Decision making as a system and stages of the decision making process

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1 DECISION MAKING AS A SYSTEM

Introduction

This chapter focuses on the question: What is meant by thinking about decision-making as a system?

Study the attached presentation and then answer the following questions:

- What does mean decision making?
- What is a structure and main parts of 'an open system' and 'a cybernetic system'?
- Is there a relationship between system and decision making?
- Can you find a video which deals with activities/phases of decision making processes in public available sources?

Key words: Cybernetics; Decision Maker; Decision Making; Feedback; System

1.1 DECISION MAKING

Decision-making is a process of choosing among alternative courses of action for the purpose of attaining a goal or goals. According to Herbert A. Simon (1977), he won the Nobel Memorial Prize in Economic Sciences in 1978 for his contributions to modern business economics and administrative research, managerial decision-making is synonymous with the whole process of management. Consider the important managerial function of planning. Planning involves a series of decisions: What should be done? When? Where? Why? How? By whom? Managers set goals, or plan; hence, planning implies decision-making. Other managerial functions, such as organizing and controlling, also involve decision-making. [5]

1.2 SYSTEM

Would you recognize a system if you saw one?
Systems are all around us, once we recognize systems, where they exist, and how they work, it can shift our approach we see, identify or solve real problems.
The word 'system' is used a lot. The system [1] is a collection or group of parts that interacted with each other to function as a whole and with a purpose.
Within systems we have elements. And when the elements of system interact, there is a bigger outcome or different result that you would see from each of the elements independently. Systems allow us to do more together than we can independently.

1.2.1 What is a system?

If we talk about a system then we use terms: parts or subsystems, inputs, processes or activities, outputs, goals and outcomes or desired results, feedback, boundary, environment or surroundings.

An example of their explanation you can find in following videos:

- 'Introduction to Systems: What is a System?' It takes 01:28 and is available at: https://www.youtube.com/watch?v=Fd-zhGXgHUs
- 'What is a system xRev?' by Gene Bellinger (2014). It takes 07:24 and is available at: https://www.youtube.com/watch?v=dTkdDx_0aRU

1.2.2 Cybernetics

Decision making problems can be generally defined by the existence of a difference between the desired state (standard, norm, plan, managerial decision) of a certain component of the decision maker's environment and its actual state.
We observe a parallel with the problem of control theory here. When we talk about management, we must assume that it is a dynamic system and accept the validity of systems theory. The cybernetic principles of control of a dynamic system are generally expressed in Figure 1. There are two elements in the process – a controller and a controlled part, and a link between these elements. The controller which is represented by a manager or a board, for example, and the controlled one, which can be understood as a company in this case. The link between these elements represents the control intervention or action. The inputs are the planned requirements to the control element and the external action on the controlled element. The output is a targeted, purposeful change to a selected component of the controlled system [1,4].

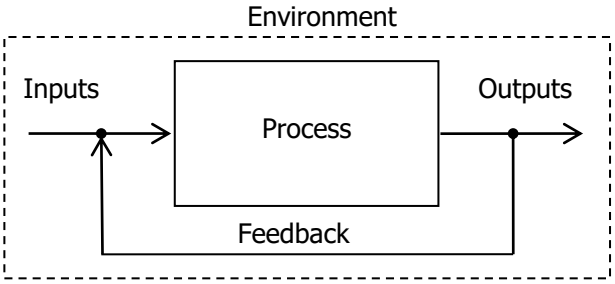

Fig. 1. System control model according to Norbert Wiener [1,4]

1.3 DECISION MAKING SYSTEM

Decision-making systems in Figure 2 are divided into three distinct parts: inputs, processes and outputs. They are surrounded by an environment and often include a feedback mechanism. In addition, a human decision-maker is considered part of the system.

