Rethinking Decision Analysis

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Abstract
A brief review of the several definitions of decision analysis forms the basis for a categorization of decisions as recurring or non-recurring. A summary of the general procedures for addressing recurring decisions precedes the development of a procedure for the analysis of non-recurring decisions. In contrast to those described in the extant literature, the procedure is systemic, iterative, adaptive, self-correcting, and active. The “Decision Star” is employed as a graphic representation of (and guide to) the analytic procedure and an explanation of the elements of the process. The procedure described is consistent with the requirements of the 21st century organization and representative of current (best) practice in management.

Key words: Decision analysis, non-routine decisions, opportunities for decision, decision goals, participants in decision, framing decisions, decision alternatives, choice in decision-making, implementing decisions.

Introduction
The apparent variety and complexity of decisions motivates the use of classification schemes as a basis for decision analysis. Classes include decisions under certainty, risk, and uncertainty; single and multistage decisions; group or individual decisions; decisions with monetary or non-monetary objectives; and so forth.

Independent of classification, the decision-making literature consistently presents a process for decision analysis typically involving five steps. The usual presentation of the analysis process is:

First: recognize and define the decision situation
Second: Identify alternatives
Third: Evaluate alternatives
Fourth: Select the best alternative
Finally: Implement the chosen alternative
This particular statement is from a basic text in management (Griffin, 2008) and reflects content from a specialized source on management decision-making (Harrison, 1999). Variations on, and elaborations of, this process have been presented by authors from both the behavioral sciences and the quantitative disciplines. These are notable more for their similarities than their differences. Harrison summarizes them succinctly (pp. 37-38):

“There are various views on the process of decision making. Simon (1960) assigns three major elements to the process: (1) finding occasions for making a decision; (2) finding possible courses of action; and (3) choosing among courses of action. Witte (1972) advances the notion of decision making as a total process involving discernible and separate activities: (1) information gathering, (2) development of alternatives, (3) evaluation of alternatives, and (4) choices. The process espoused by Schrenk (1969) focuses on three elements: (1) problem recognition, (2) problem diagnosis, and (3) action selection. Janis (1968) envisions a decision-making process with five stages: (1) recognition of a challenge, (2) acceptance of the challenge, (3) meeting the challenge through a choice, (4) committing oneself to the choice, and (5) adherence to the choice. Eilon (1979) advances a comprehensive process composed of eight stages, which begins with information input and culminates in a choice. Mintzberg and his associates (1976) offer an incredibly complex formal structure derived from twenty-five “unstructured” decision-making processes that are then organized into a general model of interrelated strategic decision processes. Fredrikson (1976) proposes a method for organizing noneconomic criteria in a decision-making process that includes four stages: (1) developing a criteria set, (2) posing criteria questions, (3) scaling the responses, and (4) choosing among alternatives. Nutt (1989) advances a decision-making process made up of: (1) exploring possibilities, (2) assessing options, (3) testing assumptions, and (4) learning.

The salient point is that the recommended process for analysis seems not to vary depending upon the characteristics of the decision. Given the huge diversity of decisions and decision environments, it is unreasonable to believe that a simple five-step process will successfully address all decisions. Recognizing that the antecedents of the simple process lie in the perfect information assumptions of competitive market theory further supports its inadequacy as a guide to decision analysis.

How decisions should be (and are) made does depend on the nature and circumstances of the decision. A proper consideration of decision-making must begin with an understanding of how decisions can vary.

The most basic classification scheme divides decisions into two major categories: Routine and Non-Routine decisions (Drucker, 1967 or Harrison, 1999). This scheme is significant since it is typically determines (1) which decisions must be subject to study and analysis, and (2) which decisions are made using rules and models to guide the decision maker.
Routine decisions recur and have characteristics that remain largely the same from one occurrence to another. This attribute allows organizations to gain experience in making these decisions and to develop expertise in making them to pursue organizational objectives. Harrison (1999, p. 21) characterizes the structure of routine decisions as

“Procedural; predictable; certainty regarding cause/effect relationships; recurring; within existing technologies; well defined information channels; definite decision criteria; outcome preferences may be certain or uncertain.

