Chapter 12 - TM-Functions - Decision Making

Course Contents: TM-Functions - Decision Making: Nature of Decision Making, Management Science, Tools for Decision Making, Computer-Based Information Systems, and Implementation. [TB 2: Ch. 3]

Contents

Introduction

In psychology, **decision-making** is regarded as the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities. Every decision-making process produces a final choice; it may or may not prompt action. Decision-making is the process of identifying and choosing alternatives based on the values and preferences of the decision-maker.

Nature of Decision Making

Decision-making can be regarded as a problem-solving activity terminated by a solution deemed to be satisfactory. It is therefore a process which can be more or less rational or irrational and can be based on explicit or tacit knowledge.

Human performance with regard to decisions has been the subject of active research from several perspectives:

- ***Psychological:*** examining individual decisions in the context of a set of needs, preferences and values the individual has or seeks.
- ***Cognitive:*** the decision-making process regarded as a continuous process integrated in the interaction with the environment.
- ***Normative:*** the analysis of individual decisions concerned with the logic of decision-making, or communicative rationality, and the invariant choice it leads to.

A major part of decision-making involves the analysis of a finite set of alternatives described in terms of evaluative criteria. Then the task might be to rank these alternatives in terms of how attractive they are to the decision-maker(s) when all the criteria are considered simultaneously. Another task might be to find the best alternative or to determine the relative total priority of each alternative (for instance, if alternatives represent projects competing for funds) when all the criteria are considered simultaneously. Solving such problems is the focus of multiple-criteria decision analysis (MCDA). This area of decision-making, although very old, has attracted the interest of many researchers and practitioners and is still highly debated as there are many MCDA methods which may yield very different results when they are applied on exactly the same data.[2] This leads to the formulation of a decision-making paradox.

Logical decision-making is an important part of all science-based professions, where specialists apply their knowledge in a given area to make informed decisions. For example, medical decision-making often involves a diagnosis and the selection of appropriate treatment. But naturalistic decision-making research shows that in situations with higher time pressure, higher stakes, or increased ambiguities, experts may use intuitive decision-making rather than structured approaches. They may follow a recognition primed decision that fits their experience and arrive at a course of action without weighing alternatives.

The decision-maker's environment can play a part in the decision-making process. For example, environmental complexity is a factor that influences cognitive function.[3] A complex environment is an environment with a large number of different possible states which come and go over time. Studies done at the University of Colorado have shown that more complex environments correlate with higher cognitive function, which means that a decision can be influenced by the location. One experiment measured complexity in a room by the number of small objects and appliances present; a simple room had less of those things. Cognitive function was greatly affected by the higher measure of environmental complexity making it easier to think about the situation and make a better decision.

Research about decision-making is also published under the label problem solving, in particular in European psychological research.

Characteristics of decision-making

Followings are the key characteristics of decision making:

- Objectives must first be established
- Objectives must be classified and placed in order of importance
- Alternative actions must be developed
- The alternatives must be evaluated against all the objectives
- The alternative that is able to achieve all the objectives is the tentative decision

- The tentative decision is evaluated for more possible consequences
- The decisive actions are taken, and additional actions are taken to prevent any adverse consequences from becoming problems and starting both systems (problem analysis and decision-making) all over again
- There are steps that are generally followed that result in a decision model that can be used to determine an optimal production plan
- In a situation featuring conflict, role-playing may be helpful for predicting decisions to be made by involved parties

Basic steps in effective decision-making

Here are seven basic steps in effective decision making:

1. **Identify the decision to be made**: After realizing that a decision must be made, you then go through an internal process of trying to clearly define the nature of the decision you must make.
2. **Gather relevant information**: Most decisions require collecting pertinent information. Some information must be sought from within yourself through a process of self-assessment, while other information must be sought from outside books, people and a variety of other sources.
3. **Identify alternatives**: Through the process of collecting information you will probably identify several possible paths of action, or alternatives. In this step of the decision-making process, you will list all possible and desirable alternatives.
4. **Weigh evidence**: In this step, you draw on your information and emotions to imagine what it would be like if you carried out each of the alternatives to the end. You must evaluate whether the need identified in Step 1 would be helped or solved through the use of each alternative.
5. **Choose among alternatives**: Once you have weighed all the evidence, you are ready to select the choice that seems to be best suited to you.
6. **Take action**: You now take some positive action, which begins to implement the alternative you chose.
7. **Review decision and consequences**: In the last step you experience the results of your decision and evaluate whether or not it has "solved" the need you identified in Step 1. If it has, you may stay with this decision for some period of time. If the decision has not resolved the identified need, you may repeat certain steps of the process in order to make a new decision.[1]