Inputs are elements that enter the system. Examples of inputs are raw materials entering a chemical plant, students admitted to a university, and data input into a Web page for a database query. [5]

Processes are all the elements necessary to convert or transform inputs into outputs. For example, a process in a chemical plant may include heating the materials, using operating procedures, using a material-handling subsystem, and using employees and machines. In a university, a process may include holding classes, doing library work, and Web searching. In a computer a process may include activating commands, executing computations, and storing information. [5]

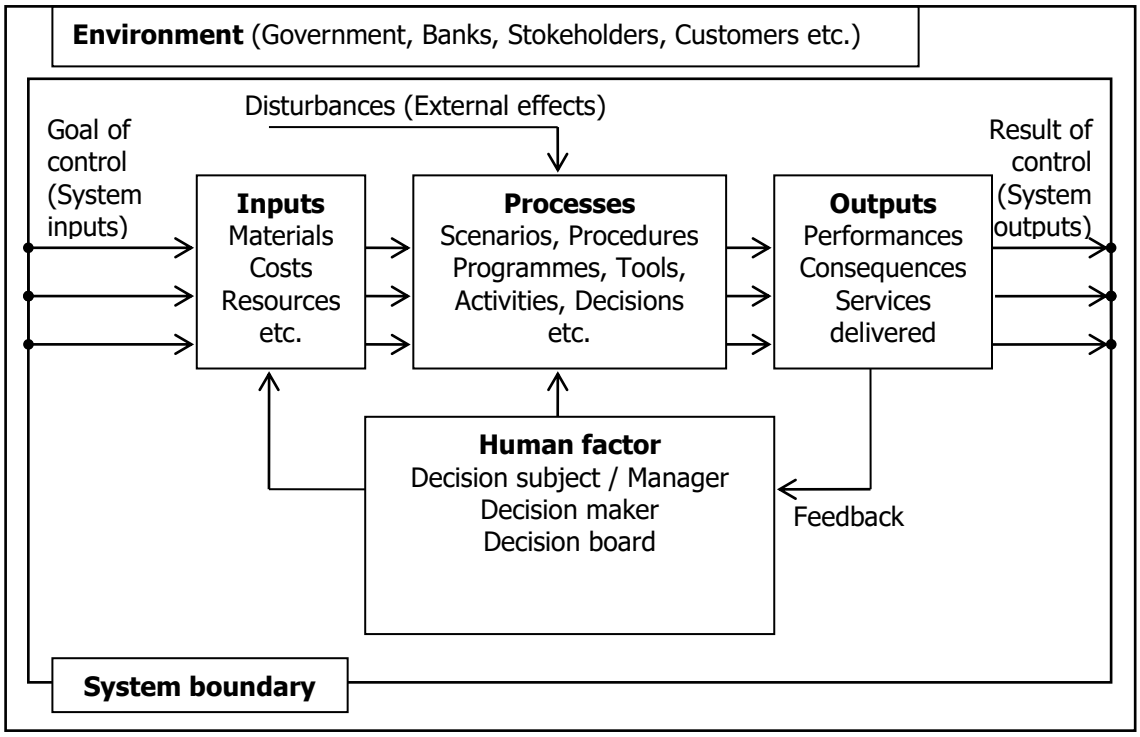

Fig. 2. Decision Making System and its environment [5]

Outputs are the finished products or the consequences of being in the system. For example, fertilizers are one output of a chemical plant, educated people are one output of a university, and reports may be the outputs of a computer system.
Feedback is a flow of information from the output component to the decision maker concerning the system's output or performance. Based on the outputs, the decision-maker, who acts as a control, may decide to modify the inputs, the processes, or both. [5]

The feedback represents this information flow, appearing as a closed loop. This is how real systems monitoring occurs. The decision maker compares the outputs to the expected outputs and adjusts the inputs and possibly the processes to move closer to the output targets. [5]

The environment of the system is composed of several elements that lie outside it in the sense that they are not inputs, outputs, or processes. However, they affect the system's performance and consequently the attainment of its goals.

