LECTURE 4 PROBLEM

answers in (a) and (b)? Construct a table to examine the month in which the cash balance disappears as a function of the monthly increment in sales.

d. Suppose the monthly increment in sales is 300—instead of 500, as in the base case. How does this change affect the answers in (a) and (b)? Construct a graph showing the profitability percentage in (b) as a function of the monthly increment in sales.

e. Starting with the base case, suppose that unit cost runs higher than originally thought. What level of unit cost will lead the firm to run out of cash by the end of March?

2. Refer to the Medical Supplies for Banjul case. Design a spreadsheet that will enable you to request the required funds from your team's finance officer, order supplies from the home office, and ensure dissemination of appropriate quantities to each village. Your final order to the home office should specify the number of packages required of each item.

a. The population figures will show that there are 3,000 children, 2,500 teenagers, 500 seniors, and 9,000 other adults in the population. If there were no stock on hand, what amount would be required for ordering supplies?

b. Using the parameters in (a), construct a graph showing how the amount required for the order would vary if the unit cost of a package of bandages rose by $0.25, $0.50, and so on, up to $3.00 per package.

c. Following up on (a), a check on stock shows an inventory of 124 packages of A-bandages, 16 packages of B-bandages, 82 packages of C-bandages, 72 rolls of tape, and 4 hearing aids. What amount will be required for ordering supplies?

3. Refer to the Reid's Raisins case. Design a spreadsheet that will allow the firm to determine how many grapes to buy under contract and how much to charge for the raisins they sell.

a. What is the profit projected for the base-case conditions, assuming a market price of $0.30 for the open-market grape price?

b. What is the breakeven value of the open-market grape price?

c. Construct a table showing how profit varies as a function of the price set for raisins. Cover a range from $1.80 to $2.80 in steps of $0.10.

d. Construct a tornado chart for the analysis in (a). List the relevant parameters in descending order of their impact on annual profit.

4. Refer to the Big Rig Rental Company case. Design a spreadsheet that will provide the owner with the five-year economic analysis requested.

a. What is the Net Present Value of the firm's cash flows over the five-year period?

b. Construct a tornado chart for the analysis in (a). List the relevant parameters in descending order of their impact on the Net Present Value.

c. What is the internal rate of return for the cash flows in (a)?

d. Construct a table to show how profit varies with the base rental rate, which is currently $1,000 per month.

5. Refer to the Flexible Insurance Coverage case. From the corresponding exercise in Chapter 5, review the design of a spreadsheet that will allow an individual employee to compare the annual expenses for each plan and thereby choose the cheapest alternative.

a. Consider the case of a single employee with estimated annual expenses of $400. What plan is the cheapest? What is the total annual cost associated with this plan?

b. For the analysis in (a), construct a table to show the best plan and the associated cost for annual expenses ranging from $100 to $1,200 in steps of $100.

c. Consider the case of a married employee with estimated annual expenses of $1,000 and an equal amount for the spouse. What plan is the cheapest? What is the total annual cost associated with this plan?

d. For the analysis in (c), construct a table to show the best plan and the associated cost for annual expenses ranging from $100 to $1,500 in steps of $100 for the employee, assuming that the employee's expenses and the spouse's expenses are the same.

e. For the analysis in (d), find the level of expenses at which the cost is the same under Plan 1 and Plan 2.

6. Refer to the Snoey Software Company case. Design a spreadsheet for the desired five-year economic analysis mentioned in the case.

a. Consider a recommendation that the prices for the Educational, Large-Scale, and Professional versions should be $75, $275, and $475, respectively. What annual profit would these prices achieve?

b. Construct three separate sensitivity analyses, starting from the base case in (a). For each analysis, vary the price above and below the base case, and find the best price for the version being analyzed. When these prices are used in combination, what annual profit is achieved?

c. For the pricing in (a), consider the set of prices that the five segments would be willing to pay for the three products. If each of these prices could vary by 15 percent, which one would have the greatest dollar impact on the annual profit?

