

### Chapter Overview

- 1) Overview – This chapter discusses the process for selecting which of the many projects an organization could pursue and it should pursue. It introduces techniques for evaluating and making the selection. The chapter also introduces concepts of risk and applies them to the analysis typically performed during the project selection process.
- 2) Project Management Maturity – Many organizations use maturity models to determine their level of mastery of project management processes and skills.
- 3) Project Selection Criteria and Models – Organizations should use consistent and rational tools to select among the myriad of projects from which they have to choose. There are many models for the selection process to choose from as well. Good criteria for choosing the selection model are:
  - a) Realism – The model should take the organization's situation into account including limits on people, facilities, and capital.
  - b) Capability – The model should be capable of dealing with the complexities of the organization's environment.
  - c) Flexibility – The model should work under a range of conditions.
  - d) Ease of use – The model should be relatively easy to use and understand.
  - e) Cost – The model should not be costly to use.
  - f) Easy computerization – The model should be easy to capture and modify in a computer.
- 4) The Nature of Project Selection Models – Models are useful tools to aid in decision making. They are not, however, the decision maker, nor do they ever completely represent the reality confronting modern organizations. Any criteria developed for project selection should be weighted to represent the degree to which that factor contributes to the organization's goals.
- 5) Types of Project Selection Models
  - a) Nonnumeric Models – These models do not attempt to reduce the evaluation process to numbers, but instead look at other factors that make for "obvious" choices for that organization. These models could include senior management mandates and regulatory necessities. Examples include *The Sacred Cow*, *The Operating Necessity*, *The Competitive Necessity*, *The Product Line Extension*, and *Comparative Benefit Model*.
  - b) Numeric Models: Profit/Profitability – These models analyze the potential projects in terms of the single criteria of monetary return. The analysis may or may not include the time value of money. These include traditional measures such as *Payback Period*, *Discounted Cash Flow* (also referred to as Net Present Value), *IRR*, and *Profitability Index*.

- c) **Numeric Models: Real Options** – These models are based on the concept of an investment that leads to opportunities that would not have been available otherwise. This model chooses investments that may not be profitable or beneficial in the near future, but will lead to options for the future with a great promise.
  - d) **Numeric Models: Scoring** – These models analyze the potential projects based on multiple criteria the organization selects. The models use numeric scales to rate the projects against the desired criteria. Then the ratings can be analyzed using various techniques to determine the best choices. Examples include *Unweighted 0-1 Factor Model*, *Unweighted Factor Scoring Model*, *Weighted Factor Scoring Model*, and *Window of Opportunity Analysis*.
  - e) **Numeric Models: Window-of-Opportunity Analysis** – This model attempts to determine the cost, timing, and performance specifications of a new technology to understand whether it qualifies as useful and economic. Having thus estimated the economic impact of the innovation, the decision of whether or not to undertake the development project is much simpler.
  - f) **Numeric Models: Discovery-Driven Planning** – Similar to window of opportunity analysis model, this model funds a portion of the project and tries to determine two important aspects about the project: the critical assumptions and the cost of testing each assumption. Analyzing the assumptions enables the management team to find out if a project continues to be as promising as was believed or a change of strategy is required.
  - g) **Choosing a Project Selection Model** – The authors strongly favor using weighted scoring models.
- 6) **Risk Considerations in Project Selection** – The text distinguishes between risk and uncertainty. Risk applies to events that have a known (or estimated) probability of occurrence. Uncertainty applies to events where there is insufficient data to estimate the probability of occurrence. For effective project management, decisions should be treated as risks rather than uncertainties. That is probabilities of occurrence, if not otherwise known, should be estimated for relevant issues and events.
- 7) **Project Portfolio Process (PPP)** – The Project Portfolio Process is used to consistently and transparently select projects that match the organization's goals. The process has eight steps:
- a) **Step 1: Establish a Project Council** – The council is established to articulate strategic direction and allocate funds to projects it selects.
  - b) **Step 2: Identify Project Categories and Criteria** – Categories are established by the Council to ensure that a variety of projects are pursued. Criteria for measuring prospective projects are established to form the

- framework for the selection process. Common categories used for classifying projects are:
- i) Derivative projects – Projects that are only incrementally different from previous efforts.
  - ii) Platform projects – Projects that impact organization outputs or the processes that create them.
  - iii) Breakthrough projects – Projects that involve implementing new, sometimes “disruptive” technology.
  - iv) R&D projects – Projects used to acquire new knowledge or create new technology.
- c) Step 3: Collect Project Data – Collect relevant data and assign scores to prospective projects.
  - d) Step 4: Assess Resource Availability – Analyze the availability of resources to execute the prospective projects.
  - e) Step 5: Reduce the Project and Criteria Set – Use multiple screens to narrow down the number of projects under consideration.
  - f) Step 6: Prioritize the Projects within Categories – Using the analysis developed, prioritize the projects within the previously identified categories.
  - g) Step 7: Select the Projects to be Funded and Held in Reserve – The first task in this step is determination of the mix of projects across the various categories and time periods. The next task is to leave some percent of the organization's resource capacity free for new opportunities, crises in existing projects, errors in estimates, and so on. Then allocate the categorized projects in rank order to the categories according to the mix desired.
  - h) Step 8: Implement the Process – The results of the process must be recorded, and then widely communicated within the organization.
- 8) Project Bids and RFPs – This section introduces the documentation necessary to present a prospective project to a selection process. The text equates the internal project selection process with that of a prospective customer using a Request for Proposal (RFP) or Request for Quote (RFQ) process. The proposal documentation required by the customer is much different than that needed for the internal analysis. In fact, part of the bid/no bid analysis is evaluating the cost to prepare the RFP or RFQ knowing that the organization could lose. For large military or space projects the preparation costs can run into the millions of dollars. Regardless of whether it's for internal or external consumptions, or for a technical or nontechnical project, the proposal should be prepared with care.

