

Case 1

New Office Equipment

by

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You are one of the first engineers hired into the manufacturing engineering department at a brand new facility for producing aircraft engine controls. Your department is responsible for selecting, justifying, and installing all equipment for the factory. Most of the production equipment is being transferred up from the old facility in Fairfield, about a 3-hour drive away. The first production line has just been installed, and 8 more will be implemented over the next few months. When fully operational, approximately 700 production personnel will be employed on the factory floor. Most of your time is being spent on the shop floor learning about the equipment and trying to help with the installation process.

Right now most of the office cubicles are empty, but more people are being hired and transferring in from the main plant every week. Around 100 support personnel in operations management, quality engineering, manufacturing engineering, computer information systems, finance, purchasing, and human resources will have cubicle offices in a very large open area. Managers of each of the departments have already arrived. A separate design engineering liaison office will have approximately 20 personnel. The plant manager has a separate office suite.

Since the manufacturing engineering department is responsible for selecting and justifying all new equipment, it is being tasked with selecting and justifying the copy machines for the new office. For the transition period, two small copiers were purchased, one for the plant manager's office and another for receiving inspection. A few small copy

machines were rented and placed around the office area, but now a decision must be made on equipment for full plant operation.

The manufacturing engineering manager has selected you for this project. In giving you this assignment, she tells you that she understands that it is not a very exciting piece of equipment for your first justification project. She explains that the task is a very important one, and it will give you the opportunity to meet personnel in all the other departments. It will also help you learn the steps of the machine selection and implementation process. The phone rings about then, and the manager is called to the shop floor to decide what to do with a machine that was damaged in transit. As she leaves, she asks you to start talking to people about their needs and to outline the steps you think would need to be taken to get this project done. She says she will review the outline with you tomorrow.

You should consider the following in preparing your outline:

1. How would you find out what the needs are for copy machines?
2. What are the project's objectives? Would different people in the office have different objectives? Are any of these objectives conflicting?
3. How can you find out what type of equipment is available and what it costs?
4. What additional considerations would you have to make in deciding on equipment and where to physically locate it?
5. How will you develop, evaluate, and compare alternatives?
6. Who do you think would have to approve your proposal?
7. How do you think an order would actually get placed for the equipment?
8. What steps might need to be taken before the equipment actually arrives to prepare for installation?
9. When should you follow-up to see that the equipment is meeting the needs?
10. How do the defined steps fit into the framework of the engineering design process? Where do the tools of an economic analysis fit in?

Case 2

Budgeting Issues

by

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Your new job is being an engineering manager in a division of a large firm. One of your first responsibilities is to prepare and submit a budget for next year's departmental expenses. Included in the expense budget are office and maintenance supplies, travel, education, and hospitality. You look at last year's budget and see that \$50,000 was requested but only \$45,000 was approved. In looking at the expenditures to date, you notice that, with three months remaining in the fiscal year, you still have \$20,000 left in the expense account. The budget request is due in two weeks. You decide to ask managers from other divisions how they go about preparing their budget submissions.

The manager at the Greenville Division tells you that he always submits 10% more than last year's request. She comments that they always cut you about 20%.

The manager at the Newtown Division tells you that he tries to figure out where he will be with his expenditures at the end of this fiscal year, then estimates 15% higher for the next year. He says his first year he really had to scramble to cover his expenses because he only asked for what he thought he needed and they gave him 15% less.

The Boston Division manager says that he has all his personnel submit a "wish list" of items to put into the expense budget. He puts in for the whole amount, but tells his employees not to expect everything on the list. He also tells you that he always makes sure to be slightly over budget in any given fiscal year so that he can justify increasing the budget for the following year. He emphasized that if you don't spend all that you are given in a budget year, that they will probably give you even less the following year.

Suggestions to the Student:

1. What additional information would you want to have before preparing your budget submission?
2. What “strategies” could you take in submitting the budget?
3. Which strategies do you feel will most likely result in getting the amount of money that you need to run your department the following year?
4. What are the ethical implications of each of the strategies?

Case 3

Wildcat Oil in Kasakstan

by

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Wildcat Oil has recently discovered a new 500 million barrel crude oil reservoir in Kasakstan. Reservoir engineers predict recovery of about 300 million barrels with current technology. The firm needs a preliminary cost estimate for a feasibility study of a facility to produce the oil and prepare it for pipeline transmission. Wildcat has paid the Kasakstan government \$400M in up-front lease costs. Additionally, the Kasakstan government will receive 10% of the net revenues (value/barrel [bbl] – operating costs – transportation costs). After 100 million barrels have been produced, all facilities and the remaining oil will belong to the Kasakstan government.

The feasibility study should optimize the trade-off between capital investment and production capacity in barrels/day (bbl/day). Engineering on a generic 36,000 bbl/day facility identified the major equipment items. Vendors have provided equipment costs for the five classes of major equipment (see Table 3-1) for this size facility. The factor estimates shown in Table 3-1 for all equipment, piping, and controls linked with each class of major equipment have been compiled from Wildcat's database based on past experience. For example, the total cost linked with the turbines is 2.5 times the \$33.2 million (including the turbine cost).

Wildcat Oil uses a price of \$19.50/bbl for oil of this quality delivered to the Kasakstan tanker facility. Facility operating costs are estimated at \$4.50/bbl, and transportation to the tanker facility is estimated at \$1.25/bbl. Production of all oil fields follows a decline curve;

however, negotiations between the government and Wildcat Oil have sized the facility so that production is basically constant through the period of Wildcat's ownership of the facility.

For estimating the cost of different size facilities, the production facility can be classed as a large refinery (with a power sizing or capacity exponent or Lang factor of .67).