7. Refer to the Cox Cable and Wire Company case. In the role of Meredith, design a spreadsheet that will evaluate the profitability of any particular production and delivery schedule.

a. Find a machine schedule and a corresponding inventory and shipment schedule that meets demand. What is the profitability of this schedule?

b. Suppose that material costs for both products were to rise by a specific percentage. At what percentage increase would profitability drop to zero?

c. Construct a table showing how profitability varies with changes in the selling price of Plastic reels. Repeat for Teflon reels. Which price has a greater effect on profitability?

8. Refer to the BMW Company case. From the corresponding exercise in Chapter 5, review the design of a spreadsheet that will allow BMW management to estimate the cost of disposal a decade into the future (i.e., in 1999) as a percentage of net income.

The deductible amount is paid by the employee. The first figure applies to an individual; the second applies to two-person or family coverage. In the case of Option 1, for example, this means that the insurance coverage takes effect once an individual has paid for $1,500 worth of expenses. (This limit holds for any individual under two-person or family coverage, as well as for an individual with one-person coverage.) In the case of two-person or family coverage, the insurance also takes effect once the household has incurred $2,500 worth of expenses.

The co-insurance is the percentage of expenses that must be paid by the employee when the insurance coverage takes effect. In the case of Option 2, for example, this means that the insurance covers 80 percent of all expenses after the deductible amount has been reached.

The Annual Premium is the cost of the insurance to the employee.

SNOEY SOFTWARE COMPANY

Snoey Software Company is developing a new piece of software that can be tailored to various market segments. At this stage, the developers envision three versions of the software: an Educational version, a Large-Scale version, and a High-Speed version. Each is built around the same basic design, but a number of data-handling and input/output procedures are different in the different versions. By creating these versions, Snoey hopes to extract more value from the marketplace than it could obtain with just one version.

Currently, the developers are close to completing the Educational version, but they have done little more than outline the other two versions. The estimated R&D expenditures required to finish those tasks are $100,000 for the Large-Scale version, and $150,000 for the High-Speed version. The actual variable costs are estimated to be $10 for the Educational version, $20 for the Large-Scale version, and $36 for the High-Speed version.

The marketing director at Snoey Software has identified five market segments that would respond differently to the new software: (1) university students, (2) academic and government laboratories, (3) consultants, (4) small companies, and (5) large companies. The potential sales in each of these markets, together with the cost of advertising in each market, are as follows.

Segment	Market Size	Marketing Costs
Students	400,000	$350,000
Laboratories	1,200	75,000
Consultants	12,000	150,000
Small companies	24,000	200,000
Large companies	6,000	100,000

In a series of surveys and focus groups, the marketing staff has tested the interest of each market segment in the three different versions of the software. The results of the tests have been summarized in a table of values that represent the prices each segment would be willing to pay for each of the versions. This information is shown in the following table.

Segment	Educational	Large-Scale	High-Speed
Students	$25	$40	$75
Laboratories	125	300	1,000
Consultants	100	500	750
Small companies	75	250	500
Large companies	150	1,000	2,500

In order to develop a price structure for the software, the marketing director uses the following logic. For each segment and for each version, the potential customer will calculate the difference between the price and the value. The highest difference will dictate what the customer will purchase. On that basis, it will be possible to estimate the sales volumes of each version in each segment and compute the resulting profits.

You have been hired to build a model that will compute the sales of each version in each market segment and then calculate the resulting profit for Snoey Software. Given the approach they have taken thus far, the company is committed to the Educational version, but it could halt development activities on either or both of the other versions. The question on everybody's mind is: which versions should be brought to market?

COX CABLE AND WIRE COMPANY

Meredith Ceh breathed a sigh of relief. Finally, all the necessary figures seemed to be correctly in place, and her spreadsheet looked complete. She was confident that she could analyze the situation that John Cox had described, but she wondered if there were other concerns she should be addressing in her response.

Mr. Cox, president of Cox Cable and Wire Company, and grandson of the company's founder, had asked Meredith to come up with plans to support the preliminary contract he had worked out with Midwest Telephone Company. The contract called for delivery of 340 reels of cable during the summer. He was leaving the next day to negotiate

a final contract with Midwest and wanted to be sure he understood all of the implications.