- a) The Technical Approach – This section summarizes what the problem is and how it will be approached by the project.
- b) The Implementation Plan – This section summarizes the schedule, cost and resources estimated to complete the project.
- c) The Plan for Logistic Support and Administration – This section summarizes the support that the project will need and how it will be administered.
- d) Past Experience – This section summarizes the past projects undertaken by key personnel along with their titles and qualifications.

### Teaching Tips

Most students will benefit from in-class examples to make the material come alive. One area that will benefit from this approach is the use of Crystal Ball<sup>®</sup>. In spite of the hype of software makers, all students will not have the ability to sit down and use Crystal Ball<sup>®</sup> without some assistance. Demonstrating the example in the text with a computer and a projector will help students understand the process and generate a lot of good questions.

The other area that requires demonstration is the project selection process. Students need to see the criteria in action and see how a real scoring model would work. A good way to accomplish these goals is to use the Pan-Europa Case Study as an in-class exercise. There are a couple of ways to approach this. The simpler process would be to have the students read the case in advance. Then questions 1, 2, and 3 can be discussed with the class as a whole. Questions 4 and 5 can be addressed through pair-wise brainstorming (discussed in the Teaching Tips for Chapter 1). The student teams would take notes on their answers to these questions to then be discussed with the class as a whole. The result of this discussion would be used to come up with a class consensus view on the screens and criteria to be used for the project selection process. Then the students could go back to working in pairs (preferably the same ones as before) to apply the criteria and make their selections. Then another whole class discussion can be used to share each group's results and see if a class consensus emerges. This whole process, depending on the vigor of the class would take 2-3 hours. It is important for the instructor to circulate during the small group discussions to keep the students on track and answer their questions. This is particularly important as there are multiple questions embedded in Questions 4 and 5, and students will have a tendency to get hung up on one to the exclusion of the others. The instructor may wish to suggest a time budget for each question to assist the group's progress.

A more elaborate approach to this case would involve students role-playing the members of the Pan-Europa board. Then the "board members" would have the opportunity to advocate their own projects and try to influence the selection process in their favor. Depending on the size of the class, this technique may not keep enough of the students involved. One way to address this would be to assign a team of students to each board member to assist them in establishing their

position. Then the board member becomes essentially a spokesman for the group. Again, it's important to alternate between whole class and small group activities to ensure the maximum participation of each student. This could be accomplished by the groups meeting to discuss their position, a "presentation" to the whole class by each board member, then another group discussion of criteria, followed by presentations to the whole class of the recommended criteria with an undoubtedly vigorous discussion to follow.

A good reference case for this chapter follows:

9-305-101 **Boeing 787: The Dreamliner** (Harvard). This is an excellent strategy case and is so recent that it is reported in the papers and business magazines almost every week.

### **Material Review Questions**

#### **Question 1:**

Refer to Section 2.6 in the text. A proposal should be responsive to the solicitation document that the buyer prepared during the solicitation process. Usually, a technical proposal will contain:

- 1) the nature of the technical problem and how it is to be approached.
- 2) the plan for implementing the project once it has been accepted.
- 3) the plan for logistic support and administration of the project.
- 4) a description of the group proposing to do the work, plus its past experience in similar work.

#### **Question 2:**

Managers often judge selection criteria by their own narrow interests. These could include their own advancement or sub-optimizing the products and processes of their own department. This bias clearly could be to the detriment of the overall corporate goals and well being.

Refer to Section 2.2 in the text. Instead, the project selection models should be able to evaluate how well a project's execution will contribute to the overall business strategy of the performing organization. Some commonly used standards of judgment include:

- 1) Realism
- 2) Capability
- 3) Flexibility
- 4) Ease of use
- 5) Cost
- 6) Easy computerization

**Question 3:**

Refer to Section 2.3 in the text. Both models are examples of nonnumeric models. Moreover, both models will tend to sustain an existing status quo and are subject to misuse in pursuit of hidden agendas of key stakeholders.

- 1) *Operating Necessity Model*: The operating necessity project is perceived as a necessity to maintain the status quo for operations. If the plant is flooded by a hurricane, it's an operating necessity to dry it out and restore production. The advantage of this model is that it involves little data and fairly obvious decisions. The disadvantage is that relying on it to solve problems may mask a long-term issue that needs to be solved in a manner other than firefighting. Perhaps, for example, the plant needs to be moved to a different location to prevent frequent flooding.
- 2) *Competitive Necessity Model*: The competitive necessity project is perceived as a necessity to keep from losing the current competitive position. For example, a video rental chain that operates in physical stores might decide to add an Internet based ordering facility to stay competitive with Internet only operations. Again the decision making process can seem simple, but the danger is similar to the operating necessity model. The "obvious" decision on what to do quickly to maintain a competitive position may, in fact, be the wrong thing to do in the long run.

**Question 4:**

Refer to Section 2.3 in the text. In the United States, the term "sacred cow" has become an idiom used to denote someone or something that is exempt from criticism. A senior manager's blind loyalty to an obsolete product or process they introduced to the company long ago is an example of a sacred cow. Another example would be a company's loyalty to a product line, like Hershey to chocolate, even if it were a money loser.

**Question 5:**

Refer to Section 2.3 of the text. Q-Sort is a nonnumeric technique managers can use to evaluate comparative benefits associated with a list of potential projects. This type of selection model is useful when a goal has many potential alternatives for implementation. For example, what experiments should NASA engineers include in the next Mars Probe? What projects should be included in the company's R&D portfolio? Which archeology projects would best illustrate the lifestyle of the cave dwellers that inhabited Colorado in the first millennium AD?