Environmental elements can be social, political, legal, physical, or economic. Often, they consist of other systems. For a chemical plant, suppliers, competitors, and customers are elements of the environment. A university may be affected by rules and laws passed by the state legislature, but for the most part the legislature is part of the environment, since the university system probably has no direct impact on it. In some cases, they may interact, though, and the environment is redefined. For a computer system, the environment is anything that is not part of the system. It can include other systems with which it interacts, users that provide input, and users who examine output. [5]

A boundary separates a system from its environment. The system is inside the boundary, whereas the environment lies outside. A boundary can be physical (e.g., the system is a department with a boundary defined by Building C; in the case of your bodily system, the boundary is your skin), or it can be some nonphysical factor. For example, a system can be bounded by time. In such a case, we can analyse an organization for a period of only one year.
The boundary of an information system is usually defined by narrowing the system's scope to simplify its analysis. In other words, the boundary of an information system, especially a decision support system, is by design. Boundaries are related to the concepts of closed and open systems. [5]

2 PHASES OF DECISION MAKING PROCESS

Introduction

This chapter focuses on the question: What is meant by decision-making as stages of the decision-making process?
Study the attached presentation and then answer the following questions:

- What is a structure of decision-making process?
- What means Simon's four phases model of decision-making process?
- Can you explain phases: intelligence, design, choice and implementation?
- Can you find a video which deals with activities/phases of decision making processes in public available sources?

Key words: Decision making process; Simon's four phases

2.1 SIMON'S PHASES OF DECISION MAKING PROCESS

It is advisable to follow a systematic decision-making process. In 1977 Herbert A. Simon says that the decision making process involves three major phases: intelligence, design and choice. He later added a fourth phase, implementation. Monitoring can be considered a fifth phase – a form of feedback. However, we view monitoring as the intelligence phase applied to the implementation phase.

Simon's four phases model is the most concise and yet complete characterization of rational decision making. A conceptual picture of the decision making process is shown in Figure 3.
There is a continuous flow of activity from intelligence to design to choice but at any phase there may be a return to a previous phase (feedback). Modelling is an essential part of this process. The seemingly chaotic nature of following a haphazard path from problem discovery to solution by decision-making can be explained by these feedback loops. [5]

The decision making process starts with the intelligence phase. Reality is examined, and the problem is identified and defined. Problem ownership is established as well. In the design phase, a model that represents the system is constructed. This is done by making assumptions that simplify reality and writing down the relationships among all the variables. The model is then validated, and criteria are determined in a principle of choice for evaluation of the alternative courses of action that are identified. Often the process of model development identifies alternative solutions, and vice versa. The choice phase includes selection of a proposed solution to the model (not necessarily to the problem it represents). This solution is tested to determine its viability. Once the proposed solution seems reasonable, we are ready for the last phase: implementation of the decision (not necessarily of a system). Successful implementation results in solving the real problem. Failure leads to a return to an earlier phase of the process. In fact, we can return to an earlier phase during any of the latter three phases. [5]

