ANSWERS TO CHAPTER 2 QUESTIONS

ANSWER 2.1

This is where planning makes a lot of sense. Stacy Engineer should do the following:

A. Conceive of a set of mutually exclusive and collectively exhaustive objectives which on attainment will lead Joe Engineer to an exciting and happy life. Examples include: (a) money/ wealth, (b) respect and recognition by peers, (c) professional/ technical achievements, (d) social support, and (e) health.

B. Define tasks to be completed in the next 5 years which aim at accomplishing parts of the following:

(a) Learn to save and invest - setting up an internet trade account and using automatic deposit to start saving money and practicing prudent investment.

(b) Look for a job in a prestigious firm where learned skills can be best applied for both the company and for oneself. Demonstrate technical excellence and establish oneself as a worker who is capable, reliable and a fast-learner.

(c) Apply herself to learn, produce, innovate and excel.

(d) Get a mate who has earning power and start a family. Stay in contact with college friends and acquire new friends constantly. Exercise and eat healthy foods.

C. Define tasks to be completed in the next 5 to 10 years which aim at accomplishing parts of the following:

(a) Continue to save and invest. Maximize savings in 401(k) and IRA accounts. Set up savings accounts for children's college education and invest more in stocks. Try options trading.

(b) Practice the principles of engineering management and get promoted into a mid management position with a large company. Become active in professional societies. Seek opportunities to publish technical papers and/or develop patents. Write a long term career plan so that the needed preparations are initiated in a timely manner.

(c) Practice leadership skills to excel at work. Get training to acquire new skills. Seek opportunities to broaden one's own experience base. Request a transfer to another department if doing so will broaden one's own exposure to other important managerial functions.

(d) Continue to network with old friends and make new friends, both professionally and socially.

(e) Exercise regularly and eat healthy foods.

(f) Spend quality time with family and manage relationships.

D. Define tasks to be completed in the next 10 to 15 years which aim at accomplishing parts of these objectives:

(a) Actively manage one's own savings and investment programs.

(b) Seek promotion to Director’s level. Continue to broaden one's own experience base to prepare for bigger and better jobs, either inside or outside the company.

(c) Present papers at professional conferences, get more patents, and become active in societies and industrial committees.

(d) Achieve recognition by peers in industry.

(e) Continue to manage one's network of friends and acquaintances.

(f) Cultivate an active network of business contacts and relations.

(g) Exercise and eat healthy foods.

(h) Manage family relationships.

E. Determine tasks to be completed in the next 15 to 20 years which aim at accomplishing parts of the following: -----

ANSWER 2.2

Obviously, the company must find ways to protect its current market share in the high-price, high-quality niche. Without protection, this niche could become slowly eroded by the anticipated introduction of a new low-price, low quality product by the competition. Time is of essence and the company must act quickly. Thus, the strategic plan to protect company’s position should include:

A. Explore the option of importing a low-price and low-quality product to the market and make inquiries about cost, performance, delivery and logistics.

B. Follow the competition closely to understand their new products and evaluate the market reaction to them.

C. If the market exhibits signs of accepting the competition's new products, then the company should introduce the imported products to compete directly at a discounted price. The purpose is to reach and understand customers in this new low-price, low-quality niche so that they may be served better in the future.

One obvious alternative is for the company to drive out the competition using the imports, based on a "second brand" strategy.

D. If the company registers a decline of sales in the high-price and high-quality market niche, then it should consider the development of new medium-price and medium-quality products in order to recover some of its lost customers.

ANSWER 2.3

1. INTEL CORPORATON

A. Our mission – Do a great job for our customers, employees and stockholders by being the preeminent building block supplier to the computing industry.

B. Discipline – The complexity of our work and our tough business environment demands a high degree of discipline and cooperation. We strive to: (a) properly plan, fund and staff projects; (b) pay attention to detail; (c) clearly communicate intentions and expectations; (d) make and meet commitments; and (e) conduct business with uncompromising integrity and professionalism.

C. Quality – Our business requires continuous improvement of our performance to our mission and values. Examples include: (a) setting challenging and competitive goals, (b) doing the right things right, (c) continuously learning, developing, and improving, and (d) taking pride in our work.