A company may use this method to evaluate several projects to choose from. The potential projects could be grouped by the level of strategic importance, then by cost, then by time required to complete. By using this method, the "best" projects to start could be selected using these criteria.

**Question 6:**

Refer to Section 2.3 in the text. Models, like projects, have characteristics that influence when a decision-maker should use the model.

Models cannot make decisions for its user. The user should understand the advantages and disadvantages of each model in reference to the goals associated with the scenario's reality. Each model will provide a limited viewpoint about the reality it represents. It may

be beneficial to consider the model's appropriateness from different perspectives before actually using it to evaluate selection alternatives.

Although not specifically mentioned in the text, the following can be influenced as well:

- 1) The applicability of a model is one such characteristic that reflects the range of scenarios that the model can reasonably support.
- 2) The model should make a scenario more understandable by reducing its complexity. However, when a model reduces a scenario's complexity, an important distortion of the scenario may also be experienced. The distortion may happen because many important factors have been left out of the model in order to make it easier to use or more understandable to the user.
- 3) Models are only as good as the data they receive. Bad data will lead to a bad analysis.

**Question 7:**

Profitability models analyze a potential project using a single criterion—monetary return. Time value of money may or may not be included in this analysis.

Real options models are based on the concept of investing now to create opportunities for the future. This model analyzes a potential project in terms of options it generates for a firm in the future. The investment may or may not be profitable or beneficial in the near future.

**Question 8**

Refer to Section 2.3 in the text. The models in this question fall into the general category of profitability models.

- 1) The internal rate of return model can result in multiple solutions. Discounted cash flow method results in a definite solution.
- 2) Payback-type model ignores cash flows beyond the payback period. Discounted cash flow method does not ignore cash flows beyond the pay back period.
- 3) Payback-type model is a model that does not include discounting, ignores the timing of the cash flows and time—value of money. Discounted cash flow method is a model that includes discounting, does not ignore the timing of the cash flows and the time—value of money.

**Question 9:**

Refer to Section 2.3 in the text. A profitability model will assess the financial gain on the use of capital during a period of operations. Profitability models as a general class of models have advantages and disadvantages that include:

*Advantages:*

- 1) They are simple to use and understand.
- 2) Relevant data are available from the accounting system.
- 3) Business decision makers are familiar with the output formats.
- 4) With a few exceptions, model output is on an “absolute” profit/profitability scale and allows “absolute” go/no-go decisions.
- 5) Some profitability models can be amended to account for project risk.

*Disadvantages:*

- 1) Except for risk factors, these models ignore other nonmonetary factors.

- 2) Some of the profitability models do not evaluate the timing of cash flows.
- 3) Present value models have a short-term bias that tends to ignore long-run opportunities.
- 4) Payback-type models ignore cash flows beyond the payback period.
- 5) The internal rate return model can generate multiple solutions.
- 6) All models in this class are sensitive to data input errors, especially during the early periods of the project's planning horizon.
- 7) Discounting models are nonlinear. Hence, decision makers are seldom able to recognize the impact of changes (or errors) in the values of parameters used in the models.
- 8) All these models depend on input for the determination of cash flows, but it is not clear exactly how the concept of cash flow is properly defined for the purpose of evaluating projects.

**Question 10:**

The desired result is to evaluate each of the projects and continue with those that are closely related to the organization's mission, goals, and strategy. The project portfolio process also helps in monitoring and controlling the organization's strategic projects. Usually many firms find that only a few projects are checked for alignment with the organization's strategy before granting approval for a project. Thus, these kinds of projects neither add value nor help in gaining competitive advantage in accordance with the goals of a firm.

**Question 11:**

The discovery driven planning approach model funds a portion of the project and tries to determine two important aspects about the project: the critical assumptions and the cost of testing each assumption. Analyzing the assumptions enables the management team to find out if a project continues to be as promising as was believed or a change of strategy is required.

**Question 12:**

Refer to Section 2.5 of the text. A portfolio contains projects undertaken to support business goals. The eight-step project portfolio process of is as follows:

- 1) Establish a project council
- 2) Identify project categories and criteria
- 3) Collect project data
- 4) Assess resource availability
- 5) Reduce the project and criteria set
- 6) Prioritize the projects within categories
- 7) Select the projects to be funded and held in reserve
- 8) Implement the process

**Question 13**

Refer to the glossary of the text. In the context of the text, maturity is "the sophistication and experience of an organization in managing multiple projects."

**Question 14**

Most firms do not score very well in terms of maturity. Of the firms surveyed, about three-quarters of the firms are no higher than level 2 (planned) and fewer than 6 percent are above level 3 (managed).

**Class Discussion Questions**

**Question 15:**

Refer to Section 2.5 in the text.

- 1) *Low project management maturity:*
  - a) To make managers aware of the number of projects both proposed and underway.
  - b) To identify proposed projects that are not really projects and should be handled using other processes.
  - c) To have managers achieve consensus on what criteria should be used to select projects.
  - d) To limit the number of projects so the important projects can get the resources and attention they need for success.
  - e) To eliminate projects that bypassed a formal selection process and may not provide benefits corresponding to their risks and/or costs.
  - f) To keep from overloading the organization's available capacity.
  - g) To balance short-, medium-, and long-term returns.
- 2) *High project management maturity:*
  - a) To prioritize the list of available projects.
  - b) To limit the number of projects so the important projects can get the resources and attention they need for success.
  - c) To identify projects that best fit the organization's goals and strategy.
  - d) To identify projects that support multiple organizational goals and cross-reinforce other important projects.
  - e) To eliminate projects that incur excessive risk and/or cost.
  - f) To balance short-, medium-, and long-term returns.
  - g) To balance the resources with the needs of the organization.

