

LESSON 5

Choosing the Right Decision-Making Technique

Assigned Reading

Selected assigned readings can be found on the BUSI 460 Course Resources website, under "Online Readings".

1. UBC Real Estate Division. 2011. *BUSI 460 Course Workbook*. Vancouver: UBC Real Estate Division. Lesson 5: Choosing the Right Decision-Making Technique
2. Russo, J. Edward & Schoemaker, Paul J. H. 2002. *Winning Decisions*. New York: Random House, Inc.
Chapter 6: Choosing: A Pyramid of Approaches, p. 133-158.

Recommended Reading

Selected recommended readings can be found on the BUSI 460 Course Resources website, under "Online Readings"

1. Goodwin, Paul & Wright, George. 2004. *Decision Analysis for Management Judgement, 3rd Edition*. West Sussex England: John Wiley & Sons.
Chapter 3: Decisions Involving Multiple Objectives, p. 27-58 (excludes Exercises at end of chapter).
2. Clemen, Robert T. 1996. *Making Hard Decisions, 2nd Edition*. Belmont CA: Duxbury Press.
Chapter 1: The Decision-Analysis Process.
3. Appraisal Institute of Canada and Appraisal Institute (US). 2010. *The Appraisal of Real Estate (3rd Canadian Edition)*. Vancouver: UBC Real Estate Division.
Chapter 9: Market and Marketability Analysis.
4. Hayashi, Alden M. 2001. "When To Trust Your Gut". *Harvard Business Review*. February 2001. p.59-65.

Learning Objectives

After completing this lesson, the student should be able to:

1. explain the importance of identifying the best approach to decision making;
2. describe the strengths and weaknesses of four different approaches to decision making;
3. select among four approaches the best decision making technique for the task at hand — i.e., the simplest technique sufficient to satisfy client requirements; and
4. apply decision analysis concepts to decisions involving multiple objectives.

Instructor's Comments

In Lesson 4, we looked at how your ability to manage uncertainty determines the quality of your decision. In this lesson, we will look at how other complexities in decision making influence which technique is most appropriate for the task at hand.

Introduction to Decision-Making Techniques

There are various methods of decision making, some informal and some formal. Intuitive choice and rules of thumb are examples of informal techniques, and these are perfectly appropriate in some circumstances. The more formal systematic processes are termed "decision analysis" and all involve some degree of weighing of benefits and costs of alternatives. We will examine the strengths and weaknesses of four decision-making techniques in this lesson.

The following example will be used throughout the lesson to illustrate these decision-making techniques. We will first outline the situation and then investigate each technique in turn, discussing the pros and cons and the circumstances under which the technique might be applicable.

Case study: adapted from "Pharmaceutical Giant's Warehouse Goes Vertical", Reed Business Information website, January 12, 2005 (www.csemag.com/article/CA495789.html).

Sally Smith is the director of logistics for Mega-Pills Inc., a mid-sized family owned pharmaceutical manufacturer in Toronto, Canada, and is known for her ability to "think outside the box." Mega-Pills' pharmaceutical products are used to fill around 5 million prescriptions a year in Canada. Although its major market is currently in Canada, the company has started to enter the U.S. generic drug market. There has been a favourable reception to Mega-Pills in the US and the senior management team at Mega-Pills has recently drawn up future plans that include increasing annual production at its Pickering, Ontario plant by 400% in five years – from 10 million dosages to 50 million dosages. Management's plan calls for a 400,000 square foot expansion to the plant's existing 300,000 square feet, with part of the space to become a new raw materials warehouse that would replace the existing 2,000 pallet warehouse. Sally's team has to enable the plant's logistics process to support the extra production.

"The business case is the opportunity that the US market provides," says Sally. Quickly increasing health-care costs in the US and the role of generic drugs in reducing these costs make being first-to-market very important for foreign generic drug companies such as Mega-Pills. Mega-Pills currently sells 20% of its product to the US, with 70% going to Canada and 10% to other international markets. One of Mega-Pills' 5-year objectives is to increase its percentage of product going to the US to 80%.

Sally's team has found that movement to another site is cost-prohibitive because of the existing investment in the Pickering facility. Also, Mega-Pills' family-oriented owners want to keep manufacturing operations there. The manufacturing plant is located on expensive property just east of Toronto and expansion possibilities are limited by a major highway and roads on all four sides.

An axiom for a project of this type is that because the company is continuing to grow rapidly, manufacturing or production space is always at a premium compared to warehouse space. In other words, less space dedicated to warehousing leaves more space for manufacturing and production. Warehousing has been allocated a small footprint of 50,000 square feet. However this small footprint has to be able to hold Mega-Pill's entire inventory of up to 10,500 pallets.

Sally's team also faces design constraints requiring the new warehouse to maintain temperature and humidity control without affecting storage space plans.

Sally's team identified an option to "go vertical" and build the warehouse high instead of wide. That would give Mega-Pills the ability to conserve floor space for production and at the same time provide enough cubic space for warehousing. Sally delegates the project to Mary who will be responsible for the vertical expansion.