Non-routine decisions, again from Harrison, are

“Novel; unstructured, consequential, elusive and complex; uncertain cause/effect relationships; nonrecurring; information channels undefined incomplete information; decision criteria may be unknown; outcome preferences may be certain or uncertain.

Drucker (1967) uses the terms “generic” and “exceptional” for the categories and suggests a four-way classification scheme:

1. Truly generic events. Here, the occurrence of the decision situation is only a symptom that requires an adaptation of an existing procedure. Drucker cites inventory decisions as illustrative of this class.

2. The apparent exceptional event which appears unique (and may be unique for a particular organization), but which occurs commonly elsewhere. A merger or acquisition decision is illustrative of this class.

3. Truly exceptional events. These decision situations have not occurred before and are unlikely to occur again. The correct response to the development (by a competitor) of a substitute for a major product would fall into this class.

4. Exceptional events that are a first/early occurrence of a new generic category. Internet based attacks on a company’s database or other internet-based attacks illustrate this class.

Drucker’s scheme is interesting in that it ties decisions directly to the occurrence of “events” to which a response is required. Further, generic events do not require decisions at all. The proper response is an “adaptation” of an already developed procedure for the circumstance.
Routine Decisions
The idea, of course, is that during the first (or first few) occurrences of a generic (routine) decision, analysis is required to determine the best decision. Once the analysis is complete, formulation of the relation between the best choice and the characteristics of the decision situation becomes the basis for a protocol that relates the choice to the specifics of the situation. Once developed, the protocol may be refined and sharpened, but no significant additional resources are devoted to analysis of the decision unless prompted by some change (usually technological) in the decision environment. An illustration of this would be a new technology for routing delivery trucks for FedEx or UPS that would save one or two percent on mileage traveled.

Many routine decisions are quite significant to the performance of the organization. Often they determine financial performance, quality, levels of customer satisfaction, or any one of a number of significant performance metrics. Indeed, it is in the interest of the organization to routinize as many of these decisions as possible, thereby achieving stability and predictability in operations.

Decision protocols may take one of a variety of forms. Major categories include (1) Programmed systems (including optimizing systems and AI applications), (2) Expertise, and (3) Heuristics. In every instance of protocol use, two conditions obtain. First, the decision (is expected to) recur, allowing the formulation of a relationship between situation characteristics and the optimal (or desirable) choice. Second, the decision must be of sufficient import to justify the expenditure of the effort required to develop a protocol.

A (solvable) mathematical model of the decision and its environment represents programmed (decision) systems. These applications are widespread, including inventory systems (mentioned above), optimization of refinery operations, routing delivery vehicles, managing supply chains, and media selection.

In contrast, the protocols employed by an expert are rarely articulated or formalized. They are, however, powerful methods for decision-making. Expertise and its development has been the subject of many studies, including Chi (1988), Ericcson (2006), and others. Colvin (2008) and Gladwell (2008) provide accessible descriptions of the development of expertise and highly developed skills in specialized fields. Messick (1988) provides a concise description of some of the most salient characteristics of expertise.

“Fortunately, cognitive psychology affords not only numerous clues about the nature of expertise but also a coherent emerging picture of expertise that has considerable generality from field to field. To begin with, experts accumulate a large store domain-specific knowledge that is hierarchically or otherwise organized in accord with the underlying structure of the domain. … It also appears that experts, in contrast to novices, not only have a vastly richer store of relevant knowledge
accessible in memory but also structure and continually restructure knowledge in more complex ways. In particular, experts construct complex schemas or mental models that combine some of the dimensions and simpler schemas used by novices into integrated functional patterns, while at the same time discarding as redundant or irrelevant some other dimensions that novices attend to. Thus, experts develop mental models representing new and adroitly usable patterns of perceiving, thinking, and acting that direct, organize, and control both the acquisition of new knowledge and the processing of information in the course of problem solving. In particular, the development of relevant mental models facilitating problem representation has been shown to be a critical aspect of expertise in widely disparate fields.

Klein (1999) in his groundbreaking description of recognition primed decisions (RPD) provides a complementary perspective on expertise and its development and application.

Finally, protocols represented by heuristics provide guides to decision-making. While not necessarily based on (or refined by) experience or the product of formal statements of the characteristics of the decision situation, they nevertheless can be useful and valuable guides in decision-making. Clarkson (1962) and Bonini (1963) present descriptions of highly developed protocols for decisions in an organizational context.