**Question 16:**

Refer to Section 2.3 in the text. It attempts to estimate the opportunity cost of implementing the project now versus deferring its execution to some time in the future. The cost of the project is reduced by deferring it and there may also be a reduction in uncertainty.

**Question 17:**

Refer to Section 2.3 in the text. The profitability model is primarily a single criterion numeric model. The scoring models evaluate multiple criteria by converting their values to a normalized scale that facilitates making a holistic decision capable of using both numeric and nonnumeric variables. Any scoring model can include profitability as a criterion, thus getting the best of both worlds.

**Question 18:**

The window of opportunity approach seeks to determine the cost, timing, and performance specification of a new technology to find out if it can be useful to pursue development. While the discovery-driven planning approach funds a portion of the project and determines if the critical assumptions of the project come out to be true. The analysis of these results allows the team to identify flaws in its strategies and make necessary changes before heavy rework has to be done, thus increasing costs and time. The discovery-driven approach is often used in multiple phases of the project development to keep the project on track and under control.

**Question 19:**

- 1) *Capital Investment with Discounted Cash flow*: For short-term capital projects, the impact of discounting rates may be insignificant to the overall project. Discounting is a nonlinear algorithm that increases its impact as the duration of a project increases. On long-term capital projects, the discounting models can be quite elaborate and may even drive work plans by delaying one or more expenditures to increase return on investment.
- 2) *Simulation Models*: Simulation models are easy to misuse, but when used properly can be very helpful. For most applications suitable for such an analysis, the project manager should seek competent advice from someone who has demonstrated expertise in creating and manipulating these models. Simulation models (discussed later) can also be used to estimate the probability of completing the project within a given time frame at a given cost. Some organizations will require that such analysis be included in proposals they receive from prospective bidders.

**Question 20:**

There are several reasons why managers may underutilize selection models:

- 1) In many organizations, the project managers are self-taught, so they may be unaware of these techniques.
- 2) Even if some of the managers are aware, their senior management may not be familiar or comfortable with selection models.
- 3) The managers may not think the models are worth the time and trouble. They believe that they get good enough results with the techniques they currently use.
- 4) Managers may believe that using analytic techniques will reduce their personal ability to influence the selection process. They may not want to give up their perceived power.

**Question 21:**

Uncertainty models can be classified as one of the variety of models depending on how they are used. "Uncertainty" in this context means that the analyst has not estimated the probability of occurrence of something related to the project. This could be cost, cash flow, schedule, customer satisfaction, or environmental catastrophe. The list is endless. Since any of these factors could be part of a selection model, "uncertainty" and how it is handled could affect them all.

**Question 22:**

Project management maturity measures the ability of an organization to manage projects. It doesn't distinguish between multiple projects and a single project environment.

**Question 23:**

Refer to Section 2.3 of the text. When an organization can describe a project in terms of a compelling need for action, and when the called-for action will produce benefits in rough proportion to the costs of executing the project, nonnumeric selection models will often be adequate to approve the project. The compelling reason may be responding to an emergency situation like a flood. There isn't a lot of need to analyze the necessity for a response so nonnumeric criteria are fine. In other cases, numeric methods may be more appropriate as in a case where cost estimates can be obtained.

**Question 24:**

A number of ethical issues can come up during the RFP process, such as:

- Gaining confidential knowledge of a competitor's data or the customer's criteria.
- Deliberately bidding below cost to win the job believing that the real money will be made in charging the customer for changes.
- Bribes or other favors to the people who choose the winning proposal.
- Collaborating with the competition (or the customer) to set the bids to favor a preselected winner.

**Question 25:**

The size of the projects plotted on the array indicates the size/resource needs of the project and the shape may indicate another aspect of the project, e.g., internal/external, long/medium/ short term, or whatever aspect needs to be shown. The numbers indicate the order, or time frame, in which the projects are to be (or were) implemented, separated by category, if desired.

The aggregate project plan can be used for many purposes:

- To view the mix of projects within each illustrated aspect (shape)
- To analyze and adjust the mix of projects within each category or aspect
- To assess the resource demands on the organization, indicated by the size, timing, and number of projects shown
- To identify and adjust the gaps in the categories, aspects, sizes, and timing of the projects
- To identify potential career paths for developing project managers, such as team member of a derivative project, then team member of a platform project, manager of a derivative project, member of a breakthrough project, and so on

**Question 26:**

Plan of record includes “Priority”. This is not shown by the aggregate project plan.

**Question 27:**

The reason is that that sustainability not only covers profitability issues but also covers environmental issues and social issues. The metrics are yet to be developed to quantify the profits that sustainability achieves.

**Questions for Project Management in Practice**

**Implementing Strategy through Projects at Blue Cross/Blue Shield**

**Question 28:**

The approach is top-down, where the goals are still set by the senior management team. Using this approach, however, the senior management team is able to express their strategic desires through the specific projects they select and monitor. This ties together the day-to-day activities with the strategic point of view.

**Question 29:**

The role of projects and their management is to execute the activities that will bring life to the corporate strategic vision. Using projects as opposed to functional organizations leads to a number of benefits including:

- 1) Lower costs
- 2) Better management of projects
- 3) Improved project success

**Question 30:**

This system will give on-going visibility of the status of projects to important members of the senior management team. This keeps senior management grounded in the problems associated with executing real projects. It benefits the project teams by giving them the benefit of senior management’s experience as the projects encounter issues during execution. It ensures senior management support for the project results while exposing the talents of the project teams to them.

**Project Selection for Spent Nuclear Fuel Cleanup**

**Question 31:**

It is likely that some stakeholders simply did not believe the problem existed. Others probably were worried that the proposed solutions would only worsen the situation.