After initial costing research, Mary finds that building a 65-foot clear-height warehouse and purchasing the necessary cranes will add substantially to capital cost and operating costs over the next five years. Mary knows an expansion in some form is necessary, but she is starting to question the tentative decision the management team made.

Remembering to use her new decision framing skills, Mary follows the process to evaluate the decision frame:

1. **Assess the frame**
2. **Evaluate the fit and**
3. **Rebuild the frame**

To start, Mary assesses the frame the management team started with: "to increase production at the Pickering site", which technically ignores the warehouse space problem she has to address. Although she is aware that the cost of moving the production site is considered prohibitive, she wonders if the team should have started out with a broader frame of "to increase the capacity of Mega-Pills Inc." before selecting the site extension at the present location as the best option. As she had been left to sort out the costing for this project, Mary was at liberty to assume that there had been no risk profiling carried out for the expansion option. However, she thought there may have been some informal forecasting carried out for the site moving option that led to the management team's belief that a move was cost prohibitive. She decides to redefine the decision frame "to increase the capacity of Mega-Pills Inc." in order to more truly reflect the management team's frame.

Being a creative thinker, Mary immediately starts coming up with other ideas and questions. Maybe the warehousing can be moved to another site? Could they buy the private road behind the plant and the neighbouring lot to expand in that direction? How was intelligence gathered concerning the site move option? Maybe there are some alternatives available to the company that we don't yet know about. As she has no idea if the team has been alternative or objective focused in deciding to keep the whole site at Pickering, she decides to present her ideas to Sally and suggest a search for creative alternatives.

If Mary managed to convince Sally and the management team to reconsider other alternatives and they wanted to know more about how to select an appropriate piece of real estate, how would you proceed? Write your ideas in the box below:

Now we will proceed to investigate this decision through the lens of four different decision-making approaches.

Hierarchy of Decision-Making Approaches

In Chapter 6 of *Winning Decisions*, Russo and Schoemaker detail four alternative decision-making approaches. They present these approaches hierarchically:

- Level 1: Intuitive Choice (Seat-of-the-Pants Judgments)
- Level 2: Heuristic Procedures (Rules of Thumb)
- Level 3: Importance Weighing (Bootstrapping)
- Level 4: Value Analysis

The remainder of this lesson will examine the strengths and weaknesses of each of these approaches using the Mega-Pills example. Let's continue the scenario, with Mary meeting with Sally (Director of Logistics) to inform her of the huge capital costs involved in expanding the warehouse vertically.

LEVEL 1: Intuitive Choice (Seat-of-the-Pants Judgment)

This approach consists of applying your intuitive judgement to reach a decision. Alden Hayashi, in a 2001 Harvard Business Review article¹, explained that intuitive or "gut" based decisions are really the result of complex, subconscious interaction of emotional and mental responses to information. Hayashi quotes Henry Mintzberg, Professor of Management at McGill University, who believes that when we experience an instantaneous revelation about a problem to be solved, our conscious mind has learned something that our sub-conscious mind has already known. The basis of this theory is that the mind is constantly looking for patterns in the information we are constantly exposed to and draws on rules to make connections about the meaning of the patterns. The author concludes that gut instincts or intuition is simply the outcome of all these experiences over your lifetime.

Example: After listening to Mary's reasoning, Sally tells Mary how the management team faced an ultimatum from the owners: as a result, Sally's team had been required to make a seat-of-the-pants judgment. Sally takes a moment to consider the issues surrounding the decision to expand the capacity at Pickering. She recalls the decision tree her team had drawn up, showing that moving to another site was equally or more costly than Mary's estimate of expanding the warehouse vertically. She then imagines that the work involved in selling the move idea to the owners would be prohibitive in itself. Sally tells Mary that she is to continue with the decision to extend the building vertically and construct the 65 foot clear-height warehousing area. Mary asks if they could phone and ask for more time.

Quality of results: Mediocre. In this example, the warehouse will be expanded at a cost that is similar to the cost of moving the production site, which could have other benefits as well.

Strengths: Incredibly rapid. Relying only upon intuitive judgement, it took the manager just a few minutes to make the decision ("from the seat of her pants" — i.e., not getting out of her chair!).

Weaknesses: High risk. In this example, Sally relied completely on her own expert judgement. She assumed that the rough estimates from her team were just as accurate as Mary's more detailed estimation. Sally fell into the common human tendency of seeing patterns in data where none exist (over-fitting the data). She assumed the owners would not likely contemplate a move.

¹ Hayashi, Alden M. 2001. "When To Trust Your Gut". *Harvard Business Review*. February, 2001, p.61.

When to use it: In truly critical circumstances when a quick, decisive decision is required or when a situation truly matches those you have faced numerous times before. Note that we have been careful to use the word "truly" and not "exactly", because even though the decision problem may be exactly the same as before (e.g., how to effectively use warehouse space), the range of alternatives may change over time, rendering the newly perceived situation untrue.

The status of a critical decision should always be questioned. In our example, Sally had been given an ultimatum, but in reality this decision did not require such a rapid decision. Postponing the decision would have allowed another approach to be used and a better quality decision reached.

Before using this approach: Quickly think about the urgency of the situation. With a little more time you will be able to assess your decision frame and take control of your cognitive biases in order to make a better quality decision. Hayashi suggests this self-assessment about decisions should be continuous throughout the decision-making process and that we should be careful not to "fall in love with our decisions".

