At a meeting to his staff, Tom Richards, director of manufacturing planning, stated that they needed to plan to bring additional capacity for FlexConnex online in about two years. He suggested that they begin by proposing possible alternatives. The staff quickly identified three promising alternatives:

1. The Santa Clara plant had been designed for future expansion. Additional space was available at the site, and new production capacity could be easily intergrated into the existing production processes as long as compatible manufacturing technologies were employed.
2. CTI owned a plant in Waltham, Massachusetts that manufactured a product line that was being phased out. Some existing equipment in the Waltham plant was compatible with the Santa Clara plant’s manufacturing technology and could be converted to the production of FlexConnex. Half of the Waltham plant would be available in 2003, and the remainder in 2005.
3. CTI could build a greenfield plant in Ireland, close to its major European customers. To attract such industries, the Irish government would make a site available at low cost. A new technology currently being Beta-tested by an equipment manufacturer could be used to equip this plant.

Tom believed that these three were promising proposals. To ensure CTI could bring additional, profitable, FlexConnex capacity online in two years. Tom felt that they should begin developing plans for these alternatives. Nonetheless, he wanted the staff to keep an open mind to additional alternatives even as they evaluated these three. As the discussion started to wind down, Gracie Stanton, and engineer, said that she had a suggestion.

Gracie: Before we spend our time developing these three alternatives in detail, I’d like to get a rough feel for the potential profitability of each alternative. We shouldn’t waste our time developing detailed plans for and alternative if there is no chance it will ever show a positive NPV.

Tom: Good point, Gracie. Let’s break up into three groups, and do back of the envelope calculations based on what we currently know about each alternative. Gracie, would you head up the Santa Clara group, since you where part of the engineering team for that plant? Edward Lodge, how about Waltham? Ian Townsley, could you and your folks take a look at Ireland? To start, what are the facts and assumptions about each facility?

Gracie: Well, there’s enough space at the Santa Clara site to produce an additional 30 million units annually. I expect it would cost about $23 million to expand this pant, and bring its total capacity to 105 million units. Of the $23 million, we would spend $5 million to expand the building, and $18 million for additional equipment compatible with Santa Clara’s existing manufacturing process. All $23 million would probably be spent in 2003, and the plant would be ready for production in 2004. I assume that the selling price per unit will remain at its current level; further, since the same manufacturing technology will continue to be used, the variable manufacturing cost will remain the same as we show in the 2002 Santa Clara Cost Analysis (See Exhibit 1). Expanding the existing pant would allow some fixed manufacturing costs, like the plant managers’ salary, to be shared with the existing facility, so I estimate that the additional fixed manufacturing costs, excluding depreciation, will be $2.1 million annually beginning in 2004. In 2006, these fixed costs will rise to $2.4 million and remain at that level for the foreseeable future.

Edward: Well, the Waltham plant is smaller than the space available in Santa Clara, so I think its capacity will be about 25 million units. It will require renovations to adapt the plant to manufacture FlexConnex, say, about $2 million, and approximately $12 million for equipment. Half of this would be spent in 2003, and half in 2005. Initial production would begin in 2004; half of the 25 million unit capacity should be available in 2004; 2/3 in 2005; the remainder in 2006. Since the Waltham plant will use the same technology as Santa Clara, we can assume that the variable manufacturing costs will be the same as Santa Clara’s. Selling price will also be the same. However, since Waltham will be a stand-alone faculty, its fixed manufacturing costs, excluding depreciation, would be somewhat higher: $2.4 million annually beginning in 2004. In 2006, however, fixed costs will increase to $2.6 million annually, where I expect them to remain for the foreseeable future.

Ian: I just visited the Beta-test site for the manufacturing equipment using the new technology that I propose we use for the greenfield plant. There I learned that the economic size for a pant using this technology to manufacture a product such as FlexConnex is about 70 million units, so I propose that we prepare our estimates for Ireland based on a 70 million unit capacity plant. Of course, this will cost more, since it is much larger than other sites. With the help of the Irish government, an appropriate site can be obtained for about $1 million. A building large enough to produce 70 million units can probably be built for about $10 million, and equipping the facility with the new technology equipment will cost about $50 million. Most of this would be spent in 2003, although as much as 10 percent might be spent before the end of 2002 to acquire and prepare the site. The plant would begin production in 2004; some areas of the plant would bot be complete, however, and as much as 20-25 percent of the investment would remain to be spent during 2004. Although FlexConnex’s worldwide selling price will be the same as for the other facilities, the new equipment will lower the variable manufacturing cost to $0.195 per unit. The efficiency of this new plant will help keep fixed manufacturing costs down, as well, but since the facility will be so large, fixed manufacturing costs, excluding depreciation, would be higher than the other two facilities: $2.8 million annually beginning in 2004, rising to $2.9 million annually beginning 2008.