Management Science

Management science (MS), is the broad interdisciplinary study of problem solving and decision making in human organizations, with strong links to management, economics, business, engineering, management consulting, and other sciences. It uses various scientific research-based principles, strategies, and analytical methods including mathematical modeling, statistics and

[1] See more at: http://www.businessnewsdaily.com/6162-decision-making.html#sthash.f2lpct2I.dpuf

numerical algorithms to improve an organization's ability to enact rational and accurate management decisions by arriving at optimal or near optimal solutions to complex decision problems. In short, management sciences help businesses to achieve goals using various scientific methods.

The field was initially an outgrowth of applied mathematics, where early challenges were problems relating to the optimization of systems which could be modeled linearly, i.e., determining the optima (maximum value of profit, assembly line performance, crop yield, bandwidth, etc. or minimum of loss, risk, costs, etc.) of some objective function. Today, management science encompasses any organizational activity for which the problem can be structured as a functional system so as to obtain a solution set with identifiable characteristics.

Management science is concerned with a number of different areas of study: One is developing and applying models and concepts that may prove useful in helping to illuminate management issues and solve managerial problems. The models used can often be represented mathematically, but sometimes computer-based, visual or verbal representations are used as well or instead. Another area is designing and developing new and better models of organizational excellence.

The management scientist's mandate is to use rational, systematic, science-based techniques to inform and improve decisions of all kinds. The techniques of management science are not restricted to business applications but may be applied to military, medical, public administration, charitable groups, political groups or community groups.

Decision-making tools and techniques

While the basic principles might be the same, there are dozens of different techniques and tools that can be used when trying to make a decision. Among some of the more popular options, which often use graphs, models or charts, are:

- **Decision matrix**: A decision matrix is used to evaluate all the options of a decision. When using the matrix, create a table with all of the options in the first column and all of the factors that affect the decision in the first row. Users then score each option and weigh which factors are of more importance. A final score is then tallied to reveal which option is the best.
- **T-Chart**: This chart is used when weighing the plusses and minuses of the options. It ensures that all the positives and negatives are taken into consideration when making a decision.
- **Decision tree**: This is a graph or model that involves contemplating each option and the outcomes of each. Statistical analysis is also conducted with this technique.
- **Multivoting**: This is used when multiple people are involved in making a decision. It helps whittle down a large list options to a smaller one to the eventual final decision.
- **Pareto analysis**: This is a technique used when a large number of decisions need to be made. This helps in prioritizing which ones should be made first by determining which decisions will have the greatest overall impact.

- **Cost-benefit**: This technique is used when weighing the financial ramifications of each possible alternative as a way to come to a final decision that makes the most sense from an economic perspective.
- **Conjoint analysis**: This is a method used by business leaders to determine consumer preferences when making decisions.

Commonly Used Tools For Decision Making.