A better approach: See the alternative approaches below.

LEVEL 2: Heuristic Procedures (Rules of Thumb)

This approach consists of using rules of thumbs to screen or sort information.

Example: Sally takes a moment to consider how they had reached the decision to stay and expand the capacity at Pickering. Sally informs Mary that the owners have adopted a rule of thumb that any site move needs to include a contingency fund of 100% to account for potential bureaucratic problems in real estate acquisition. When Mary points out that setting the contingency so high effectively precludes ever moving operations from Pickering, Sally tells Mary that the owners had a bad experience 20 years ago when they first moved to the Pickering site: actual installation cost ended up at triple the estimated cost. Because management never wanted this to happen again, they imposed this rule to make sure a move would only be made when it was clearly worthwhile economically.

Results: Good if the rule of thumb is relevant. In this case, it might be worthwhile investigating why the initial move ended up with such a large cost overrun. Maybe this type of cost overrun could be avoided in the present or future, making this prohibitive rule of thumb unnecessary.

Strengths: Fairly quick decision and clear guideline set for decision approval.

Weaknesses: Rule may become outdated or flawed. The problems that the owners may have encountered in the past may not be relevant today. In Mary's example, the company today is managed much more competently than the haphazard start-up 20 years ago, and it is unlikely that these types of cost over-runs would be tolerated once a contract has been drawn up.

When to use it: When the rule has been proven and is still truly relevant to the decision frame.

Before using this approach: Quickly think about the quality of the decision frame your rule imposes on the decision. Question its relevance, be aware of cognitive biases, and fully understand how the rule may restrict your current choices.

Use this approach: When you are sure the relationship between the decision frame and the situation remains true. If your rule of thumb is no longer valid, change or drop the rule and use another approach. For a real estate example, consider lease negotiations. If a common rule of thumb is that the tenant should counter a landlord's initial rent offer by \$1-2 per sq. ft., can you see problems which may arise? What if the landlord had presented an opening offer at the high end of market rents and the tenant anchored their response to this offer?

A better approach: See the alternative approaches below.

LEVEL 3: Importance Weighting

The decision making approaches in Levels 3 and 4 are more complex in that they attempt to account for the existence of multiple attributes that can be used to evaluate the outcomes of decisions. For example, the Mega-Pills decision at Levels 1-2 may consider only one or two factors going into the decision, and these limiting assumptions effectively ignore much of the reality of the situation. A multiple attribute analysis accounts for more factors and this more realistic analysis should result in more comprehensive outcomes. However, more realism does mean more complexity — the Level 3 and 4 decision-making approaches are a way to incorporate this complexity, but keep it at a manageable level.

Important Weighting (Level 3) is a systematic approach that can be used when the decision is complex (involves many objectives and attributes) and entails various alternatives. In a Level 3 decision analysis, you treat attributes passively, in other words, you take factors as given and not explicitly testing their robustness. In Level 4, the decision maker's objectives (or those of a multitude of stakeholders) actively guide the identification of these attributes, leading to more robust results.

Russo and Schoemaker outline three steps for building a decision weighing model:

Step 1: Identify the relevant attributes to be used to evaluate the outcomes in the decision at hand.

Step 2: Assign importance weights to each attribute.

Step 3: Compute a final measure to evaluate each alternative.

Example: Sally is able to convince the owners that seat-of-the-pants judgement and rules of thumb are not adequate decision-making approaches when a high level of investment is involved and the future of the company is at stake. They give her three days to submit her plan for capacity expansion. She takes a moment to consider the issues surrounding the decision to expand the capacity at the Pickering plant.

Sally recalls the three alternatives identified during prior discussion:

1. vertical expansion of the warehouse;
2. moving the production facility to a new industrial zone in the local area; and
3. moving the production facility to other plots within the current industrial zone.

Mary and Sally conclude that the management team did not look into the problem deeply enough and that they should reconsider the options using an importance weighting approach. This will enable the owners to have a much more balanced picture of the relative merit of each of the alternatives, and will also build Mary and Sally's confidence in the alternative they are advocating. Sally calls on another member of the logistics team, Rodney, to help.

Step 1: Identify the attributes

Rodney thought about how to best evaluate the outcomes of each alternative and identified the four relevant attributes listed below:

- Shop floor logistics — production cycle after 5 years of experience.
- Distribution logistics — effectiveness of distribution, accessibility, and traffic control of raw materials, in-progress inventory, and finished products.
- Capital cost — investment required.
- Potential for future expansion — ability to meet future production requirements beyond five years via expansion.

Because all three alternatives must meet the desired increase in five-year production capacity, this is not included as a separate attribute.

Step 2: Assign importance weights to each attribute

Step 2a: Weight the attributes

In order to account for differences in relative importance among attributes, Rodney distributes 100 "importance" points across the attributes (i.e., analogous to percentage weights). Rodney assigns 45 to shop floor logistics, 30 to distribution logistics, 20 to capital cost, and 5 to future expansion. These values will be applied in Step 3.