D. Result Orientation – We are results-oriented. We strive to: (a) set challenging goals, (b) execute flawlessly, (c) focus on outputs, (d) assume responsibility, and (e) confront and solve problems.

E. Customer Orientation – Partnerships with our customers and suppliers are essential to our mutual success. We strive to: (a) listen to our customers, (b) communicate mutual intentions and expectations, (c) deliver innovative and competitive products/services, (d) make it easy to work with us, and (e) serve our customers through partnerships with our suppliers.

F. Risk Taking – to maintain an innovative environment, we strive to: (a) embrace change, (b) challenge the status quo, (c)

listen to all ideas and viewpoints, (d) encourage and reward informed risk taking, and (e) learn from our successes and mistakes.

G. Great Pace to Work – A productive and challenging work environment is the key to our success. We strive to: (a) respect and trust each other, (b) be open and direct, (c) work as a team, (d) recognize and reward accomplishments, (e) be an asset to our community, and (f) have fun.

2. SATURN CORPORATION

A. The Mission of Saturn

- To market vehicles developed and manufactured in the United States that lead in quality, cost, and customer satisfaction through the integration of people, technology, and business systems.

- To transfer knowledge, technology and experience throughout General Motors.

B. The Philosophy of Saturn

We the Saturn Team, in concert with the UAW and General Motors, believe that meeting the needs of Saturn customers, members, suppliers, dealers, and neighbors is fundamental to fulfilling our mission.

- To meet our customers' needs, our products and services will lead in value and satisfaction.

- To meet our members' needs, we will create a sense of belonging in an environment of mutual trust, respect and dignity. We believe that all people want to be involved in decisions that affect them. We will develop the tools, training, and education that each member needs. Creative, motivated, and responsible team members who understand that change is critical to success are Saturn's most important asset.

- To meet our suppliers' and dealers' needs, we will create real partnerships with these suppliers and dealers. We will strive for openness, fairness, trust, and respect and we will work with them to help them feel ownership of Saturn's mission and philosophy.

- To meet our community neighbors' needs, we will be good citizens and protect the environment as well as seek to cooperate with government at all levels.

By continuously operating according to this philosophy, we will fulfill our mission.

C. The Core Value of Saturn

As a final complement of Saturn's mission and philosophy statements, the founding team has enunciated five core values: commitments to customer enthusiasm, excellence, teamwork, trust and respect for the individual and continuous improvement.

ANSWER 2.4

A typical set of operational guidelines may emphasize the following:

A. Employees are the most important asset to our organization (respect and listen to them).

B. Quality of our product/service must never be compromised (this is based on the total quality concept as measured by customers).

C. The system must continuously advance all aspects of its operation (seeking a stream of incremental emendation while not neglecting innovation for major step-change in performance).

D. Each action that is taken should add value to the final product or service (eliminating wasteful and unnecessary steps).

E. Timely response of the system to changing external conditions is paramount to success (time to market is a key competitive factor in today's marketplace).

F. Integrity in all actions by all employees is paramount (all shareholders must have confidence in the enterprise).

ANSWER 2.5

All new ventures have inherent uncertainties. In deciding to take the risks of going forward with the venture, several questions need to be answered first:

A. Should it luckily turn out to be successful, what is the maximum pay-out (e.g., value) of the venture?

B. Why is the venture deemed to be risky? How likely are all risk factors expected to play out in reality? What contingency steps are available to minimize the impact of these risky factors? Answers to these questions will lead to an assessment of the probability of success for the venture.

C. Should the venture fail (e.g., time delay, reputation,

company bankruptcy, loss of market share, etc.), what is the adverse impact on company?

A typical set of guidelines for avoiding taking unwarranted risks may include the following:

A. The cost of going forward with the venture must be much smaller than the expected value of the risky venture (the probability of success multiplied by the maximum pay-out of venture).

B. The adverse impact on company must be smaller than the maximum pay-out of the venture.

ANSWER 2.6

The steps she should take include the following:

A. Collect critical market information (e.g., market research, competitive information, customer feedback, technology development, business alliance, and forecasting) - in need of staff support.