1. **Pareto Analysis** - Often better known as "The 80/20 Rule," Pareto helps you locate where you can derive the greatest benefit by expending the least relative effort (or cost or resources or what have you). In the go-go dotcom days, the bizdev guys used to call this "low-hanging fruit." *Ew*. (Seriously, though, once you learn about the 80/20 rule, you start seeing instances of it everywhere).
2. **Paired Comparison** - Compose a table that pits each option directly against each other option, *mano a mano,* cage-match-style, and weighting each for relative importance. It's a fast and bloodless way to plow through what would otherwise be a huge mess to evaluate.
3. **Grid Analysis** - Evaluate a larger set of options based on numerous criteria, then weight the importance of each criterion to derive the best choice. Given the complexity and arithmetic required, this one really benefits from using good old Excel.
4. **Decision Trees** - I've never personally used this, but it looks kind of promising. Basically you build a set of "what-ifs" based on a tree of possible options, assigning the estimated value, cost, or savings associated with each choice.
5. **PMI** - One of my favorites that I actually use quite a lot. List all the pluses, minuses, and implications behind any decision (I've also seen this "I" column referred to *interesting* or *intriguing* data points). Then assign a + or - numerical value to each based on the positive or negative impact. Tally up the columns, and your better option emerges. Takes the emotion and guesswork out of complex decisions, with the side benefit of forcing a brain dump. By the way, although you can totally do this in Excel (or on paper), I made a template for OmniOutliner that works like a champ for more lengthy or detailed option sets.
6. **Force Field** - I've never completely gotten this one, but I know some folks swear by it. You identify all the forces for and against a theoretical change, weighted for amount of force exerted by each "side." I suppose I could see this being useful for touchy political decisions or any time a well-established more is going to be challenged. Might help in mitigating risk and knowing where best to allocate your resources and influence.
7. **Six Thinking Hats** - Recently added de Bono's book on this subject to the left rail (See it? Over there by all my hippie meditation books?). It's a method for seeing an issue from all perspectives by forcing yourself (or more often your team) to—one at a time—adopt different "thinking hats" that reflect opposing and orthogonal points of view (analytical, positive, negative, creative, etc.). I'd be curious to hear how this has worked for folks in real-world projects. Seems like it could get tedious in the wrong hands.
8. **Cost/Benefit** - This is an evergreen you've probably used a dozen or more times; estimate the costs and the benefits and decide if the delta is worth the hassle. As ever, be sure to account for *all* the costs of a change, including the meta stuff.

Computer-Based Information System

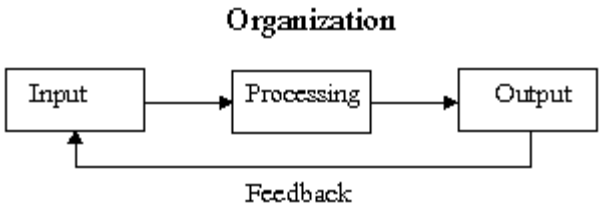
What is a system?

A **system** is a set of elements with relationships between them. They work together to achieve a common purpose or goal. System has inputs, processing mechanisms and outputs. Systems can be relatively simple, or they can be more complex. Hospitals, manufacturers, insurance companies and electric utilities can be viewed as systems. In most of these cases, the system goals is profit maximization or customer satisfaction. Inputs of these systems include labor, capital, land, merchandise, equipment, and so on. Output from these systems is the goods and services offered by the business. The system boundary defines the system and distintinguishes it from everything else (the environment). The input, the processing mechanism and the output are system elements. Systems in the system are **subsystems**. Systems can be classified along numerous spectrums.

- A **simple system** is one which there are few elements or components and the relationship or interaction between elements is uncomplicated and straightforward.
- A **complex system** has many elements that are highly related and interconnected.
- An **open system** has an interaction with its environment. In other words, there is a flow of inputs and outputs across the system boundary.
- A **closed system** has no interaction with environment.
- A **stable system** is one in which changes in the environment result in a little or no changes in the system.
- A **dynamic system** is one that undergoes rapid and constant change due to changes in its environment.
- An **adaptive system** is one that responds to a changing environment. In other words, an adaptive system is one that monitors and undergoes change in response to changes in the environment.
- A **non adaptive system** is one that does not change with a changing environment
- A **permanent system** is one that is or will be existence for a long period of time, usually ten years or more.
- A **temporary system** is one that will not be in existence for a long period of time. In some cases, temporary system exist for less than a month.

What is an information system?

Information system is a set of interrelated elements or components that collect (input), manipulate and store (processing), and disseminate (output) data and information as well as feedback mechanism.



- **Input** is the activity of capturing raw data resources in the organization.
- **Processing** involves converting (as calculations, comparisons and storing) this raw input into a more appropriate and useful outputs.