As the foregoing makes clear, analysis is the foundation for the protocols used in making routine decisions, but is not a part of the actual decision process.

**Non-routine Decisions**

Due to their nature, exceptional (non-routine) decisions require analysis. They have not occurred before and there is no base of experience to guide the decision-maker. Non-routine decisions are not “economist’s decisions” – neither perfect information nor knowledge of all available alternatives is available. Interesting non-routine decisions are simultaneously significant to the organization and unlike previous decision situations. Analysis is required for these decisions and the quality of the decision relates directly to the quality of the analysis.

The five-step analysis process cited at the beginning of this development (along with the variants described in summary form), while interesting, is singularly inappropriate as a guide to making non-routine decisions. The attributes of the process render it ineffective for non-routine decisions. In summary form, the attributes are:

- **Sequential**; once a step is complete, it is not revisited.
- **Complete**, all alternatives are identified
- **Deterministic**, in the sense that the decision-maker understands the relation between alternatives and outcomes. The relation may involve probabilities (risk) in which case the selection may involve computing an expected value.
• Assume perfect information (outcomes, and their probabilities, for each alternative are known)
• The analyst (decision-maker), if not an individual, is a group of undifferentiated individuals with a unitary purpose

Only a superficial comparison of these attributes to the characteristics of non-recurring decisions is necessary to reveal that the analysis process, as described, will be singularly ineffective in addressing non-recurring decisions.

The nature of non-recurring decisions makes the formulation of a completely effective procedure for analysis problematic. However, an improvement on the existing process is not difficult to conceive. There is a \textit{prima facie} argument that an analysis process with the following characteristics will produce decisions superior to those developed from the existing process(es).
- Systemic
- Iterative
- Adaptive (to new information)
- Self-correcting
- Active (in seeking new information and innovative approaches)

The formulation of a revised analytic process incorporating these characteristics involves synthesizing several well known, but seemingly disparate, research results and applications.

\textbf{A Systemic Approach to Decision Analysis}

The object of a revised analysis procedure is to guide improved decision-making for non-routine decisions (and for initial occurrences of routine decisions). Effective development of a protocol for routine decisions obviously depends upon the quality of the analysis of the initial occurrences. Protocols for recurring decisions may be improved over time, but at a cost. The quality of non-routine decisions depends even more critically on the quality of the analysis since there is only one opportunity to make such decisions. It is therefore important to have a guide to analysis that will produce the best possible results.

We propose that a proper model for analysis will exhibit the characteristics noted immediately above and provide procedural guidance in seven areas: (1) Understanding the decision \textit{opportunity}, (2) Formulating the correct \textit{goals} for the decision, (3) Identifying and involving the correct \textit{participants} in the decision, (4) \textit{Framing} the decision correctly (including understanding relevant alternative framings). (5) Generation of \textit{alternatives}, (6) \textit{Choice}: selecting an alternative and (7) \textit{Learning}, to improve future decision-making.
A star-shaped graphic represents the analytic process, Figure 1. Characteristics of the process are:

- Elements are systemically interactive. Each point of the star connects to all other points, indicating the joint and reciprocal influence of all elements of the process.
- Facilitates an iterative process. Consideration of any aspect of the decision may prompt a re-evaluation of any other aspect to accommodate newly developed or revealed information or perspectives. The analysis process concludes only when all issues described by points of the star are jointly resolved. Selection of an alternative occurs only when the iterative process is stable, producing no change in any element.
- Accommodates a broad range of perspectives and approaches. Multiple framings of the decision situation are required.
- Facilitates the development of expertise (in situations expected to recur). The analysis, conducted properly, will reveal the crucial relations extant in the decision situation. These form the basis for the mental models associated with expertise or the formal models of programmed decision systems.
- Encourages *post hoc* analysis as the basis for individual (and organizational) learning. Outcome statements are an essential part of alternatives.
Each of the elements of the decision (points of the star) makes a distinct contribution to the decision. Each element controls, and is controlled by, each other element. As noted, choice occurs only after all interactions are fully developed and all implications assessed.