**Question 32:**

Probably the authorities were less than honest in the past with some of the stakeholders.

**Question 33:**

- Option 1 simply puts a band-aid on the problem by leaving the containers at their present location, albeit in a second shell. Most stakeholders would have probably viewed this as an unacceptable alternative.
- Option 2 is an example for insanity—doing the same thing over again and expecting a different result. Most stakeholders would have probably recognized the potential of future leaks similar to the present situation.
- Option 4 transfers the problem to another location and would have certainly raised some interesting ethical dilemmas for the stakeholders.

**Question 34:**

Option 3 repackages the fuel until the government can reprocess it during a 40-year period. The repackaging should prevent leaks until well after reprocessing has been completed.

**Using a Project Portfolio to Achieve 100% On-Time Delivery at Decor Cabinets**

**Question 35:**

No. Special products divert management and workers' attention and either require a different process to produce the product or hinder the improvement of standard processes to produce the standard products. On the other hand, it might be a good idea to choose some of the projects with a higher potential payoff in order to diversify the project portfolio.

**Question 36:**

Part of the problem in this dilemma is defining what the investment is. Too often return on investment (ROI) is narrowly interpreted to mean physical facilities, ignoring the firm's investment in people, maintenance, research, development, skills, training, etc. Any manager can look good on short term ROI measures by quickly eliminating all these long term investments, but the firm will eventually wither and go bankrupt.

**Taipei 101: Refitted as World's Tallest Sustainable Building**

**Question 37:**

The owners of the building wanted to show the world that it is possible to make an existing building sustainable by winning a LEED certification. By picking the tallest building in East Asia and succeeding in their endeavor they showed the world that it is possible to make an existing building sustainable rather than starting from scratch.

**Question 38:**

Sustainability does, of course, call for incorporating environmental concerns into project decision-making, like tenants in Taipei 101 incorporating healthy office environments (air-quality testing, environmental inspections), but it should cover social issues, like maintaining office etiquette, treating all employees fairly, helping fellow co-workers, etc.

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The social issues are the aspect of the tenant's habits and routines that relate to sustainability, as opposed to "green."

**Problems**

**Problem 1:**

- 1) *Project A*: Payback Period =  $\$250,000/\$75,000 = 3.3$  years.  
 2) *Project B*: Payback Period =  $\$150,000/\$52,000 = 2.9$  years  
 Project B is better because it has a shorter payback period.

**Problem 2:**

Payback period =  $\$200,000/\$30,000 = 6.7$  years

**Problem 3:**

i = 20%					
	Investment	Yr 1	Yr 2	Yr 3	Yr 4
<b>Cashflow</b>	\$ (75,000)	\$ 20,000	\$ 25,000	\$ 30,000	\$ 50,000
<b>PVIF</b>	1.0000	1.2000	1.4400	1.7280	2.0736
<b>PV \$</b>	\$ (75,000)	\$ 16,667	\$ 17,361	\$ 17,361	\$ 24,113
<b>NPV</b>	\$ 502				

**Problem 4:**

i = 24%					
	Investment	Yr 1	Yr 2	Yr 3	Yr 4
<b>Cashflow</b>	\$ (75,000)	\$ 20,000	\$ 25,000	\$ 30,000	\$ 50,000
<b>PVIF</b>	1.0000	1.2400	1.5376	1.9066	2.3642
<b>PV \$</b>	\$ (75,000)	\$ 16,129	\$ 16,259	\$ 15,735	\$ 21,149
<b>NPV</b>	\$ (5,729)				

The addition of 4% inflation makes the investment unfavorable at a hurdle rate of 24%.

**Problem 5:**

1) *Problem 3 PI:*

<b>Discounted Cash Outflows</b>	\$ 75,000
<b>Discounted Cash Inflows</b>	\$ 75,502
<b>Profitability Index</b>	1.007

2) *Problem 4 PI:*

<b>Discounted Cash Outflows</b>	\$ 75,000
<b>Discounted Cash Inflows</b>	\$ 69,271
<b>Profitability Index</b>	0.924

**Problem 6:**

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Year	Pessimistic	Most Likely	Optimistic	Used	PVIF	PV\$
0	\$(65,000)	\$(65,000)	\$(65,000)	\$(65,000)	1	\$(65,000)
1	\$14,000	\$20,000	\$22,000	\$20,000	1.200	\$16,667
2	\$19,000	\$25,000	\$30,000	\$25,000	1.44	\$17,361
3	\$27,000	\$30,000	\$36,000	\$30,000	1.728	\$17,361
4	\$32,000	\$35,000	\$39,000	\$35,000	2.0736	\$16,879
<b>Rate</b>	20%			<b>NPV</b>	\$3,268	

The column labeled "Used" indicates the cash flow value used to calculate the net present value.

The profitability index is the sum of the discounted cash flows divided by the initial investment. For this problem it is the sum of the PV's for years 1-4 divided by \$65,000 or:

$$68,268/65,000 = 1.05$$

Since the value is greater than one, the project should be accepted (assuming everything else is equal).

**Problem 7:**

In this example, Method C has the highest score, so the decision-maker would regard it as

		<i>Method Options</i>					
		<i>Grade</i>			<i>Score</i>		
<i>Category</i>	<i>Weight</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>
Consulting costs	20	1	2	3	20	40	60
Acquisition time	20	2	3	1	40	60	20
Disruption	10	2	1	3	20	10	30
Cultural differences	10	3	3	2	30	30	20
Skill redundancies	10	2	1	1	20	10	10
Implementation risks	25	1	2	3	25	50	75
Infrastructure	10	2	2	2	20	20	20
<b>Total Score</b>					<b>175</b>	<b>220</b>	<b>235</b>

the best option. The instructor should emphasize that it is not necessary for the weights to sum to 100. It is only necessary that the model use the same scoring categories to evaluate each option.