Step 2b: Define scales used to measure attributes

Rodney decides to keep things as simple as possible and evaluate each attribute using a scale of 1 to 5 with values of "5" being most favourable. He then needs to specify exactly how each scale will be measured (i.e., a coding scheme). He discusses the various levels for each attribute with the appropriate people in the company and comes up with the following measures. Shop floor logistics will be measured by the minimum time it takes for one dosage to be produced and leave the factory. Distribution logistics will be measured using the weighted average trip time to suppliers. Capital costs will be measured using the size of the investment required as an indicator of affordability. Potential for further expansion will be measured by the size of the plot area chosen.

This rating scale or coding scheme is summarized in the table below.

Attributes	Shop floor logistics	Distribution logistics	Capital cost	Potential for further expansion
Scale	Definition and criteria			
5	Excellent — Under 10 minutes	Excellent — Under 4 hours	Bargain — under \$0.5 million	Excellent — More than 0.5 million sq. ft.
4	Very good — 10-12 minutes	Very good — 4-5 hours	Very affordable — \$0.5-1.0 million	Very good — 0.4-0.5 million sq. ft.
3	Good — 13-15 minutes	Good — 5-6 hours	Affordable — \$1.0-1.5 million	Good — 0.3-0.4 million sq. ft.
2	Fair — 16-20 minutes	Fair — 6-7 hours	Somewhat affordable — \$1.5-2.0 million	Fair — 0.2-0.3 million sq. ft.
1	Poor — More than 20 minutes	Poor — More than 7 hours	Not very affordable — More than \$2.0 million	Poor — Less than 0.1 million sq. ft.

Step 2c: Assign values

Rodney now must review each of the alternatives and assign values for each attribute based on his rating scale. For example, for the vertical expansion alternative, he feels that shop floor logistics will be only fair, compared to good or very good for plans to move the facility. He recognizes the inherent uncertainty in assigning these values and bases his estimate of attribute value on what he sees as the "most likely" value.

His coding effort yields the following table:

Attributes	Shop floor logistics	Distribution logistics	Capital cost	Potential for further expansion
Alternatives				
Vertical expansion	Fair = 2	Very good = 4	Somewhat affordable = 2	Poor = 1
Move to new zone	Very good = 4	Good = 3	Somewhat affordable = 2	Very good = 4
Move within current zone	Good = 3	Very good = 4	Not very affordable = 1	Good = 3

Step 3: Compute a final measure

Finally, Rodney takes one alternative at a time and multiplies the score for each attribute by its weight and sums these weighted scores to come up with an overall score for the alternative. For instance, the overall score for the vertical expansion alternative (255) was obtained from the following calculation $[(2 \times 45) + (4 \times 30) + (2 \times 20) + (1 \times 5)]$. In this case, higher scores indicate more desirable alternatives.

Attributes	Shop floor logistics	Distribution logistics	Capital cost	Potential for further expansion	Overall score
Alternatives					
Relative weight for attribute (from step 2a)	45	30	20	5	
Vertical expansion	$2 \times 45 = 90$	$4 \times 30 = 120$	$2 \times 20 = 40$	$1 \times 5 = 5$	255
Move to new zone	$4 \times 45 = 180$	$3 \times 30 = 90$	$2 \times 20 = 40$	$4 \times 5 = 20$	330
Move within current zone	$3 \times 45 = 135$	$4 \times 30 = 120$	$1 \times 20 = 20$	$3 \times 5 = 15$	290

Based on the importance weights and scores in this example, it appears that a move to a new zone is the recommended alternative for Mega-Pills Inc.

You should keep in mind that the results of an importance weighting analysis are somewhat relative in nature rather than absolute — in other words, the numerical scores found are not necessarily critical in themselves, but more so in comparison to each other. This impacts the confidence you may have when results are close, in particular if you are uncertain about the attribute ratings you have assigned. A sensitivity analysis may help determine if results are significantly skewed by this uncertainty (explained in detail in following section). However, if you are unable to carry out a comprehensive sensitivity analysis, at minimum you may wish to revisit the estimates of the most heavily weighted attributes in your matrix, as these have the highest risk of undue influence. For example, you may try changing a few assumptions and see what effect this has on the result, to isolate any problem areas. Spreadsheet software is very helpful for carrying out this sort of analysis.

Sensitivity analysis: For a better quality decision, you may wish to conduct various forms of sensitivity analysis to see how sensitive the preferred alternative is to the judgments incorporated into the importance weighting approach. Sensitivity analysis can be especially useful to examine uncertainties in the decision being considered.

Suppose that Sally and Mary feel uncertain about the values assigned to some of the attributes. For example, they might be less-than-confident that vertical expansion is actually rated as "fair" in terms of shop floor logistics. In the earlier analysis, a single most likely outcome was chosen for this evaluation, namely that a "fair" result would occur (i.e., a minimum time of between 12 and 16 minutes for the Mega-pill to be produced and leave the factory). Instead they might choose a range for this evaluation between minimum times of 13-15 minutes (a "good" result) and more than 20 minutes (a "poor" result). Similarly they might choose ranges like this for the performance of attributes on other alternatives being considered. The following table illustrates this.