B. Analyze available data (verification of data accuracy, interpretation, what-if analysis, financial projections, risk analysis, search on external databases, SWOT (strengths, weaknesses, opportunities and threats) analysis, etc.) - in need of staff support.

C. Apply judgment to data and formulate strategies, to be performed by the Director himself.

D. Get staff feedback, in order to benefit from the different viewpoints and broad experience they may have, - in need of staff participation.

E. Devise the plan (graphics, project plan preparation proof reading, printing, binding) - in need of staff support.

ANSWER 2.7

A. Elements of Critical Path Method (CPM)

- Visualize all action steps in the form of a network of events.

  (a) Arrow (branch): Activity to be performed requiring allocation of resources (time, money, manpower, equipment, facilities, etc.).

  (b) Node: Milestone or accomplishment which is to be

sequenced.

- Specify time relationships between activities:

  (a) Which activity should be done first.

  (b) Which activity should be done last.

  (c) Which activity should be done concurrently.

- Define slack which is the difference between total expected time and the latest allowable date. Slack serves as the extra time available for non-critical activities.

- Identify activities which are on the "critical path." A delay of any critical path activity will result in a time delay of equal magnitude in the completion of the project.

B. Construction of CPM Network

- Start with the end objective and work backwards until the starting point is reached.

- Follow these sequencing rules:

  (a) One beginning event, marked as node 0.

  (b) Arrow from note i to the node j, with $i < j$.

  (c) No duplication of node number.

  (d) One ending event.

  (e) An event is completed only if all the preceding events are completed.

  (f) Each arrow represents a specific activity to be performed.

- Assign time requirement (average completion time) for each activity, which is designated by a letter.

C. Example

Figure 2-1 shows one application example.

FIGURE 2-1. CPM CHART

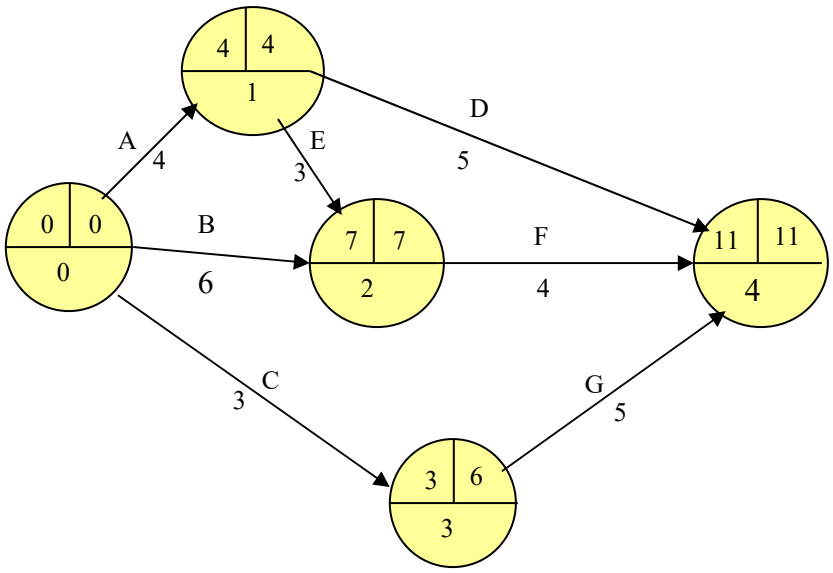


Table 2-1 illustrates the calculation of slack.

TABLE 2-1. SLACK CALCULATION

Event	Average Completion Time	Latest Allowable Time	Slack
1	4	4 (6 for D & 4 for E)	0
2	7	7	0
3	3	6	3
4	11	11	0

No slack at the nodes 1, 2 and 4.

D. Identify Critical Path Activities

The critical path is the line(s) connecting no-slag nodes.

Activities on the critical path are the critical path activities. Any delay in completing these activities will result in a delay of equal magnitude in completing the entire project. These are the pacing activities (tasks A, E and F in the above example).

E. Advantages and Disadvantages of Using CPM

The advantages of using CPM are:

(a) Define clearly the end goal and action steps.

