Decision Engineering

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Decision Engineering is a framework that unifies a number of best practices for organizational decision making. It is based on the recognition that, in many organizations, decision making could be improved if a more structured approach were used. Decision engineering seeks to overcome a decision making "complexity ceiling", which is characterized by a mismatch between the sophistication of organizational decision making practices and the complexity of situations in which those decisions must be made. As such, it seeks to solve some of the issues identified around complexity theory and organizations. In this sense, Decision Engineering represents a practical application of the field of complex systems, which helps organizations to navigate the complex systems in which they find themselves.

Despite the availability of advanced process, technical, and organizational decision making tools, decision engineering proponents believe that many organizations continue to make poor decisions. In response, decision engineering seeks to unify a number of decision making best practices, creating a shared discipline and language for decision making that crosses multiple industries, both public and private organizations, and that is used worldwide.

To accomplish this ambitious goal, decision engineering applies an engineering approach, building on the insight that it is possible to design the decision itself using many principles previously used for designing more tangible objects like bridges and buildings. This insight was previously applied to the engineering of software--another kind of intangible engineered artifact--with significant benefits.

As in previous engineering disciplines, the use of a visual design language representing decisions is emerging as an important element of decision engineering, since it provides an intuitive common language readily understood by all decision participants. Furthermore, a visual metaphor improves the ability to reason about complex systems as well as to enhance collaboration.

In addition to visual decision design, there are two other aspects of engineering disciplines that aid mass adoption. These are: 1) the creation of a shared language of design elements and 2) the use of a common methodology or process, as illustrated in the diagram above.

Motivation

The need for a unified methodology of decision making is driven by a number of factors that organizations face as they make difficult decisions in a complex internal and external environment.

Recognition of the broad-based inability of current methods to solve decision making issues in practice comes from several sources, including government sources and industries such as telecommunications, media, the automotive industry, and pharmaceuticals.

Examples:

The outcomes of decisions are becoming more complex, going well beyond next quarter's revenues or other tangible outcomes to multiple goals that must be satisfied together, some of which are often intangible:

The car is becoming an expression of identity, values, and personal control in ways that move far beyond traditional segmentation and branding. For example, fuel efficiency will be only one consideration for a socially responsible vehicle (SRV). What percent of the parts are recyclable? What is the vehicle's total carbon footprint? Are there child labor inputs? Toxic paints, glues, or plasticsHow transparent is the supply chain? Is the seller accountable for recycling? What methods are used? Are fair labor practices employed?
-- Shoshana Zuboff, The GM Solution: Life Boats, Not Life Support. Business Week, November 18, 2008

Global increase in complexity:

We live in a dynamic world in which the pace, scope, and complexity of change are increasing. The continued march of globalization, the growing number of independent actors, and advancing technology have increased global connectivity, interdependence and complexity, creating greater uncertainties, systemic risk and a less predictable future. These changes have led to reduced warning times and compressed decision cycles.

-- Director of National Intelligence, Vision 2015: A Globally Networked and Integrated Intelligence Enterprise Also see this Vision 2015 summary

Transferring engineering principles

Unlike other decision making tools and methodologies, decision engineering seeks to bring to bear a number of engineering practices to the process of creating a decision. These include requirements analysis, specification, scenario planning, quality assurance, security, and the use of design principles as described above. During the decision execution phase, outputs produced during the design phase can be used in a number of ways; monitoring approaches like business dashboards and assumption based planning are used to track the outcome of a decision and to trigger replanning as appropriate. One view of how some of these elements combine is shown in the diagram at the start of this article.

Like related engineering disciplines before it, decision engineering promises improvements in the quality of decisions made, the ability to make them more quickly, the ability to align organizational resources more effectively around a change in decisions, and lowers the risks associated with decisions. Furthermore, a designed decision can be reused and modified as new information is obtained.
Bringing numerical methods to the desktop

Although many elements of decision engineering, such as Sensitivity analysis, are mature disciplines, they are not in wide use by strategic planners. Decision engineering seeks to create a visual language that serves to facilitate communication between them and quantitative experts, allowing broader utilization of these and other numerical and technical approaches.