**Problem 8:**

- a) Implementation risks = 10 and cultural differences = 25

		<i>Method Options</i>					
		<i>Grade</i>			<i>Score</i>		
<i>Category</i>	<i>Weight</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>
Consulting costs	20	1	2	3	20	40	60
Acquisition time	20	2	3	1	40	60	20
Disruption	10	2	1	3	20	10	30
Cultural differences	25	3	3	2	75	75	50
Skill redundancies	10	2	1	1	20	10	10
Implementation risks	10	1	2	3	10	20	30
Infrastructure	10	2	2	2	20	20	20
<b>Total Score</b>					<b>205</b>	<b>235</b>	<b>220</b>

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Due to the changes in weights for implementation risks and cultural differences, method B is now the best option.

- b) Using the initial values from problem 6, make the changes so that Method A implementation risks = 3 and Method C cultural differences = 2.

		<i>Method Options</i>					
		<i>Grade</i>			<i>Score</i>		
<i>Category</i>	<i>Weight</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>
Consulting costs	20	1	2	3	20	40	60
Acquisition time	20	2	3	1	40	60	20
Disruption	10	2	1	3	20	10	30
Cultural differences	10	3	3	2	30	30	20
Skill redundancies	10	2	1	1	20	10	10
Implementation risks	25	3	2	3	75	50	75
Infrastructure	10	2	2	2	20	20	20
<b>Total Score</b>					<b>225</b>	<b>220</b>	<b>235</b>

The change in A's implementation risks grade was not sufficient to replace Method C as the best option. The grade for cultural differences at Method C had already been set to 2 in the initial evaluation of the problem.

- c) Using the initial values from problem 6, insert Tax considerations = 15 and A = 3, B = 2, and C = 1.

		<i>Method Options</i>					
		<i>Grade</i>			<i>Score</i>		
<i>Category</i>	<i>Weight</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>
Consulting costs	20	1	2	3	20	40	60
Acquisition time	20	2	3	1	40	60	20
Disruption	10	2	1	3	20	10	30
Cultural differences	10	3	3	2	30	30	20
Skill redundancies	10	2	1	1	20	10	10
Implementation risks	25	1	2	3	25	50	75
Infrastructure	10	2	2	2	20	20	20
Tax considerations	15	3	2	1	45	30	15
<b>Total Score</b>					<b>220</b>	<b>250</b>	<b>250</b>

Due to the insertion of tax considerations, Methods B and C are now the best options.

**Problem 9:**

		<b>Mall Options</b>							
		<i>Grade</i>				<i>Score</i>			
<i>Category</i>	<i>Weight</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Class of clientele	1.000	2	3	1	3	2.000	3.000	1.000	3.000
Rent	0.900	3	2	1	3	2.700	1.800	0.900	2.700
Indoor mall	0.855	3	1	3	1	2.565	0.855	2.565	0.855
Traffic volume	0.720	3	2	3	1	2.160	1.440	2.160	0.720
		<b>Total Score</b>				9.425	7.095	6.625	7.275

Based upon the evaluation of categories, Nina should select Mall Option 1.

**Problem 10:**

Change the grade for Location 3's rent to 3.

		<b>Mall Options</b>							
		<i>Grade</i>				<i>Score</i>			
<i>Category</i>	<i>Weight</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
Class of clientele	1.000	2	3	1	3	2.000	3.000	1.000	3.000
Rent	0.900	3	2	3	3	2.700	1.800	2.700	2.700
Indoor mall	0.855	3	1	3	1	2.565	0.855	2.565	0.855
Traffic volume	0.720	3	2	3	1	2.160	1.440	2.160	0.720
		<b>Total Score</b>				9.425	7.095	8.425	7.275

Due to the rent change, Location 3 moves up from last place to second place based upon the grades assigned to the evaluated categories.

### **Incidents for Discussion**

#### **Portillo, Inc.**

This case is a good lead in to the whole subject of estimates. The students should, even at the college level, be able to share experiences of estimate being manipulated either up or down to support an agenda. This could be his or her own inflating of how long it will take to get something done, or a supervisor arbitrarily cutting budgets.

Ms. Portillo has discovered a fundamental truth about estimates, namely that they are always wrong. While the estimates that have been used to base the business decisions on may be technically wrong, she needs to ask whether they have still been useful. In other words, do the errors and biases cancel each other out enough to still lead to the right decision for the business? Nonetheless, she needs to share her findings with the committee. Here are some things to do to improve the accuracy of the estimates:

1. For the projects that are selected, compare the actual outcomes to the estimates to develop a database of estimating bias. The techniques for this are described in Chapter 7.
2. Train her managers on a consistent tool set and process for estimating and then follow it.
3. Allow the management team to challenge each other's estimates during the project selection process. An alternative would be to prohibit the sponsor from taking part in the decision for his or her product.
4. Bring in outside consultants to independently estimate selected projects.

#### **L & M Power**

This case is a good opportunity, particularly for college students, to try and put themselves in the place of a company promoting a high visibility project. What are all the factors that must be considered to have both the reality and perception of a successful project? How should these factors be considered in the internal process of selecting a project?

These are expensive, high visibility projects dealing with politically sensitive issues. The financial model has some useful information, but using it by itself would lead to a woefully inadequate selection process. This simple financial model does not take into account legal, environmental, safety, or community issues. It says nothing about the risk of either project completing within cost and schedule, or the risk of problems in the subsequent operations. It's not clear how this project fits into the organization's long-term goals, and this model does nothing to further that knowledge.