(b) Identify critical path activities which pace the project.

(c) Concentrate management attention on these pacing activities to enhance the probability of completing the project on time and within budget.

(d) Facilitate documentation and reporting (e.g. cost, time and performance).

(e) Enhance project control if computer-based project planning software is utilized which permits "what-if" analyses and frequent updates.

The disadvantages of using CPM are:

(a) Spend extensive planning efforts up-front.

(b) Require discipline to implement and control.

ANSWER 2.8

The company is facing a major threat and must consider several strategic options. These options include: stay the current course, expand software offering to run on computers of common platforms, and continue to market the software products but abandon the bundling with the hardware.

A. Staying the course

Marketing the original hardware-software bundle has several advantages. The system works well as a group partly because the company offers maintenance services using technicians who are knowledgeable about both hardware and software. Customers can count on the high system reliability of the integrated package. An additional possibility is for the company to constantly upgrade the system, both hardware processor and software features, so that its customers can always enjoy the latest technology.

The company can of course continue to innovate by adding new functions and features to serve the law firms better (e.g., Internet access, document search, data mining, and others). The company may also have to refocus its marketing on mid- to large-size law firms which prefer and can afford a centralized

hardware-software system. Some erosion of the company's market share may be likely.

B. Marketing two versions of the software

Generally speaking, it is quite easy to develop a second software version. Doing so allows the company to expand its customer segment to include law firms which have existing computers running on common operating systems. This segment is potentially very large as the computers of common platform enjoy a very extensive installed base. Some law firms can thus avoid the initial investment of purchasing a hardware-software bundle, also making such software attractive to some new and small size firms.

The question of system reliability is unresolved at this time.

Customers who purchase hardware and software from different sources do not have a single point of contact to turn to for services. System reliability may be important to some, but not to others. For law firms involved in criminal court cases, it would be a disaster if their ERP systems broke down during a trial. On the other hand, if the law firms work primarily on patent and copyright assignments, then an occasional delay of a few days due to the system failure may still be manageable.

C. Pursue the software products only

This option of abandoning the hardware business is useful only if the company wants to refocus its energy on competing directly against the new competitors. The sense of urgency could spark the innovative talents of the company in adding new software features to make the company increasingly more competitive.

Some existing customers may feel betrayed by such a move. Accordingly, the company needs to extensively restructure its hardware and service divisions.

Which option should the company pursue? To answer this question, there is one more piece of information missing, namely the customer's perception and preference.

Thus, it is strongly advised that the company conduct a customer survey (e.g., focus group, web-based survey, and phone interviews) to determine the relative value of these options to them. Specifically, XYZ Company needs to know how important the issues are to customers regarding system reliability and services channeled through a single point of company contact. Based on the results of these surveys, the company should plan its counter strategy and implement action steps accordingly.

Case #2

"Associated Instruments Corporation: Analytic Instruments Division"

Harvard Business School Case #9-689-052 (Rev. Feb. 6, 1992)

Academic instructors who are registered with the publisher's website (http://www.hbsp.harvard.edu) may download the Teaching Note #5-690-091 (May 1, 1990) for this case free of charge.

ABSTRACT

The Analytic Instrument Division of Associated Instrument Corporation attempts to develop a new product to spur a business turn-around. In order to strengthen its product development capabilities, the division needs to resolve a number of issues. This case highlights the role of marketing and the impact of different product development options on price and the market positioning of technology intensive products.

TEACHING OBJECTIVES

The objective of this case is to expose students to the basic issues related to product development. The integrity, consistency and quality of products are affected by the selected product development procedures. Data is available for students to analyze the impact of development efforts on cost, quality and timing. It is also available to illustrate the important roles of the executive staff, the division general manager, and the project managers in resolving conflicts and managing the overall product development efforts.

SUGGESTED QUESTIONS FOR CLASSROOM DISCUSSION

1. Explain the changes occurring in the marketplace for Associated Instruments Corp. In what way can product development strengthen the competitive position of Associated Instruments in the marketplace?

2. If web-based technologies (as we understand them today) are deployed, what else, besides product development, can the company do to augment its competitive position in the market place?