Attributes	Shop floor logistics	Distribution logistics	Capital cost	Potential for further expansion	Most likely score	Predicted range of score
Alternatives						
Relative weight for attribute	45	30	20	5		
Vertical expansion	Poor to Good 1-3 (45-135)	Very good 4 (120)	Somewhat affordable 2 (40)	Poor 1 (5)	255	210-300
Move to new zone	Very good 4 (180)	Good 3 (90)	Not very affordable to somewhat affordable 1-2 (20-40)	Very good 4 (20)	330	310-330
Move within current zone	Poor to Good 1-3 (45-135)	Very good 4 (120)	Not very affordable 1 (20)	Good 3 (15)	290	200-290

Again, spreadsheet or statistical software aids in these more complicated analyses.

For this revised example, it appears that moving to a new zone remains the dominant alternative. However, Sally can now also see the risk associated with the decision alternatives to expand the warehouse vertically or to move within the current zone. Even though the maximum potential weighted scores of alternatives 1 and 3 approach the lower limit of the best alternative, alternative 2, their range is wide, showing significant uncertainty in estimating their attributes. With this information in mind, Sally decides to present this matrix to the owners and discuss the advantages of moving to a new zone.

Results: Very Good

Strengths: Efficient, results are quantitative, may reduce risks.

Weaknesses: Can be time consuming, especially if you decide to also carry out a sensitivity analysis. If things don't work out like your cognitively biased mind believes they should, the spreadsheet may be easily manipulated to reflect these biases.

When to use it: When you and/or your client are able to estimate at least ballpark figures (low to moderate level of uncertainty) for the weights and attribute measures associated with each alternative.

Before using this approach: Question how the alternatives have been arrived at. If they were alternative focused, perhaps some good opportunities have been missed? Consider using a value analysis (Level 4) if this has not already been done.

One way to strengthen a decision-weighting model is through the collaboration of others in building the decision framework. Russo and Schoemaker explain how a technique known as boot-strapping can improve the quality of the weighting process by studying how decision makers consistently make the same decisions. Boot-strapping involves averaging the response or prediction on a decision outcomes from multiple experts (Russo & Schoemaker, p.146). Real estate analysts use boot-strapping constantly on a sub-conscious level when weighting various indicators as they attempt to make sense of market trends. When analysts survey brokers, salespeople, and others for opinions on the relative importance of trends in interest rates, availability of financing, etc., in shaping investor sentiment about markets, they are relying on others to boot-strap their decision making model.

LEVEL 4: Value Analysis (Objectives Analysis)

As discussed above, a Level 3 analysis accounts for the impact of multiple attributes on decision making. Level 4 builds on this, by more comprehensively identifying key attributes.

Example: Sally goes back to the owners with her weighted analysis and explains to them why she feels that moving to a new zone is the best option. They thank her for her suggestion, but inform her that they will stick with her initial decision to expand the warehouse vertically. Sally is confused and asks why they would go with the initial seat-of-the-pants judgment and decline the result from the subsequent more informed, balanced, and transparent analysis. The owners tip their heads forward and say: "ever since your team came up with the idea of expanding the warehouse vertically, we realized a personal benefit: we wouldn't have to leave our beloved family home". When asked why this was so important, the owners explained that they had just invested \$2 million on home renovations for their upcoming retirement and really like the idea of being near the factory in case something happened.

Sally thought for a couple of minutes. She was worried that the growth of the company would be thwarted by the apparent whims of the owners, but then she realized that to the owners, maybe keeping control of the company was more important to them than its growth. After all, at the end of the day it was the owners who were responsible for the decision. She regretted not drawing up an influence diagram at that initial meeting with her team. She realizes now that Henry, the owners' son-in-law, would likely have immediately identified this influence that now seems potentially significant. Thinking back to her prospective hindsight exercise (see Lesson 4) when she was considering uncertainties, she wondered what would happen if in five years the vertical expansion of the warehouse failed to deliver. Would the logistics team be blamed?

Sally then had what she thought was an interesting idea. She asked the owners if they would let her take another week to reanalyze the problem, but this time taking their objectives into account (both business and personal). She would need to have another meeting with them as soon as possible to ensure that she understood all of their objectives. When the owners agreed, Sally walked out of the meeting confident that the more comprehensive value analysis method could be more effective in creating alternatives that better met the objectives of the owners. A further benefit of this analysis' explicitness is that the resulting report would form a permanent record of the reasons the final outcome was chosen.

When Sally returned to the office, she called her team together and told them they had not worked within the optimal decision frame and that the owners had additional objectives that were beyond a "growth-at-all-costs" philosophy. She told them they needed to work within a multi-objective frame. She felt that she could guide her team through an in-house objectives analysis herself and saw no need to call in value analysis consultants.

The various steps she will follow are explained below (adapted from *Making Hard Decisions*):

- Step 1: Frame the decision
- Step 2: Elicit the objectives
- Step 3: Organize the objectives
- Step 4: Create alternatives
- Step 5: Select the best alternative

Step 1: Frame the decision

(a) Assess the frame

Sally concludes that the original decision question was "How should we increase the capacity of Mega-Pills Inc.?" and notes that the frame only took into account business objectives.