Table 3-1 Cost Estimation Basis

<u>Item</u>	<u>Cost (Millions of \$)</u>	<u>Factor Estimates</u>
Turbines	33.2	2.5
Compressors	24.8	2.8
Vessels & tanks	25.6	2.7
Valves	7.2	3.8
Switchgear	4.8	2.4

Suggestions for the Student:

1. What point of view should you take for analyzing this project?
2. How much should be budgeted for the 36,000 bbl/day production facility?
3. What additional costs and benefit(s), if any, are there to be derived from resizing the facility to process an additional 5,000 bbl/day?

Options:

1. What is the present worth of this project with a 36,000-bbl/day facility? An interest rate of 15% per year is appropriate for this type of investment.
2. Is the larger facility a wise investment?

Case 4

Balder-Dash Inc.

by

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Balder-Dash Inc. (B-DI) is a large conglomerate with both manufacturing and service-based businesses. B-DI's goal is to provide its customers (who are original equipment manufacturers or OEMs) one-stop shopping for a wide range of component parts. B-DI's customers will pay a small premium for quality but are extremely cost conscious.

An opportunity to purchase an item it currently produces to sell as part of a bundle of products to one of its major customers has occurred. You have been assigned to recommend a course of action.

The item in question, a small fabricated metal part, currently is sold for \$5.00 and has annual demand of 10,000 units. Demand is stable and reasonably uniform throughout the year. One of B-DI's suppliers was asked to quote the part and has come back with a price of \$4.00. The current standard cost for this part is \$6.70. The G&A (general and administrative) and R&D (research and development) costs add 20% to the standard cost for figuring profits on a per item basis. Accounting and purchasing have recommended discontinuing the part since no profit is made on the part. Marketing has proposed that the part be outsourced, which will convert an annual loss of \$30,400 into a small profit. Marketing has indicated that discontinuing the part will not directly impact sales of the remainder of the bundle to the major customer but has expressed a concern that while pricing this item, the customer would "shop around" for other items in the bundle.

The current cost accounting picture is shown in Table 4-1.

Table 4-1 Current Standard Cost for Manufactured Part

<u>Cost item</u>	<u>Cost per Unit</u>	<u>Annual Total</u>
Direct material	1.00	10,000
Direct labor	4.00	40,000
Indirect labor (supervision)	1.20	12,000
<u>Indirect overhead (warehouse)</u>	<u>.50</u>	<u>5,000</u>
Total manufacturing costs	6.70	67,000
<u>G&A / R&D costs</u>	<u>1.34</u>	<u>13,400</u>
<u>Total revenues</u>	<u>5.00</u>	<u>50,000</u>
Profit (loss)	(3.04)	(30,400)

The proposed cost accounting picture is shown in Table 4.2.

Table 4-2 Proposed Standard Cost for Purchased Part

<u>Cost Item</u>	<u>Cost per Unit</u>	<u>Annual Total</u>
Direct material	4.00	40,000
Direct labor	0.00	0
Indirect labor (supervision)	0.00	0
<u>Indirect overhead</u>	<u>0.00</u>	<u>0</u>
Total manufacturing costs	4.00	40,000
<u>G&A / R&D costs</u>	<u>.80</u>	<u>8,000</u>
<u>Total revenues</u>	<u>5.00</u>	<u>50,000</u>
Profit (loss)	.20	2,000

The Manufacturing Process

Manufacturing takes place in a 1000 square foot area in an under-utilized warehouse on the main plant site. With improvements to planning and scheduling, lead times are dropping as are inventory requirements. It is projected that the raw material inventory will increase slightly over the next few years due to increases in demand, the work-in-process inventory will be stable, and the finished goods inventories will decline. Total warehousing requirements are expected to remain stable over the next five years.

The plant uses an overhead allocation of \$5.00 per square foot per year. This is based on the plant's electric bill of \$500,000; other utilities at \$150,000; and building and grounds, maintenance, janitorial, and so forth at another \$850,000. There are 300,000 square feet on the site, so the allocated cost is \$1,500,000 over 300,000 square feet, which equals \$5 per square foot per year.

The supervisor assigned to this product supports this product in addition to other duties in the main production facility. These duties include scheduling, maintenance oversight, as well as direction of direct labor for one of the plant's two main production departments—machining operations. When the part in question is being made, which is infrequent, this supervisor will visit the warehouse several times a day to assess the status of production. Currently one-fifth of his full time salary of \$60,000 per year (including labor-related overhead) is allocated to this product.

As stated previously, this part is produced infrequently. When production of the part is in process, "production associates" from the "floater pool" (a group of cross-trained workers who fill in for vacations, sickness, and worker absences) are used. If five of the production associates in the labor pool are available, average weekly demand can be satisfied in one day. If fewer than five production associates are available, production takes correspondingly longer. Annual direct labor requirements for this part thus equate to one full time employee or \$40,000 per year (including labor-related overhead).

The raw material for the part in question costs \$1.00/kg if purchased new. However, the raw material for this part is not purchased directly but is the recovered drop from the production of another part (XV12C). The part in question consumes about half the drops from current production levels for XV12C. The drops not used in making the part in question are sold as scrap for \$.25/kg (each drop weighs .75 kg). Currently, XV12C production is forecast to remain at current levels for the next three years.

G&A and R&D are allocated based on 20% of the cost of goods manufactured.

Suggestions for the Student:

1. Are there any inaccuracies in the standard costs?
2. Should the part in question be outsourced?
3. What is the financial impact of your recommendation?
4. What other recommendations (or investigations) would you make (or start) based on your findings to date?