3. What are the strengths and weaknesses of the 77000 project? What is the role of marketing for this project?

4. What options are available to Hoffenberger and his management team in the Analytic Instruments division in October 1985? Based on your analyses, what are the advantages and disadvantages for each of these options?

5. Which option would you recommend the company implement? Would you change or modify your recommendation if web-based technologies are applied in the implementation of the program and why or why not? What would be the overall impact on the profitability of Associated Instruments Corp. of implementing your recommended option?

ANALYSIS

1. Explain the changes occurring in the marketplace for Associated Instruments Corp. In what way can product development strengthen the competitive position of Associated Instruments in the marketplace?

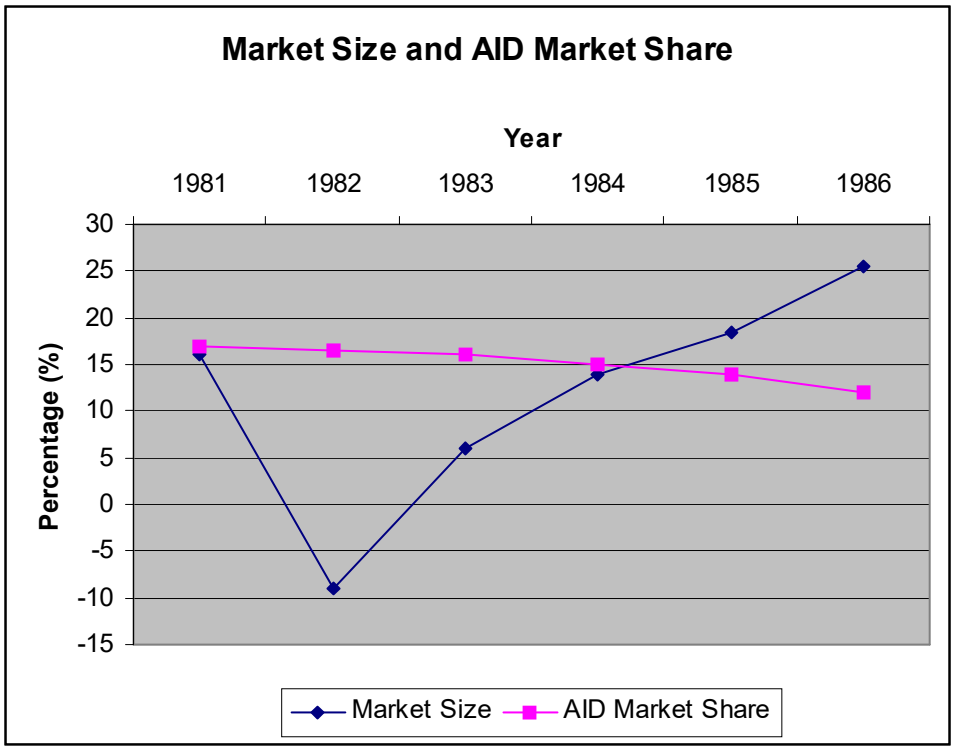
Associated Instruments Corporation produces precision instruments for construction firms, chemical laboratories, university research facilities and other institutions. In 1985 its sales reached $200 million with a net income of $6.8 million.

The Analytic Instrument Division (AID), one of six divisions of Associated, manufactures highly priced, fully featured mass spectrometers and related instruments. Its competitors include Hewlett-Packard, Varian Associates and Finnigan Corporation. A few foreign vendors from Germany, Japan and Great Britain are also active.

Mass spectrometers have now entered their mature product life cycle stage at which point new competition has begun rapidly eroding AID's market position. The major competitive foci have shifted from features to prices. Mass spectrometer prices have fallen by 10 percent to 20 percent per year. However, the market size is still expected to grow at 15 percent to 20 percent per year as it is driven by new environmental concerns which require companies to determine the quantity of certain compounds. AID is considering changing their business strategy by building cost-effective, highly featured and highly reliable products and by broadening its customer base. A new product, the 77000, is to be developed to affect this change. Figure C2-1 illustrates the market size and AID's share position.