According to Mr. Cox, he had been looking for a chance to become a supplier to a large company like Midwest, and this seemed to be the right opportunity. Demand from some of Cox Cable's traditional customers had slackened, and as a result there was excess capacity during the summer. Nevertheless, he wanted to be sure that, from the start, his dealings with Midwest would be profitable, and he had told Meredith that he was looking for cash inflows to exceed cash outflows by at least 25 percent. He also wanted her to confirm that there was sufficient capacity to meet the terms of the contract. He had quickly mentioned a number of other items, but those were secondary to profitability and capacity.

Background

The Cox Cable and Wire Company sold a variety of products for the telecommunications industry. At its Indianapolis plant, the company purchased uncoated wire in standard gauges, assembled it into multiwire cables, and then applied various coatings according to customer specification. The plant essentially made products in two basic families—standard plastic and high-quality Teflon. The two coatings came in a variety of colors, but these were changed easily by introducing different dyes into the basic coating liquid.

The production facilities at Indianapolis consisted of two independent process trains (semiautomated production lines), referred to as the General and National trains, after the companies that manufactured them. Both the plastic-coated and the Teflon-coated cable could be produced on either process train; however, Teflon coating was a faster process due to curing requirements. Planning at Cox Cable was usually done on an annual and then a quarterly basis. The labor force was determined by analyzing forecast demand for the coming year, although revisions were possible as the year developed. Then, on a quarterly basis, more specific machine schedules were made up. Each quarter the process trains were usually shut down for planned maintenance, but the maintenance schedules were determined at the last minute, after production plans were in place, and they were often postponed when the schedule was tight.

As a result of recent expansions, there was not much storage space in the plant. Cable could temporarily be stored in the shipping area for the purposes of loading trucks, but there was no space for cable to be stored for future deliveries. Additional inventory space was available at a nearby public warehouse.

Meredith had become familiar with all of this information during her first week as a summer intern. At the end of the week, she had met with Mr. Cox and he had outlined the Midwest contract negotiation.

The Contract

The preliminary contract was straightforward. Midwest had asked for the delivery quantities outlined in Table 1. Prices had also been agreed on, although Mr. Cox had said he wouldn't be surprised to find Midwest seeking to raise the Teflon delivery requirements during the final negotiation.

Meredith had gone first to the production manager, Jeff Knight, for information about capacity. Jeff had provided her with data on production times (Table 2), which he said were pretty reliable, given the company's extensive experience with the two process trains. He also gave her the existing production commitments for the summer months, showing the available capacity given in Table 3. Not all of these figures were fixed, he said. Apparently, there was a design for a mechanism that could speed up the General process train. Engineers at Cox Cable planned to install this mechanism in September, adding 80 hours per month to capacity. "We could move up our plans, so that the additional 80 hours would be available to the shop in August," he remarked. "But that would probably run about $900 in overtime expenses, and I'm not sure if it would be worth while."

After putting some of this information into her spreadsheet, Meredith spoke with the plant's controller, Donna Malone, who had access to most of the necessary cost data. Meredith learned that the material in the cables cost $160 per reel for the plastic-coated cable and $200 for the Teflon-coated cable. Packaging costs were $40 for either type of cable, and the inventory costs at the public warehouse came to $10 per reel for each month stored. "That's if you can get the space," Donna commented. "It's a good idea to make reservations a few weeks in advance; otherwise we might find they're temporarily out of space." Donna also provided standard accounting data on production costs (Table 4). According to Donna, about half of the production overhead consisted of costs that usually varied with labor charges, while the rest was depreciation for equipment other than the

TABLE 1 Contract Delivery Schedule and Prices

Month	Plastic	Teflon
June	50	30
July	100	60
August	50	50
Price	$360	$400

TABLE 2 Production Capabilities, in Hours per Reel

Process Train	Plastic	Teflon
General	2.0	1.5
National	2.5	2.0

TABLE 3 Unscheduled Production Hours

Month	General	National
June	140	250
July	60	80
August	150	100

TABLE 4 Accounting Data for Production

Cost Category	General	National
Machine Depreciation	$50.00/hr	$40.00/hr
Direct labor	16.00	16.00
Supervisor	8.00	8.00
Production Overhead	12.00	12.00

two process trains. The machine depreciation charges on the two process trains were broken out separately, as determined at the time the machinery was purchased. For example, the General process train originally cost $500,000 ten years ago and had an expected life of five years, or about 10,000 hours, hence its depreciation rate of $50 per hour.