Origins

It is interesting to note that, despite decades of development of decision support system and methodologies (like decision analysis), these are still less popular than spreadsheets as primary tools for decision making. Decision engineering seeks to bridge this gap, creating a critical mass of users of a common methodology and language for the core entities included in a decision, such as assumptions, external values, facts, data, and conclusions. If a pattern from previous industries holds, such a methodology will also facilitate technology adoption, by clarifying common maturity models and road maps that can be shared from one organization to another.

The decision engineering approach is multidisciplinary, unifying findings on cognitive bias and decision making, situational awareness, critical and creative thinking, collaboration and organizational design, with engineering technologies.

Decision engineering is considered an improvement upon current organizational decision making practices, which include the use of spreadsheets (difficult to QA, hard to collaborate and discuss), text (sequential in nature, so is not a good fit for how information flows through a decision structure), and verbal argument. The movement from these largely informal structures to one in which a decision is documented in a well understood, visual language, echoes the creation of common blueprint methodologies in construction, with promise of similar benefits.

Decision engineering is both a very new and also a very old discipline. Many of its elements--such as the language of assessing assumptions, using logic to support an argument, the necessity of critical thinking to evaluate a decision, and understanding the impacts of bias--are ancient. Yet the realization that these elements can form a coherent whole that provides significant benefits to organizations by focusing on a common methodology is relatively new.

Visual decision design

Because it makes visible the otherwise invisible reasoning structures used in complex decisions, the design aspect of decision engineering draws from other conceptual representation technologies like mind mapping, conceptual graphs, and semantic networks. The basic idea is that a visual metaphor enhances intuitive thinking, inductive reasoning, and pattern recognition--important cognitive skills usually less accessible in a verbal or text discussion. A business decision map can be seen as one approach to a formal decision language to support decision engineering.

See, e.g., Waring, 2010.

Explicit representation of intangibles

Decision engineering recognizes that many aspects of decision making are based on intangible elements, including opportunity costs, employee morale, intellectual capital, brand recognition and other forms of business value that are not captured in traditional quantitative or financial models. Value network analysis--most notably Value network maps--are therefore relevant here.

Notes

Enterprise Decision Management (EDM) is a closely related discipline that focuses on automating decisions across an enterprise. Decision Engineering is from this point of view a superset of EDM, since it encompasses both manual and automated decision making processes, unifying them into a common methodology that, when effective, breaks down barriers between quantitative analysis / analytics tools and departments and those with a more qualitative / strategic / management focus.

The term "Decision engineering" is used in several industries with more specific meaning than the framework described here. For instance, the Australian Software Research Centre has an IT evaluation approach called Decision Engineering; Idea focuses on emergency management under the heading of "Decision Engineering Analysis"; and the National University of Singapore includes an organization called the Decision Engineering Group. Each of these has a meaning that is distinct from what is discussed in the present article.

In behavioral economics, "Decision engineering" can mean the deliberate manipulation of consumer choices, as in this Journal of Consumer Research study: People choose healthy meals, if given more choice: Study. In this use of the term, Decision Engineering is roughly analogous to Soft paternalism - a quite different meaning than is covered in the present article, referring as it does to the engineering of decisions made by consumers, rather than the use of engineering principles to aid in complex decision making. Although distinctly different, this practice draws on much of the same decision-making research as does decision engineering (such as, for the example, the work of Richard Thaler as described in this article about Barak Obama's University of Chicago connections to this school of thought).

Cost engineering applies engineering principles to measure the costs associated with engineering projects. Cost engineering is sometimes grouped into the broader context of other engineering decisions, such as product engineering and design optimization, in which context it is sometimes referred to as "Decision Engineering". This can be distinguished from the broader framework of this article, which goes beyond the arena of engineering decisions to all decisions faced by organizations.

Operations research is a largely quantitative approach to decision making that attempts to identify optimal or near-optimal solutions to decision making problems.