Choice is the disjoint step marking the end of the decision analysis. Competing alternatives typically reflect different framings of the decision situation, different goals, and perhaps, different motives of participants. In many situations, the choice is from among competing framings of the situation rather than competing alternatives developed from the same frame.

**Elements of the Star**
The analysis process represented by the Star contains elements well documented in the literature on decision-making. A brief review follows.

*Opportunity* for a decision typically arises from a *Gap Analysis* in which a ”gap” between the present state and the desired state is identified. Huitt (1992) cites Arnold (1978) in identifying four types of gaps:

1) something is wrong and needs to be corrected;
2) something is threatening and needs to be prevented;
3) something is inviting and needs to be accepted; and
4) something is missing and needs to be provided.

Tunnel vision (stating the problem too narrowly) represents the major difficulty in problem identification as it leads to artificially restricting the search for alternatives.”

SWOT (Strengths, Weaknesses, Opportunities, & Threats) analysis may be used to identify strategic decisions. The “O” and “T” in SWOT usually involves one of the four types noted immediately above. Harrison (1999) describes a procedure for identifying strategic gaps.

An exploration of the process by which the organization identifies the need for a non-routine decision can provide useful insights into goals and framing.

*Goals* reflect organization mission and strategy. The goals for a specific decision involve interpretation of mission and strategy as applied to the decision environment. Different interpretations (which easily arise from different framings) can easily lead to conflicting goals or a lack of goal clarity. Both Drucker (1973) and Ackoff (1981) describe how suboptimization can easily lead to conflicting objectives.

Who *Participates* in the decision is an issue overlooked by many researchers. The notion of the decision-maker as an individual actor is deeply rooted in the assumptions of the perfectly competitive economic model. The organization in the 21st century has moved far beyond the
simplifying assumptions appropriate during the industrial revolution (see Ackoff, 1981 for an elaboration of this concept). From a different perspective, Vroom & Jago (1988) use characteristics of the decision to determine who should participate in the decision process.

How the decision is *Framed* is crucial to the decision process. Russo (2002) argues coherently that the quality of the eventual decision depends significantly on how the situation is framed. Poorly framed decisions will be poor quality decisions. Proper framing is a necessary attribute of a good decision and aggressive efforts to identify many framing alternatives for the problem are required.

The variety of potential frames is extensive. Included are: (1) the functional perspective (Finance, Operations, Marketing, etc.), (2) Ethical perspective, (3) “Green” perspective, (4) cross-cultural, (5) quantitative perspective (can we formulate the decision in an optimization model?), and so forth. Frames are not exclusive and the eventual best perspective on a decision will likely be the result of a combination of frames. Undoubtedly, “frame blindness” (Russo, 2002) is a serious impediment to quality decisions. The most notable argument for multiple frames is the famous quote by Alfred P. Sloan, Jr. (reported by Drucker, 1973 and others): “Gentlemen, I take it we are all in complete agreement on the decision here.” Everyone around the table nodded assent. “Sloan continued. “Then, I propose we postpone further discussion of this matter until our next meeting to give ourselves time to develop disagreement and perhaps gain some understanding of what the decision is all about.”

How individuals frame decision situations reflects the paradigm they find most effective as a guide to understanding the environment. The German *Weltanschauung* describes the concept nicely.

*Alternatives* are the result of problem solving activity. Each framing of the decision situation presents a problem and the solution to the problem (there may be more than one) represents an alternative for the decision. It is, of course, necessary that the alternative include a statement of the expected effect of its adoption. The linkage is direct: from frame to solved problem to decision (action) alternative to expected outcome.

*Choice* (actually making the decision) may, in view of the foregoing, be construed as selecting the frame and outcome that best serve organizational objectives. The decision-maker(s) must determine which framing of the (non-routine) decision best represents the true environment and which alternative (for the selected frame) presents the most desirable outcome. Stated thus, the choice would appear perfunctory. However, the perceptive decision maker(s) recognizes that there is great uncertainty about which frame is most appropriate, the linkage between proposed action and projected outcomes, and the desirability of the outcome in a future environment.
Learning is a post hoc activity, based on a comparison of projected outcome with reality as it occurs. Senge (1990) discusses this process in some detail. While much of the content applies to recurring decisions, there are also valuable insights in the area protocol development. It is generally not clear whether the first instance of a decision represents a non-recurring case or whether it is the first instance of a new type of recurring decision. For this reason, particular attention should be devoted to documenting projected outcomes and then to comparing what was expected to what actually occurs.