Tom: These assumptions sound like reasonable first cuts to me. Let’s start with a five-year analysis, 2003 through 2007, using the discount rate of 20 percent, which the corporate finance manual states is the hurdle rate for capital investments. For simplicity, let’s assume all cash flows occur at the end of the respective year. Discount everything today’s dollars, that is, as of the end of 2002. And, consistent with corporate policy, we’ll do a pretax analysis; we’ll ask the corporate finance staff to evaluate the tax implications later. A few minutes later, the buzzing of the small groups died down, and the tapping on the laptop keyboards had ceased.

Tom: Well, what have you learned for this first glance?

Edward: The Waltham site looks promising.

Ian: Not Ireland.

Gracie: this is odd. The Santa Clara plant is right on margin, and that surprises me since the existing manufacturing facility is one of CTI’s most profitable, and we get further economies of scale by expanding that plant. I wonder if the discount rate we are using is too high. At the “Finance for Manufacturing Engineers” seminar I attended recently, we discussed the problems associated with using a discount rate that was too high. The professor stated that there was a sound theoretical basis for using a discount rate that approximated the company’s cost of capital, but many companies “added on” estimates for risk, corporate charges, and other factors that were less well grounded. Based on what I learned in that seminar, I tried to estimate CTI’s actual cost of capital; it was about 10 percent. I wonder what would happen if we used 10 percent instead:

Tom: With these laptops and spreadsheets programs, that’s easy enough; let’s check it out.

Gracie: Now, that’s better!

Edward: Ours too.

Ian: Well, at least we’re moving in the right direction. But if doesn’t make sense to me that a facility with lower variable cost per unit, and lower average fixed cost per unit at capacity, shows a negative NPV when the others are positive. We checked our calculations; what’s the story? Could it be that Ireland would not even be up to capacity production in five years because the plant is so big?

Gracie: maybe, but our plants are being penalized, too; after all, even though they reach capacity in the first five years, they will presumably continue to produce FlexConnex. Although there is constant technological change in this industry, there is a reasonable probability that demand for FlexConnex will remain strong for at least 10 years.

Ian: Well, then, let’s look at each of the three plants over a ten-year period, using Gracie’s 10 percent discount rate.

Edward: Aha! Waltham continues to improve.

Gracie: However, Santa Clara has you beat now!

Ian: I’ve got bad news for both of you!

Required:

1. Prepare the manufacturing staff’s calculation for the three alternatives:
   1. In the first set of calculations, the staff used a discount rate of 20 percent, a five-year time horizon, and ignored taxes and terminal value. What is the relative attractiveness of these three alternatives?
   2. In the second set, they used a 10 percent discount rate. What happens to the NPV of each alternative? What happens to their relative attractiveness? Why?
   3. In the third set, they changed the time horizon to 10 years, but kept the 10 percent discount rate. Why does Ian say he has “bad news” for the others?
2. In addition to reducing costs, the new technology proposed for the greenfield plant would increase manufacturing flexibility, which would enable CTI to respond more quickly to customers and to provide them more custom features. Should these factors be considered in the analysis? If so, how would you incorporate them?
3. Should other factors be taken into consideration in choosing the location of the FlexConnex plant? If so, what are they?
4. Should Tom Richards continue to develop more detailed plans for these three alternatives? If not, which should be eliminated? Are there other alternatives that his staff should consider? If so, what are they?

Exhibit I (FlexConnex Cost Analysis Sheet Santa Clara Plant, 2002)

Plant Capacity: 75 million units

Selling Price/Unit: $0.85

Variable Cost/Unit: $0.255

Fixed Manufacturing Cost: $9.5 Million annually (includes $2.5 million depreciation)

Estimated Plant Profitability at Capacity:

Revenue: $63,750,000

Variable Cost: <19,125,000>

Fixed Manufacturing Cost: <9,500,000>

Plant Profitability (Includes interest expenses and corporate selling, general and administrative expenses): $35,125,000