#### **CASE: Pan-Europa Foods S.A.**

##### **Question 1:**

- 1) Pan-Europa is currently trading at a price below comparable companies. This is because of reduced profitability and a failure to gain sufficient market share for new products. As analysts are giving a "sell" signal, raiders are potentially buying up the

stock. Clearly then they must pursue strategies that drive up their stock price. This includes increasing net income and gross sales.

- 2) Pan-Europa needs to capitalize on their hard earned increased market share.
- 3) Humbolt and Morin should be leading the charge on this strategy.

**Question 2:**

Exhibit 3 presents three different ways to look at the data. While the NPV at the minimum accepted ROR includes a risk premium, it doesn't correct for the varying durations of the project. Instead the best available data would be the Equivalent Annuity that corrects for the project durations. Using this analysis the preferred project would be 11, the Strategic Acquisition. Then following in order would be:

- Eastward Expansion
- Snack Foods
- Southward Expansion
- Inventory Control System
- Artificial Sweeteners
- New Plant
- Expanded Plant
- Automation and Conveyor System
- Expand Truck Fleet
- Effluent Treatment Program (which has no NPV)

While the Effluent Treatment Program has no formal NPV, it can be considered an investment of \$4 million now to save a cost of \$10 million in 4 years.

**Question 3:**

There are many aspects that could invalidate the simple NPV analysis of the projects. They include:

- 1) Risk
- 2) Political considerations
- 3) Regulatory issues including health, safety, and environmental
- 4) Incompatibility with the corporate strategy
- 5) Resource availability
- 6) Impact on brand or corporate image
- 7) Quality and certainty of the data used for analyzing the various projects
- 8) Synergies between the projects

Different analysis techniques and different assumptions can be used to correct for the various factors that affect each project differently. For example:

- The time value of money can be accounted for, by using discounting methods such as NPV or IRR.
- Unequal lifetimes of the projects can be accounted for by calculating the NPV to infinity or using Equivalent Annuities.
- Risk can be accounted for (at least financially) by increasing the hurdle rate.
- The different project sizes can be accounted for by multiplying the NPV by the ratio of the size of the projects or by using a profitability ratio.

**Question 4:**

- 1) Project 6, the effluent water treatment plants is a “must do” project to meet regulatory requirements; it’s just a question of when. Project 5 is potentially one as well, depending on the regulatory environment that Pan-Europa’s safety record is measured in. Both safety and environment may be significant issues to the corporation’s image and stockholders, which would tend to elevate their importance.
- 2) Projects that involve small technology changes like expanding the truck fleet would have low risk. Increasing levels of technological sophistication, such as automation or introducing artificial sweeteners, into products would also increase implementation risks. Another risk area for any producer in a capitalist environment is attempting to increase markets with new products in new areas. The prospective customers may simply choose to not buy the product. Other elements of risk include project size, complexity, and length of the period of return.
- 3) There are real synergies between the plant expansion/additions, automation, truck upgrade, and geographic expansion projects.
- 4) Projects that have nonquantitative costs and benefits would include:
  - Projects that impact the company’s regulator compliance such as effluent treatment (environment) and warehouse automation (safety).
  - Several of the projects could impact the company’s image. For example, the snack food rollout could be positive because of its wholesome connotations, while the acquisition of the schnapps brand could be negative. The effluent project could be positive by showing the company’s willingness to act on environmental concerns early. Similarly, the automation project could cast a positive step towards increased safety. The plant expansion project may be positive or negative, depending on whether the community reacts to new jobs or factory encroachment.

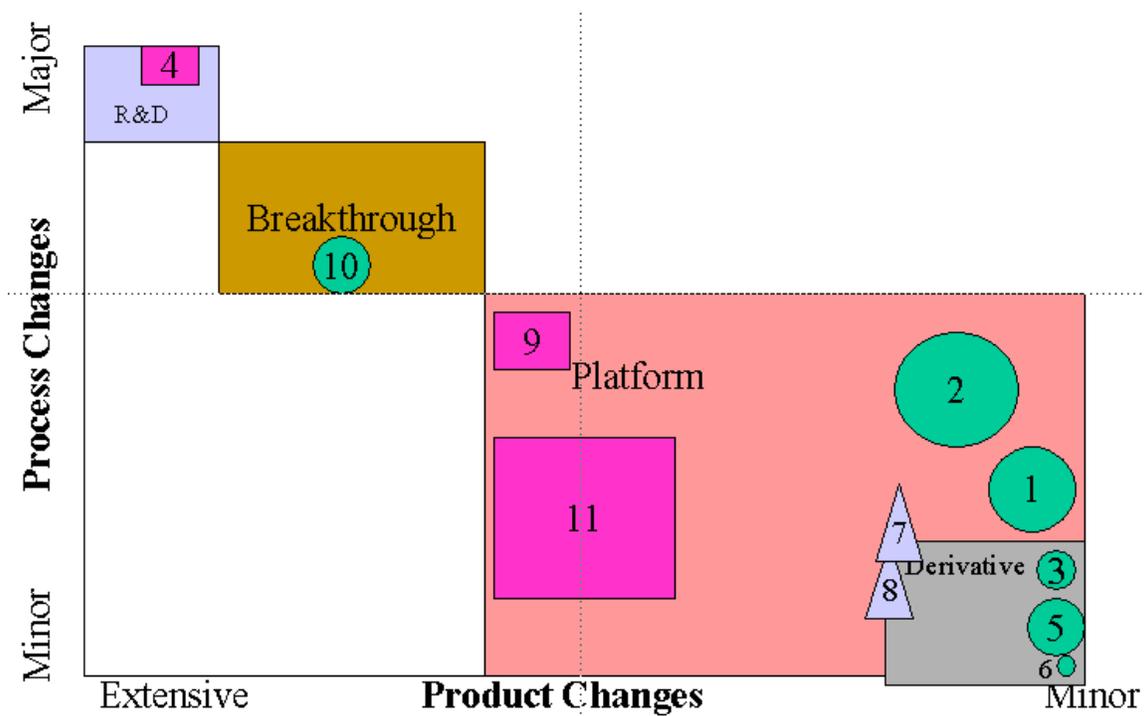
**Question 5:**

- 1) I would recommend these five screens:
  - Is the project a “Must Do” for reasons outside of the company’s control?
    - Criteria – Yes/No
  - Does the project meet the company policy for minimum IRR?
    - Criteria –Yes/No