The market segment of interest to AID consists of industrial customers who are concerned about the chemical compounds in products, by-products and waste. These new customers are substantially different from those in university facilities, research organizations and analytical laboratories. These customers are from production lines, oil companies, pharmaceuticals and chemical companies. They prefer reliable systems instead of individual superior components, systems such as mass spectrometers, small PCs, liquid and gas chromatographs, and various detector devices. Their purchase decisions are based on price, reliability, special features (e.g., automatic loading), versatile software, speed, user-friendliness and easy to read

FIGURE C2-1. MARKET SIZE AND AID MARKET SHARE



display. Moreover, the current "dead on arrival" rate of 5 percent to 15 percent of AID products is no longer acceptable.

Product development is essential in order for AID to adjust to the needs of these new customers. Possible steps include: (1) defining all components which comprise the system to satisfy customers' needs, (2) setting up supply chains to secure parts delivery and quality control, (3) ensuring just-in-time manufacturing to accelerate the time to market, (4) implementing new technology (e.g., vacuum fluorescent display) to cultivate marketplace competitiveness, and (5) developing patentable technologies to promote differentiation.

2. If web-based technologies (as we understand them today) are deployed, what else, besides product development, can the company do to augment its competitive position in the market place?

Indeed, above and beyond what can be accomplished by product development alone, AID's competitive position may be further strengthened by applying web-based technologies.

As indicated in Chapter 12 of the text, various web-based tools are available to add value:

A. Sales and Marketing – promoting the product (via linkages to scientific and environmental web sites), managing the brand, processing customer orders, creating databases for customers' use and for equipment purchase histories, conducting surveys, and performing market research.

B. Communication – enhancing the performance of supply chains and problem-solving efficiency of teams and employees.

C. Customer relationship management – fostering customer service, implementing the build-to-order strategy to better satisfy the needs of customers.

D. Manufacturing – enabling Just-in-Time manufacturing to decrease cost and speed-up the low cost procurement of parts via web portals.

E. Knowledge management – preserving lessons learned and practicing them consistently to maintain competitiveness.

3. What are the strengths and weaknesses of the 77000 project? What is the role of marketing for this project?

The strengths of the 77000 project consist of the following: (a) strong management support (Hoffenberger and Lind), (b) well-functioning supply networks for parts (e.g., minimize the number of vendors to increase quality and decrease cost, and select vendors based on lifetime cost of product), (c) Cross-functional teams with skilled members, (d) Applicable core competencies (enhanced reliability with pump design), (e) Market growth of 15 percent to 20 percent per year, and (f) Solid customer base.

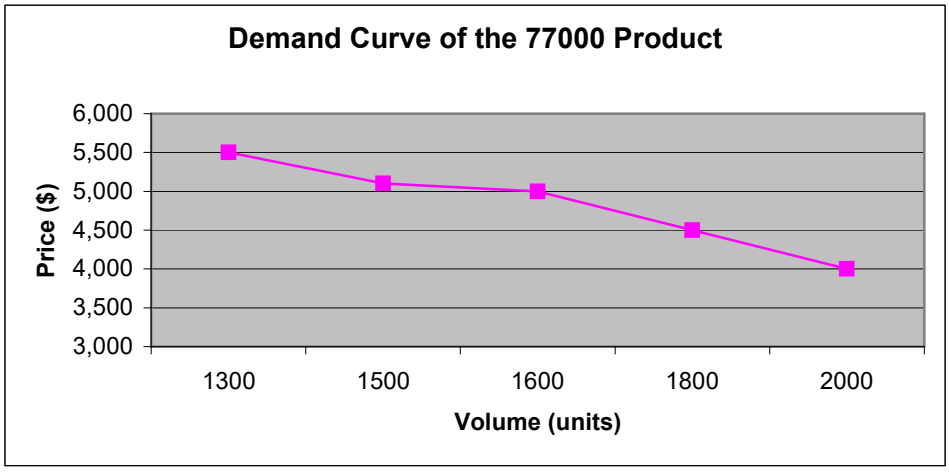
The weaknesses of the 77000 project are: (a) the cost focus is new to the team who is following a new product development process, (b) sales force is inexperienced in selling to new customers and there is a lack of marketing inputs, (c) inadequate resources to handle diversified assignments (new design, JIT, vendors, delay in the fluorescent display due to a lack of VP), and (d) profitability uncertainty.

