Management Decisions
A Whitepaper

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Abstract: People were expressing interest in understanding how humans make decisions as long ago as 1738. It was then when Daniel Bernouilli[1] announced the concept of decision theory, to explain the non-linear value of money. The concepts have evolved in an attempt to formalize a process so people could make better decisions. While changes in the evolution have focused on the "process", one basic element has remained consistent. Only when everything is known about a problem and its potential solutions, can the most "informed" decision be made. So hand-in-hand with the decision-making process is a knowledge-gathering process.

Just like decision-making, there has been a similar investigation into the aspects of knowledge capture. Both topics have spawned industries. Decision Support, Knowledge Capture and Data Mining are just a few of the titles used to label these market segments. This paper will focus on how the objectives of decision-making combined with a process of knowledge collection can be employed to make more valuable, comprehensive and rational decisions. It will highlight some contemporary approaches and discuss enhancements to make the process easier.

Knowledge Capture and Decision-Making

Consider the following "chicken and egg" problem: While it is possible to make decisions without knowledge or understanding, most would agree that the quality of the decision would suffer. At the same time one might question the need to capture knowledge if it wasn't for decision-making. Both knowledge capture and decision-making have long been addressed from a research standpoint.

Terms used in the following are those that were coined by Dr. Horst Rittel and Dr. Melvin Webber in "Dilemmas in a general Theory of Planning"[2]. In that paper, they differentiate "wicked" problems from "tame" problems. They identify "tame" problems as those where a formula can be used to calculate an answer. If someone uses the formula they can calculate a "correct" answer for a given dataset. Tame problems are either right or wrong. On the other hand, "wicked" problems are those where the answer lies in the gray area; somewhere between good and bad. There is unlikely to be a formula to calculate a "correct" answer to a wicked problem. If it was attempted, the formula would be so complex, that it would be obsolete before it was completed.

[1] Bernouilli, Daniel. "St. Petersburg Paradox", Paper, St. Petersburg Academy 1738
[2] Rittel, Horst and Melvin Webber. "Dilemmas in general Theory of Planning' Report, University of California, Berkeley 1973

Rittel and Webber were focusing their work on city planning activities and they created the IBIS ("Issue Based Information System"[3]) process in order to decompose a problem by structuring the information in the form of a discussion. An issue was decomposed through numerous levels of a decision tree where the entire dataset could be viewed as a "discussion". While they were not focusing on a specific decision, they were trying to formalize a process of gathering all of the information about a topic. By learning all aspects of a problem they believed they could make the most informed decisions possible.

Researchers focused specifically on the decision-making process have determined a long time ago that problems need to be broken down or decomposed in order to solve them. Most of these decision-making methodologies focus on choosing the best option or alternative. The issue could be to choose the best product, to choose the most important project, or to choose the most suitable supplier. It could be to choose the best course of action to solve a problem. Of course, one of the options could be to do nothing at all.

The techniques usually focus on decomposing the decision into criteria or attributes against which all alternatives should be compared. First, each of the criteria is rated as to its importance in the final decision. Then, each optional solution is compared against each of the criteria. Because we are looking at the best relative solution, the sum of the products of "criteria importance" and "level of support for each of the options" can be compared. The option with the highest relative number will provide the preferred solution.

This process of identifying and ranking criteria and then comparing options against the criteria has been given several names by academia (MADM – Multi Attribute Decision Making, MAVT – Multi-Attribute Value Theory; MAUT – Multi-Attribute Utility Theory; MCDA – Multi-Criteria Decision Analysis). In these cases, numeric values have commonly been assigned to the criteria to identify their value. Likewise, numeric values have commonly been assigned to the options to indicate how well they support the criteria. Approaches like AHP[4] (Analytical Hierarchy Process) have been offered as a solution that focuses on pair-wise comparisons so the user has only to compare two products at a time.

While these approaches differ slightly in their approach to solving multi-criteria problems, their underlying benefit is that they attempt to give the user a process by which they can expose all points of view. The advantage of these approaches is that they provide an explainable solution and demonstrate that the user has given sufficient attention to all aspects of the problem itself.