(b) Evaluate and rebuild

Sally feels that although the original decision question was fine, a more appropriate decision frame was needed that encompassed all of the owners' objectives, including the proximity of the factory to their home.

(c) Reframe the decision

Sally reframes the decision question to "What is the best method to increase the capacity of Mega-Pills Inc. by 400% taking into consideration both the business goals of the company and the personal goals of the owners?"

Step 2: Elicit the objectives

The team met for a second time. They considered the decision question and asked themselves what are the objectives supporting this decision. They identified the following four objectives.

- To maximize shop floor logistics
- To maximize distribution logistics
- To maximize opportunity for future expansion
- To minimize capital cost

Fortunately, these objectives reflected the attributes Rodney originally identified in his weighting exercise. However, Sally realized that the owners might identify further objectives based on other, perhaps conflicting, attributes.

Sally sent Mary to elicit the objectives from the owners. Mary asked them why the Pickering site in particular was so important to them. After considerable discussion, Mary was able to help the owners identify the following two objectives:

- To minimize distance from home to factory
- To minimize capital cost of moving

Step 3: Organize the objectives

Sally made an "objectives tree" (also called a "value tree") in order to better organize the attributes of the personal and business goals elicited from the owners and the management team of Mega-Pills. Recall that an attribute is used to measure the performance of an objective.

Sally's objectives tree for the Mega-Pills' decision:

Having established the main attributes for the objectives, Sally now needs to measure how the selected alternatives perform according to each attribute.

Step 4: Create alternatives

Sally remembers that three alternatives had been identified:

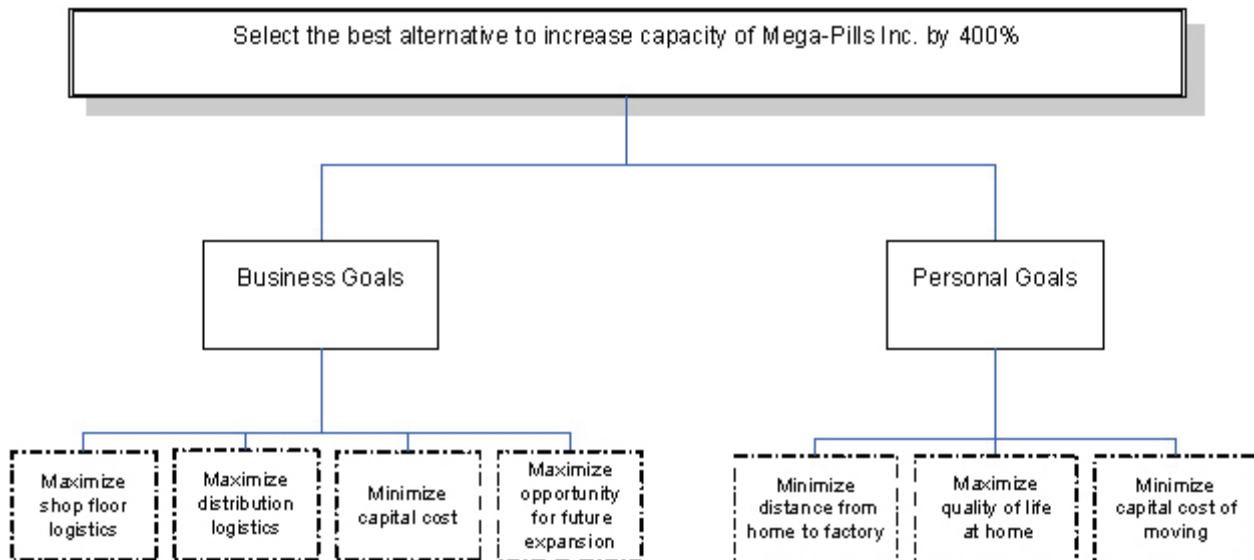
1. Vertical expansion of the warehouse.
2. Moving the production facility to a new industrial zone in the local area.
3. Moving the production facility to other plots within the current industrial zone.

Sally sits down with Mary, Rodney, and the rest of logistics team and they consider the objectives again. They brainstorm for an alternative that meets all or most of the objectives in the value tree. They realize that a horizontal expansion of the plant onto adjoining lands seems to be ideal, except for the constraint of their property being penned in by the four surrounding roads. Mary asks if the road at the back of the plant is public or private and whether this road itself could perhaps be purchased and built over. The team agrees that even though expansion seems unlikely due to this road issue and to the fact that this land has long been used for farming, Mary should investigate this possibility further. Within hours, Mary confirms not only that the road is privately owned and potentially re-developable, but also that the farmer who owns the land next door is receptive to the possibility of selling, if the price was right.

This new alternative means there are now four alternatives to be compared:

1. Vertical expansion of the warehouse.
2. Moving the production facility to a new industrial zone in the local area.
3. Moving the production facility to other plots within the current industrial zone.
4. Expand production facility to neighbouring farm.

Step 5: Select the best alternative



Sally asks Rodney to repeat the weighing model exercise described in Level 3. He is to include the new alternative and, this time, incorporate both the personal objectives of the owners and the business objectives of the company in the analysis. Rodney consults with the owners and asks them to distribute 100 points across the attributes of the personal goals in the same way that he did previously for the attributes of the business goals. The owners give 60 points to the distance from home to factory and 40 points to the capital cost of moving.