The role of marketing is to define the following:

A. Determine the needs and purchasing criteria of customers in the high growth market segment for the 77100 product with environmental concerns. Also what product features that will be attractive to customers of the 77000 products (display, others) must be taken into consideration.

B. Estimate the profitability that is possible with an established price, while also taking into account the competition (environment, constraints). For example, the 77000 product is found to be price-elastic (see Figure C2-2).

FIGURE C2-2. DEMAND CURVE OF THE 77000 PRODUCT



Because of this demand curve, there exists a volume-price pair which yields the maximum gross margin for the company (as presented in Table C2-1). The optimum price is thus $5000 at a sales volume of 1600 units.

TABLE C2-1. PRICE VOLUME PAIR TO MAXIMIZE GROSS MARGIN

Price (77000)	4,000.00	4,500.00	5,000.00	5,100.00	5,500.00
Volume (77000)	2,000.00	1,800.00	1,600.00	1,500.00	1,300.00
Revenue (77000)	8,000,000.00	8,100,000.00	8,000,000.00	7,650,000.00	7,150,000.00
Price (77100)	2,800.00	2,800.00	2,800.00	2,800.00	2,800.00
Volume (77100)	100.00	200.00	250.00	250.00	250.00
Revenue (77100)	280,000.00	560,000.00	700,000.00	700,000.00	700,000.00
Total Revenue	8,280,000.00	8,660,000.00	8,700,000.00	8,350,000.00	7,850,000.00
CGS (77000) w/o display	1,560.00	1,608.00	1,730.00	1,755.00	1,910.00
Display	150.00	150.00	150.00	150.00	150.00
CGS (77000) w/ display	1,710.00	1,758.00	1,880.00	1,905.00	2,060.00
CGS(77100) w/ display	1,632.00	1,677.60	1,793.50	1,817.25	1,964.50
Total CGS	3,583,200.00	3,499,920.00	3,456,375.00	3,311,812.50	3,169,125.00
Total Gross Margin	4,696,800.00	5,160,080.00	5,243,625.00	5,038,187.50	4,680,875.00

C. Establish which distribution channels to reach and serve the customers (direct, technical representatives, Internet, and call centers)

D. Decide how best to promote the products (Internet, sales call, industrial exhibits, advertisement in professional journals, etc.).

4. What options are available to Hoffenberger and his management team in the Analytic Instruments Division in October 1985? Based on your analyses, what are the advantages and disadvantages for each of these options?

The options available to the management team are itemized in Table C2-2.

TABLE C2-2. OPTIONS AVAILABLE

	Description
Option 1	Stay with the existing plan and use automated injection molding tooling
Option 2	Stay with the existing plan but use smaller-volume manual injection molding tooling
Option 3	Delay product introduction by three months and conduct value engineering
Option 4	Delay product introduction by three months, speed up the 77100 project, and introduce both products at the same time