- **Output** involves producing useful information to the people or activities that will use it in the form of documents or reports.
- **Feedback** is used to refine or to correct the input raw. Feedback is also important for managers and decision makers.

Information system that uses computer system, devices and technology is **computer based information systems (CBIS)**. The CBIS we will accept as **formal systems**.

A computer-based information system, or CBIS, uses computers to collect, process, store, analyze and distribute information for a specific purpose, such as meeting a business objective. The main components of a CBIS include hardware, software, data, procedures and people**. I**n a CBIS, the hardware is the physical machinery, such as a computer, printer, display screen and cables. The hardware devices work together to accept data, or raw facts, as input before processing the data into useful information and then displaying the information as output. Software refers to computer programs that provide instructions for processing the data. The procedures are what people perform when working with a CBIS to process data and produce information.

Traditionally, a business uses four types of computer-based information systems. The one used by the most people in the business is a transaction processing system, which processes events or activities that affect the entire organization, such as customer orders. A management information system provides information to managers so that they can plan and run the business. Managers also use decision support systems when making major decisions that affect the entire business. Senior executives use a special type of decision support system known as an executive information system, which provides an overview of the entire business.

What are the Components of Information Systems?

Followings are the key components of a computerized Information management Systems:

1. **Resources of people**: (end users and IS specialists, system analyst, programmers, data administrators etc.).
2. **Hardware:** (Physical computer equipments and associate device, machines and media).
3. **Software:** (programs and procedures).
4. **Data:** (data and knowledge bases), and
5. **Networks:** (communications media and network support).

People Resources

- ***End users*:** (also called users or clients) are people who use an information system or the information it produces. They can be accountants, salespersons, engineers, clerks, customers, or managers. Most of us are information system end users.

- ***IS Specialists*:** people who actually develop and operate information systems. They include systems analysts, programmers, testers, computer operators, and other managerial, technical, and clerical IS personnel. Briefly, systems analysts design information systems based on the information requirements of end uses, programmers prepare computer programs based on the specifications of systems analysts, and computer operators operate large computer systems.

Hardware Resources

- ***Machines*:** as computers and other equipment along with all data media, objects on which data is recorded and saved.

- ***Computer systems*:** consist of variety of interconnected peripheral devices. Examples are microcomputer systems, midrange computer systems, and large computer systems. Software Resources Software Resources includes all sets of information processing instructions. This generic concept of software includes not only the programs, which direct and control computers but also the sets of information processing (procedures).

Software Resources:

- ***System software***, such as an operating system

- ***Application software***, which are programs that direct processing for a particular use of computers by end users.

- ***Procedures***, which are operating instructions for the people, who will use an information system.

Data Resources

Data resources include data (which is raw material of information systems) and database. Data can take many forms, including traditional alphanumeric data, composed of numbers and alphabetical and other characters that describe business transactions and other events and entities. Text data, consisting of sentences and paragraphs used in written communications; image data, such as graphic shapes and figures; and audio data, the human voice and other sounds, are also important forms of data. Data resources must meet the following criteria:

- ***Comprehensiveness***: means that all the data about the subject are actually present in the database.

- ***Non-redundancy:*** means that each individual piece of data exists only once in the database.

- ***Appropriate structure:*** means that the data are stored in such a way as to minimize the cost of expected processing and storage.

The data resources of IS are typically organized into:

- Processed and organized data-Databases.

- Knowledge in a variety of forms such as facts, rules, and case examples about successful business practices.

Network Resources

Telecommunications networks like the Internet, intranets, and extranets have become essential to the successful operations of all types of organizations and their computer-based information systems. Telecommunications networks consist of computers, communications processors, and other devices interconnected by communications media and controlled by communications software. The concept of Network Resources emphasizes that communications networks are a fundamental resource component of all information systems. Network resources include:

- Communications media: such as twisted pair wire, coaxial cable, fiber-optic cable, microwave systems, and communication satellite systems.
- Network support: This generic category includes all of the people, hardware, software, and data resources that directly support the operation and use of a communications network. Examples include communications control software such as network operating systems and Internet packages.