Systemic Interactions
The idea of recursion in decision-making is not new. Harris (1998) describes a recursion between criteria and alternatives. The analysis process presented here extends recursion to all points of the Decision Star. In the following paragraphs, we discuss the analysis process as a systemic interaction of processes represented by the points of the star.

The decision analysis begins with recognition of an opportunity for a decision. Typically, a complete understanding of the decision will not be present from the outset. This is particularly true for non-recurring decisions. Further, an alternative may present along with the opportunity, but it is generally wise to avoid a quick decision, especially if circumstances suggest the decision is an important one. The initial actions of the decision-maker are to describe the opportunity, define the specific goals for the decision and articulate the frame as completely as possible. The next step is to validate the opportunity, goals, and frame.

Opportunity validation most conveniently involves evaluation by another individual with a presumed interest in the decision. In the ideal case, this individual will frame the decision differently or, perhaps, have a different perspective on the goals for the decision. It is well established (Connolly, 2000) that multidisciplinary teams make superior decisions to those made by individuals or groups with a single, or narrow, vision.

The participants in the decision drive the process. Alternative frames, goal clarity, viable alternatives all require participants with varied perspectives and commitment to the best possible decision.

The Star graphic with direct links connecting Opportunity, Goals, Participants, and Frame illustrates the systemic interaction of these elements of the decision. Each participant will contribute a (potentially conflicting) perspective on these elements. A systemic, iterative process with the objective of resolving conflicts and producing a completely articulated statement of alternative frames and associated action alternatives is essential to achieving the best possible decision.
As the process proceeds, each element potentially prompts a revision to other elements. Thus, a new frame will require a revision to the goal statement, and possibly a fuller understanding of the opportunity. A new participant will contribute a new perspective on goals (possibly based on the perspective of a different part of the organization), potentially prompting a revised perception of the opportunity.

The iterative process concludes with the definition of several alternative frames for the decision with corresponding action alternatives (including expected outcomes). The process should continue until:

- Alternative frames are fully developed
- Goal clarity, for each frame, is achieved
- The opportunity is validated for each frame
- Participants are satisfied that no additional participants will contribute new perspectives (i.e., that additional frames are unlikely)
- There is complete articulation of action alternatives corresponding to each frame, including statements of expected outcomes.

Observe that the adoption of a ‘frame centric’ representation of the conclusion of the process, involves associating different characterizations of opportunity, goals, and actions with alternative framings of the decision. Other representations are, of course, possible but they lack the scope of the frame-based organization.

The analysis process concludes with the choice of an alternative. Once a choice is made, the analysis is concluded and the attention of decision-makers is turned to implementation of the choice and to await the next opportunity.

The Broad Point
Existing models for analysis of non-routine decisions are deeply rooted in concepts of organization and the management process that exhibit the philosophy and assumptions of the 19th century. Organizations, and management, in the 21st century exhibit radical differences in comparison to 19th century models. One of the primary areas of contrast is decision-making in the organization. The presentation in this paper pursues the goal of showing how analysis must change and, in fact, is changing to reflect new organizational models and management processes. Gary Hamel (quoted in Barsh, 2008) puts it thus:

“The outlines of the 21st-century management model are already clear. Decision-making will be more peer based; the tools of creativity will be widely distributed in organizations. Ideas will compete on an equal footing. Strategies will be built from the bottom up. Power will be a function of competence rather than of position. In terms of the future of management, we’re at the beginning of what will be a fairly long
journey. You can see some of the pieces starting to come together, but we’re not there yet.”

Hamel is the author of *The Future of Management*. The *Wall Street Journal* recently ranked Gary Hamel as the world's most influential business thinker, and Fortune magazine has called him "the world's leading expert on business strategy."

There is little doubt that a linear and sequential analytic process is inappropriate to the function of both manager and organization in the 21st century. Systemic, iterative processes have evident in organization for some time and an objective presentation of the nature of these systemic processes is long overdue.

**References**


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