Next, Rodney asks the owners how important it is to them to achieve the personal goals compared to the business goals. After considerable deliberation, the owners say their personal goals are 50% more important to them than achieving their business goals. Rodney incorporates this judgement into the analysis by weighting the personal goals by 3 and the business goals by 2 (i.e., the ratio 3:2 represents a 50% increase). These new combined weights appear in the following table.

Because the goal of minimizing distance from home to factory has been added, Rodney next had to define a scale on which to measure how each alternative performed. He used kilometres from home to projected factory site for this purpose and then defined five levels from Excellent (under 1 kilometre) to Poor (over 20 kilometres). Since minimizing capital costs of moving was also a business goal, he used the same measure for this attribute. While it was relatively easy to evaluate each of the four decision alternatives on the new objective of minimizing distance from home to factory, this evaluation was harder for minimizing capital cost for the new alternative of expanding to the neighbouring farm. This was because the capital cost of moving depended upon the purchase price of the farmland. Sally and her team felt there was great uncertainty about this evaluation and they felt that differences in the possible purchase price could lead to resulting capital costs of moving anywhere between "somewhat affordable" (2) to "very affordable" (4).

Objectives/ Attributes	Business goals				Personal goals		Overall Score
	Maximize shop floor logistics	Maximize distribution logistics	Minimize capital costs	Maximize opportunity for future expansion	Minimize distance from home to factory	Minimize capital cost	
Alternatives							
Relative Weight for attribute	90 = 2x45	60 = 2x30	40 = 2x20	10 = 2x5	180 = 3x60	120 = 3x40	
Vertical expansion	Fair = 2 (180)	Very good = 4 (240)	Somewhat affordable = 2 (80)	Poor = 1 (10)	Excellent = 5 (900)	Somewhat affordable = 2 (240)	1,650
Move to new zone	Very good = 4 (360)	Good = 3 (180)	Somewhat affordable = 2 (80)	Very good = 4 (40)	Poor = 1 (180)	Somewhat affordable = 2 (240)	1,080
Move within current zone	Good = 3 (270)	Very good = 4 (240)	Not very affordable = 1 (40)	Good = 3 (30)	Fair =2 (360)	Not very affordable = 1 (120)	1,060
Expansion to neighbouring farm	Good = 3 (270)	Very good = 4 (240)	Somewhat to very affordable = 2-4 (80-160)	Fair = 2 (20)	Very good = 4 (720)	Somewhat to very affordable = 2-4 (240-480)	1,570 to 1,890

Rodney considered one alternative at a time, once again multiplying each score by the appropriate weight for each attribute and then adding up these weighted scores to find the overall score for each alternative. For example, the overall score for the vertical expansion (1,650) was obtained from the following calculation $[(2 \times 90) + (4 \times 60) + (2 \times 40) + (1 \times 10)] + [(5 \times 180) + (2 \times 120)]$. Again, the higher score represents the most desired alternative. [Note: because minimizing capital cost is used as both a business objective and a personal objective, an equivalent approach to this analysis could have included this objective as only a single column in the table with its weight the sum of its assigned weights for business and personal objectives.]

When personal goals were considered alongside the business goals, with their importance weights attached, both the vertical expansion and the expansion to the neighbouring farm appeared to dominate the other two alternatives. However, which of these two alternatives was deemed best depended critically on the evaluation of the capital cost of expanding to the neighbouring farm which in turn depended on the purchase price of the farmland.

With this new information taken into account, Sally was convinced that expanding to the neighbouring farm would be the best decision for the owners if they could negotiate a favourable price for the farmland. Otherwise they should expand vertically. She returned to the owners and explained the results of her analysis. When a favourable price for the land had in fact been negotiated, Mega-Pills Inc. started planning for the impending expansion.

Results: Excellent; highest quality

Strengths: If done right, the explicitness and transparency allow the resulting decision to withstand critique (at time of decision and later).

Weaknesses: It can be difficult to explain to others, especially in client-consultant relationship. As discussed in Lesson 2, many people are resistant to leave the ways of traditional alternative-focused decision framing and are unwilling or unable to see the advantages of objective-focused decision making. We have taken considerable time to explain the advantages of objective-focused thinking. However, a client might not be so inclined to take the time to analyze more alternatives when he/she considers the two existing alternatives to be quite favourable already.

Important: Value analysis has become known as a long, drawn-out, time-consuming decision-making tool that requires the use of expensive consultants and is only useful for large-scale decisions involving multiple stakeholders. However, at the core of value analysis is the process of objective-focused thinking which can (and should) be applied to any problem at any time, with or without the help of consultants.

When to use it: Whenever possible, if the timeline and decision maker allow for it (e.g., client is cooperating). Note that if you adopt this as your normal decision-making process, the issue of time spent in analysis is balanced by time saved in not repeatedly needing to go back to the drawing board (not to mention the potentially huge costs involved in making poorly thought-out decisions!).