Shortcomings of Today's Approaches

[3] Kunz, Werner and Horst Rittel. "Issues as Elements of Information Systems" Working Paper No. 131 University of California, Berkeley 1970

[4] Saaty, Thomas. "The Analytic Hierarchy Process", McGraw Hill Company, New York 1980

Cognitive psychology has found that people have a difficult time assimilating large quantities of information during the problem solving process. The conventional application of MADM / MAUT / MAVT / MCDA has required that the decision makers address multiple attributes and multiple options. By asking the decision makers to assign numeric values to these wide ranging attributes, the concern has been that the criteria and options could not be consistently evaluated.

The AHP approach, which was developed to respond to the potential complexity of MADM MAUT / MAVT / MCDA, is not without limitations. The most challenging issue is the situation where you have a large number of options and a large number of criteria. In this case, the number of comparisons increases exponentially.

The MADM / MAUT / MAVT / MCDA and AHP approaches all utilized numeric values to define rankings of criteria or to define relationships between options. This is somewhat inconsistent with subjective (emotional) decision-making which is primarily a "right-brain" activity, while numeric (logical) processing is primarily a "left-brain" activity. The very fact that the decision maker is required to translate data from right-brain to left-brain exemplifies that there is a potential corruption of the subjective information.

Focus of Conventional Tools

A large number of software tools have been released to formalize the decision-making process. The primary differentiator for these tools has been *how* they display the compiled results of the information. Along with making decisions, there is an equally important responsibility of the decision maker: to explain and justify the decision that is made. For this reason there has been a significant amount of work in defining new graphical approaches to show how information sets are compared.

Another focus of more recent research has been the addition of more complex algorithms and processes to respond to some of the issues associated with the basic processes. This has lead to even more complexity for the users. Jim Smith (GM Onstar) provided some directions to the System Dynamics community at a INFORMS Meeting in Seattle[5] in 1998, where he suggested that people involved in System Dynamics tend to build models for their own sake, often enthralled by model complexity itself. There is always the concern that tool vendors want to overwhelm the user with data and thus demonstrate their value by the amount of paper they can produce.

Compsim Management Tools

Compsim offers a software tools for knowledge capture and decision-making. Compsim's management tools differentiate themselves by removing the "numeric focus"

5 Panel Discussion: Downstream Decisions (Options) and Dynamic Modeling, Seattle INFORMS Meeting, October 25-28, 1998

from the ranking and weighting activity. Using a patent-pending graphical approach, it allows direct right-brain input of the subjective data in the information gathering stage. This visual approach greatly simplifies the data input portion of the knowledge capture and decision making activity that has not been the focus of other tools. It relies on the basic tenants of IBIS and the Multi-Criteria decision-making model to accumulate and process the information.

The focus of Compsim's management tools is on ease of use. The graphical approach for the input of subjective information is especially helpful in consensus building. It is possible to use the visual ranking and weighting function in a group environment. Group members can discuss the relationships between data items and get immediate feedback of the impact on the overall solution.

Compsim's tools also focus on the time saving elements and value of knowledge reuse. It provides a mechanism for capturing the structure of the decision-making process in the form of templates. This addresses the need to facilitate or streamline the decision-making activity and provides a means for organizations to capture knowledge that can be reused when similar problems are addressed in the future.

Summary

To remain competitive in our fast paced business environment, individuals and organizations need to be certain that they are making the most informed decisions possible. Companies are faced with ever increasing pressures to "do more with less" and they need tools to support this objective. Compsim's management tools use proven techniques to capture knowledge and evaluate information to make decisions that address "wicked" problems. Compsim's tools focus on ease-of-use in a "discussion" oriented framework. It provides a unique solution to create well understood and explainable decisions with the ability to reuse knowledge gained over time. The ability to perform the ranking and weighting in a group environment assures that all participants understand how the decisions are made and can participate in the decision-making process. There will always be pressure to make decisions faster and faster. It will be the companies that make good decisions fast that survive and grow.

Compsim LLC is a provider of next generation decision-making technology for application in industrial automation, medical, military, governmental, enterprise software and electronic gaming markets. The company also provides consulting services using its advanced technology to solve tacticaland strategic business problems. The company is headquartered in Brookfield, Wisconsin. The website is: http://www.compsim.com

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