
Totals			1,000			$ 5,900		$260

Sales (total of column 7) =			$5,900
Costs:			
Labor: 10 @ 120		$1,200	
Materials: (total of column 4 × $4)	4,000		
Inv./Past Due: (total of column 9)	260		
TOTAL COST			$5,460
Contribution to profit			$ 440 ($5,900 – $5,460)
Cumulative contribution			$ 440 (add to next period's contribution)

Notes:
1. Past due refers to the quantity of shirts not shipped as promised.
2. Available = column 3 + column 4.
3. Sales = column 6 × column 2 when demand < available; column 5 × column 2, otherwise.
4. Inventory cost = 0.10 times number of shirts in ending inventory. Past due cost equals number of shirts not shipped when promised times the penalty ($1 for Thunder Shirts; $2 for the Dragon Shirts).

EXHIBIT TN. 2 Partial P&L Statement for Min-Yo Garment Company

1 Product	2 Price	3 Beg. Inv.	4 Production	5 Available[3]	6 Demand	7 Sales[4]	8 End. Inv.[1] (Past Due)	9 Inv./Past Due Costs[2]
Muscle	$6							
Thunder	$7							
Dragon	$8							

Sales (total of column 7)=

Costs:

Labor: 10 @ 120 $1,200

Materials: (total of column 4 × $4) =

Inv./Past Due: (total of column 9) = _____

TOTAL COST

Contribution to profit =

Cumulative contribution = (add to next period's contribution)

1. Past due refers to the quantity of shirts not shipped as promised. Column 8 becomes column 3 of next period's P&L statement.
2. Inventory cost = $0.10 times the number of units in ending inventory. Past due costs equals number of units not shipped when promised times the penalty ($1 for Thunder Shirts, $2 for the Dragon Shirts).
3. Available = column 3 + column 4.
4. Sales equals column 6 × column 2 when demand is less than available inventory; column 5 × column 2 otherwise.

EXHIBIT TN.3 Production Schedule

Week / Product	0	1	2	3	4	5	6	7	8	9	10
Muscle	800										
Muscle Hours	88										
Thunder	200 ②										
Thunder Hours	30										
Dragon											
Dragon Hours											
Total hours scheduled	118										

EXHIBIT TN.4 Open Order File (Record of Commitments)

Date Order Is Due

Week / Product	1	2	3	4	5	6
Muscle Demands						
Thunder Orders	200*					
Dragon Orders						

* Unsatisfied commitment from week 0

EXHIBIT TN.4 (Cont.) Open Order File (Record of Commitments)

Date Order Is Due

Week / Product	7	8	9	10	11	12
Muscle Demands						
Thunder Orders						
Dragon Orders						