Before using this approach:

1. Quickly determine the level of analysis you need.
2. Quickly determine the value of the extra time it will take.
3. Think about how flexible your client or team-members will be to using new methods of decision making.
4. Consider the chance that your client has already done the background work in arriving at the best alternative. Ask the client why he or she has picked this option.
5. Think about the advantages/disadvantages of total transparency.

Summary

- Intuitive choice (Level 1) is for emergency situations in which time is very constrained.
- Heuristic decision making (Level 2) is for those decisions that have been repeated over and over again and the situation has not changed over time.
- Effective methods for gaining an overall view of presented alternatives are evaluation based on a listing of pros and cons and prospective hindsight.
- Importance weighting (Level 3) is a useful approach when more than two alternatives are being considered and where you can identify multiple attributes on which to evaluate these alternatives using importance weights.
- Value analysis (Level 4) can be used for all types of decisions and is especially useful where there are multiple objectives. There is no need to call in a facilitator if an in-house decision will suffice. Transparency can be useful if a record of the decision is required.
- Whatever method you use, you should question whether you are already aware of the best alternatives available for you to make your choice and whether the final outcome is influenced by biases or other decision-making traps.

This concludes our look at decision analysis techniques. We have proceeded from framing the decision, to considering the complexity inherent in most decisions due to uncertainty or the presence of multiple objectives, to identifying the important influences on the outcomes of decisions, to constructing decision trees to model uncertain situations, and finally to a variety of approaches for handling situations with multiple objectives. The assignment for this lesson will give you some experience with the decision-making approaches developed in this lesson. You will also find this helpful in completing your major project.

For the next four lessons, our focus will now turn to forecasting techniques. These techniques build on decision analysis, but focus squarely on the importance of uncertainty. An underlying assumption of forecasting techniques is that past behaviour can be used to predict future behaviour. As with decision analysis, a variety of quantitative and qualitative forecasting approaches will be covered, again with a varying range of comprehensiveness, robustness, and applicability in different situations.

Review and Discussion Questions

1. Consider the hierarchy of decision making or the four levels of decision making described in this lesson. How often do you apply one approach versus another? The answer will tell you something about the way most real estate decisions are made, regardless of the level of research.
2. How would you explain importance weighting as a decision support tool to a client? How would the client be involved in this type of analysis?
3. Can you recall a situation when value analysis might have been useful to help a client through a difficult decision? Using hindsight, how would you have used value analysis in a specific decision?
4. Government agencies often use importance weighting or a form of value analysis to evaluate responses from Requests for Proposals (RFPs) for provision of goods and services. If a federal or provincial ministry published an RFP for real estate project management services, can you think of some goals and related attributes (objectives) they would use to assess the various responses? How would they determine the relative weighting for each business goal attribute?

ASSIGNMENT 5**Choosing the Right Decision-Making Technique**

Marks 50 Marks Total

For this assignment, you may choose either to work with the following case example "To develop or not to develop: the case of downtown surface parking", or with an example of your choosing from the topic that you have selected for your major project.

In choosing either of these, consider that the decision-maker has taken a "seat of the pants" judgment. You are to rework it in an objective-focussed manner (from evaluating the decision frame to a weighted analysis). You should also include a brief rationalization of the alternative decision making approaches in the context of the client's problem. You do not need to present a sensitivity analysis, but do define upper and lower estimates and explain how you might deal with these.

As a part of your analysis, you should build an influence diagram and a decision tree. For the decision tree, you will need to estimate the probabilities of uncertain events and fold back the tree to reach a conclusion.

Clearly state any assumptions that you make about the client's objectives — these might be personal, community, or investment based. Also explain the attributes and alternatives that you select in responding to the client.

To develop or not to develop: the case of downtown surface parking

A family trust has owned a 120 by 720 foot site in what is now considered a downtown location for the past 65 years. While the site was originally used for manufacturing, this use became largely obsolete thirty years ago as the industrial base of the city centre diminished. Twenty years ago the structures on the site were demolished in a fire and, given the lack of need for manufacturing space in the downtown, the site was cleared and paved as a public use surface parking lot. It has been operated as a surface parking lot since then, being leased out on a fully net basis.

Over the past couple of years, a number of comments have appeared in the local media that the owners were "speculating" in land by keeping the site in use as a surface level parking when it "obviously" could be developed for higher density office/retail uses, in keeping with its current zoning and its central downtown location.

In response to both these comments and the need to periodically evaluate the position of all sites in the trust's portfolio, the trustees asked a consultant to determine a long run strategy for the site, considering both the yield in its current use and the return that would potentially be obtained if the trust was to develop the site under its current zoning or if it were sold as a commercial development site.

How Your Grade Is Assessed

Identification of basis for intuitive judgment or heuristics	10 Marks
Clear statement of client's objectives (or assumed objectives)	10 Marks
Identification of appropriate attributes, i.e., that relate to client's objectives	10 Marks
Rational selection of weighting and assignation of values	10 Marks
Computing and rationalizing "most likely" and "predicted range of score" for each alternative	25 Marks
Creation of an influence diagram identifying the key drivers affecting the alternatives	15 Marks
Design of a decision tree, as well as the calculations and analysis leading to a decision	<u>20 Marks</u>
Total:	100 Marks