A. Option 1

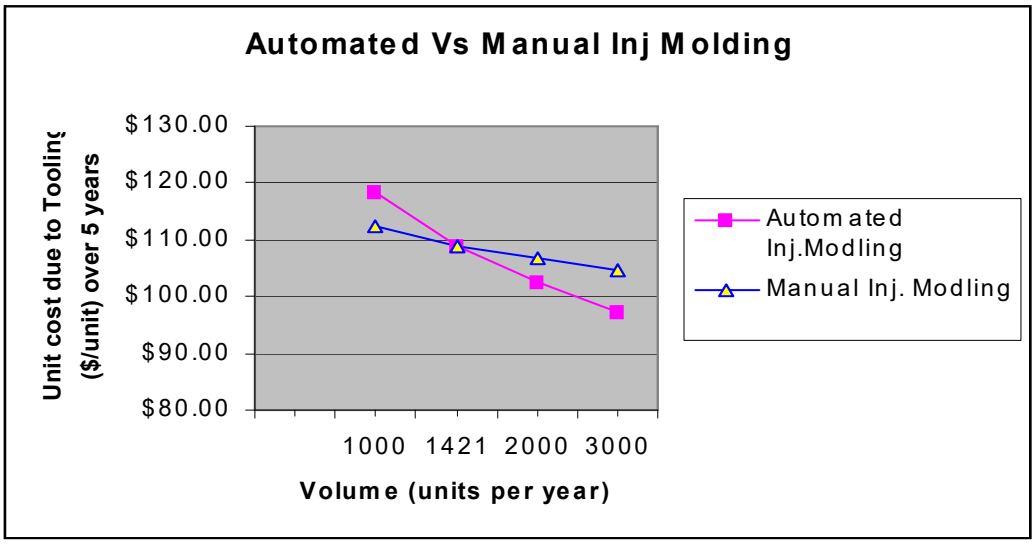
This option has the advantages of (1) being preferred by the development team and management (Hoffenberger and Lind), (2) increasing product reliability (a 10 percent increase of mean time between failure – MTBF), and (3) maintaining the October 1986 shipment date.

The disadvantages of this option include a higher product cost for volume less than 1410 units (see Figure C2-3), delayed introduction of the 77100 by 15 months, and the possibility of not meeting the sales revenue and gross margin targets.

B. Option 2

This option maintains the planned product delivery date and is strongly supported by division controllers and corporate planner. The low volume and increased manual tooling allows flexible changes to the process of manufacturing parts and initially

FIGURE C2-3. AUTOMATED VS MANUAL INJECTION MOLDING



requires less capital investment as compared to the more automated tooling option.

On the other hand, in contrast to the more automated tooling, the low volume tooling carries a higher variable cost that produces a higher unit product cost beyond a production volume of 1421 units. Furthermore, once the investment is made, switching tooling is not possible and the mean time between failures (MTBF) will decrease by 10 percent. This option may also fall short of its revenue targets. It is not supported by Lind.

C. Option 3

Delaying the product introduction by three months will allow one more product prototyping and resulting in an improvement in product reliability. The value engineering analysis to be performed by an outside consultant may define opportunities to whittle away product cost by 10 percent, thus boosting profitability. The analysis may also help link cost elements to the value these cost elements provide in the marketplace, thereby making AID more customer focused. The lessons learned in the current project may benefit other projects in the future.

However, a delay of product introduction by three months will cause AID market share to drop by 0.6 percent and customers' feedback to be delayed accordingly. The team does not prefer this delay. There is a consulting fee of $90,000 for the value engineering analysis.

D. Option 4

This option has the advantage of generating revenues using 77100, the lower end product, sooner and for a high growth market segment. The company's sales process is also strengthened by having both product options available. The sales of the 77000 model may increase to 2,100 units per year at $5,100 each and the fixed tooling cost is spread over a larger number of units. Hoffenberger will therefore appear to be appealing.

However, the disadvantages lie in staining the development team which must now simultaneously develop both the 77000 and 77100 products, accelerating the training of sales force for the new marketing niche, and losing the market share by 0.6 percent due to the delay of product introduction. Furthermore, the gross margin of the 77100 model (40 percent) is lower than that of the 77000 model (61 percent), and thus it is not a good base upon which to build profitability.

5. Which option would you recommend for implementation by the company? Would you change or modify your recommendation if web-based technologies are applied in the implementation of the program and why and why not? What would be the overall impact on the profitability of Associated Instruments Corp. of implementing your recommended option?

Based on a profitability analysis, option 4 appears to be the best. But it is a high risk option as it puts strain on the product development team. A better choice might be option 3.

However, using web-based tools (see Chapter 12 of text), value engineering and accelerated product introduction may be possible to do concurrently. Therefore, under these circumstances the combination of options 3 and 4 is favored.

The overall impact of implementing the combination of options 3 and 4 based on web-based tools is that it will enable the company to do the following: (1) become more flexible in utilizing resources (internal and external), (2) be capable of designing product systems better aligned with customers' needs, (3) be proficient in creating customer relationship, (4) be efficient in offering customer service, and (5) assume an increasingly competitive position in the marketplace.