- Does the project meet the company policy for maximum payback period?
    - Criteria – Yes/No
  - Does the project incur excessive risk?
    - Criteria – Yes/No
  - Does the project meet the current corporate strategy?
    - Criteria – Yes/No
- 2) Using these screens and criteria the following projects would be eliminated outright:
- Truck Fleet (1) because it does not meet the minimum IRR and exceeds the maximum payback period dictated by company policy.
  - New Plant (2), Plant Expansion (3), Artificial Sweetener (4), and Plant Automation (5) all because they exceed the maximum payback period dictated by the company policy.
  - Strategic Acquisition (11) and Artificial Sweetener (4) would both be eliminated due to excessive risk.
  - Strategic Acquisition (11) would also be eliminated because it does not match the current strategy.

**Question 6:**

The projects would be arrayed as follows using the categories:



**Question 7:**

Applying the criteria to the projects would yield the following recommendations for the 1993 projects:

No.	Description	Categories	Cost	Screen 1	Screen 2	Screen 3	Screen 4	Screen 5	1993 Selections
				Must Do	IRR	Payback	Risk	Strategy	Investment
1	Expand Truck Fleet	Incremental	22	No	Not Ok	Not Ok	Ok	Ok	
2	New Plant	Incremental	30	No	Ok	Not Ok	Ok	Ok	
3	Expanded Plant	Incremental	10	No	Ok	Not Ok	Ok	Ok	
4	Artificial Sweetener	Breakthrough	15	No	Ok	Not Ok	Not Ok	Ok	
5	Automation and Conveyor	Platform	14	No	Ok	Not Ok	Ok	Ok	
6	Effluent Treatment	Incremental	4	Yes	Ok	Ok	Ok	Ok	4
7	Eastward Expansion	Platform	20	No	Ok	Ok	Ok	Ok	20
8	Southward Expansion	Platform	20	No	Ok	Ok	Ok	Ok	20
9	Snack Foods	Platform	18	No	Ok	Ok	Ok	Ok	18
10	Inventory Control	Incremental	15	No	Ok	Ok	Ok	Ok	15
11	Strategic Acquisition	Platform	40	No	Ok	Ok	Not Ok	Not Ok	

Investment Cap

80

77

These projects would total 77 million ECU, leaving a prudent reserve for unforeseen circumstances.

**Reading: From Experience: Linking Projects to Strategy**

**Question 1:**

Two thirds of the revenue at HP was derived from products introduced within the past two years. Projects are an important component of business strategy to sustain profitable products in a dynamic marketplace.

**Question 2:**

The team should establish criteria that support business goals rather than personal agendas. The financial selection criteria are intended to ensure that the projects generate a sufficient return on investment within a defined time frame. They are also intended to recognize that financial success is reflected in the portfolio of projects rather than in the financial contributions of individual projects.

As suggested in Figure 3, financial criteria are an important but small part of the business value created by projects. Senior managers recognize the value of qualitative contributions to business value, so it is not always necessary to quantify a project's contributions to business value.

**Question 3:**

The objective is to select the right mix of projects required to support business success. Prioritizing projects and selecting the vital few from the necessary may help to get more work done in support of business goals. By carefully defining criteria, people are aided in developing an understanding of the company's strategy and the types of projects required to achieve success. From the improved understanding, proposed projects will be better aligned with business objectives.

**Question 4:**

The Plan of Record records the results of the selection process. It shows the mix across categories with the priority and resource needs (headcount) of each project. The Plan of Record also shows “out-plan” projects, those that show promise but haven’t yet made it through the decision process. This gives visibility to a pool of possible projects, if one of the chosen ones terminates early for some reason. It also displays the relative priority and the rough schedule of performance for the selected projects.

The aggregate project plan combines a number of important factors in an easy to understand visual format. As described in the text, this includes the number and type of projects, their relative size, timing, history and where they fall on the scales of innovation for both products and processes. It is easy to see gaps and excesses in each category as well as the mix among the categories and the degree of product and process change. This graphic allows comparison of the types of projects being conducted, the number of projects in each type with the relative size of the resources and investments. Different project portfolios’ proposals can be readily compared for discussion purposes or with past years’ selections.

**Question 5:**

They should be considered for inclusion, when it is favorable for the company to do so. For example, if missing data becomes known, the project may be reconsidered. Or, if another project is cancelled or completed, the freed-up funds could be applied to an out-plan project. Additionally, out-plan projects might be placed in the pipeline during a review of the portfolio of projects.

**Question 6:**

It reduced the number of projects authorized for execution and probably changed the mix of projects approved for execution. In one case, the reported reduction decreased the pipeline projects from 120 to 30. In another area, the projects were decreased from 50 to 17.

HP would be more mature than organizations that lacked a project selection process attempting to link business success to project strategies. The discipline and focus provided by techniques described in the article are indicators of a high level of project management maturity.

**Question 7:**

New proposals have been altered to address the measurable criteria used to select projects. This has helped to focus behavior on activities that win for the business. It also uses the portfolio approach to help manage risks inherent in generating revenues from outputs produced by projects. In addition to numeric criteria, nonnumeric projects are handled in a separate category of projects. Also refer to the answers for questions 2 and 3 of this reading assignment.