The Analysis

Meredith was able to consolidate all of the information she collected into a spreadsheet. Making what she felt were reasonable assumptions about relevant cost factors, she was able to optimize the production plan, and she determined that it should be possible to meet the 25 percent profitability target. Nevertheless, there seemed to be several factors in it that were subject to change—things that had come up in her various conversations, such as maintenance, warehousing, and the possibility of modifying the contract. She expected that Mr. Cox would quiz her about all of these factors, and she knew it would be important for her to be prepared for his questions.

THE BMW COMPANY

Late in the summer of 1989, the government of Germany was seriously considering an innovative policy affecting the treatment of scrapped vehicles. This policy would make auto manufacturers responsible for recycling and disposal of their vehicles at the end of their useful lives. Sometimes referred to as a "Producer Responsibility" policy, this regulation would obligate the manufacturers of automobiles to take back vehicles that were ready to be scrapped.

The auto takeback proposal was actually the first of several initiatives that would also affect the end-of-life (EOL) treatment of such other products as household appliances and consumer electronics. But in 1989, no other industry had faced anything like this new policy. Managers at BMW and other German automakers struggled to understand the implications for their own company. Perhaps the first exercise was to gauge the magnitude of the economic effect. Stated another way, management wanted to know what the cost of the new policy was likely to be, if BMW continued to do business as usual.

Background

A loose network of dismantlers and shredders managed most of the recycling and disposal of German vehicles, accounting for about 95 percent of EOL volume, or roughly 2.1 million vehicles per year. Dismantling was a labor-intensive process that removed auto parts, fluids, and materials that could be re-sold. The hulk that remained was sold to a shredder. Shredding was a capital-intensive business that separated the remaining materials into distinct streams. Ferrous metals were sold to steel producers, nonferrous metals were sold to specialized metal companies, and the remaining material was typically sent to landfills or incinerators. The material headed for disposal was known as Automobile Shredder Residue (ASR) and consisted of plastic, rubber, foam, glass, and dirt. ASR was virtually impossible to separate into portions with any economic value, so shredders paid for its removal and disposal. As of 1989, the annual volume of ASR came to about 400,000 tons. On average, an automobile stayed in service for about 10 years.

Although dismantlers and shredders were unaffiliated, private businesses in 1989, it was conceivable that, under the new government policy, they would be taken over by the auto companies. Even if they remained independently owned businesses, the costs of dismantling and shredding would ultimately be borne by the auto companies, since the policy made them legally responsible for the waste.

Economics of disposal

The costs in this system had been increasing and, in fact, were about to increase more quickly due to two major trends, one involving disposal costs and the other involving material composition. On the material side, automobiles were being designed with less metal each year and more plastics. In the 1960s, a typical car was made up of more than 80 percent metal, but the new models of 1990 were only about 75 percent metal. This meant that more of the vehicle was destined to end up as ASR. Averaged across the market, autos weighed an average of about 1,000 kg each. See Exhibit 1 for some representative figures.

Exhbit 1. Material Trends in Automobile Composition

Material	1965	1985	1995(est.)
Iron and Steel	76.0%	68.0%	63.0%
Lead, Copper, and Zinc	4.0%	4.0%	3.0%
Aluminum	2.0%	4.5%	6.5%
Plastics	2.0%	9.0%	13.0%
Fabric, Rubber, and Glass	16.0%	14.5%	14.5%

BMW 1989 Models	Weight (kg)	Plastics Content
3 series	1150	11.3%
5 series	1400	10.9%
7 series	1650	10.3%

On the disposal side, a much more significant trend was in progress. As in most of Europe, landfill options were disappearing in Germany. In 1989, about half of the waste stream found its way to landfills, with 35 percent going to waste-to-energy incinerators, and the remaining 15 percent to recycling of some kind. But the number of landfills was declining, and it looked like this trend would continue, so that by 1999 landfill and incineration would handle approximately equal shares. The effects of supply and demand were visible in the costs of disposal at landfills. Exhibit 2 summarizes recent and projected costs.