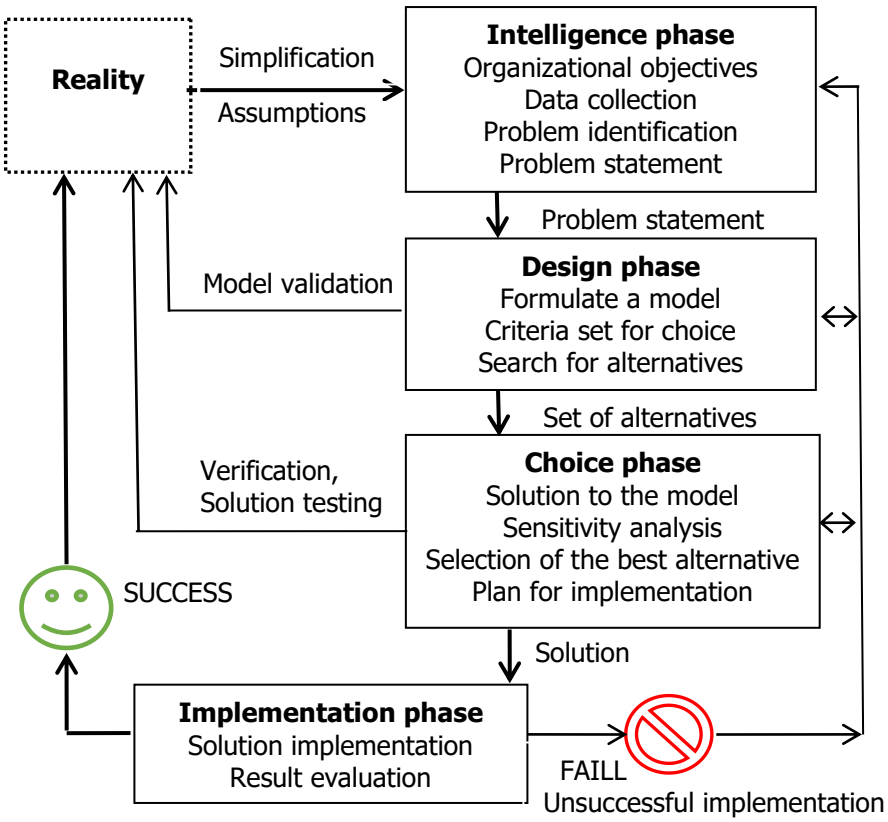

Fig. 3. Simon's four phases model of decision making process [5]

2.1.1 Intelligence phase

Intelligence in decision-making involves scanning the environment, either intermittently or continuously. It includes several activities aimed at identifying problem situations or opportunities. (It may also include monitoring the results of the implementation phase of a decision-making process.)

The intelligence phase begins with the identification of organizational goals and objectives related to an issue of concern (e.g., inventory management, job selection etc.) and determination of whether they are being met. Problems occur because of dissatisfaction with the status quo. Dissatisfaction is the result of a difference between what we desire (or expect) and what is occurring. In this first phase, one attempts to determine whether a problem exists, identify its symptoms, determine its magnitude, and explicitly define it. Often, what is described as a problem (such as excessive costs) may be only a symptom (measure) of a problem (such as improper inventory levels). Because real-world problems are usually complicated by many interrelated factors, it is sometimes difficult to distinguish between the symptoms and the real problem.

The existence of a problem can be determined by monitoring and analysing the organization's productivity level. The measurement of productivity and the construction of a model are based on real data. The collection of data and the estimation of future data are among the most difficult steps in the analysis. [5]

Some issues that may arise during data collection and estimation, and thus plague decision-makers, are:

- Data are not available. As a result, the model is made with, and relies on, potentially inaccurate estimates
- Obtaining data may be expensive
- Data may not be accurate or precise enough
- Data estimation is often subjective
- Important data that influence the results may be qualitative (soft)
- There may be too many data (information overload) etc.

Once the preliminary investigation is completed, it is possible to determine: Whether a problem really exists? Where it is located? and How significant it is?

In the intelligence phase, it is important to establish problem ownership. A problem exists in an organization only if someone or some group takes on the responsibility of attacking it and if the organization has the ability to solve it. For example, a manager may feel that he or she has a problem because interest rates are too high. Since interest rate levels are determined at the national and international levels, and most managers can do nothing about them, high interest rates are the problem of the government, not a problem for a specific company to solve. The problem companies actually face is how to operate in a high-interest-rate environment. For an individual company, the interest rate level should be handled as an uncontrollable (environmental) factor to be predicted.
When problem ownership is not established, either someone is not doing his or her job, or the problem at hand has yet to be identified as belonging to anyone. It is then important for someone to either volunteer to "own" it or assign it to someone.
The intelligence phase ends with a formal problem statement. [5]

2.1.2 Design phase

The design phase involves finding or developing and analysing possible courses of action. These include understanding the problem and testing solutions for feasibility. A model of the decision-making problem is constructed, tested and validated.
Modelling involves conceptualizing the problem and abstracting it to quantitative and/or qualitative form. For a mathematical model, the variables are identified and their mutual relationships are established. Simplifications are made, whenever necessary, through assumptions. [5]

For example, a relationship between two variables may be assumed to be linear even though in reality there may be some nonlinear effects. A proper balance between the level of model simplification and the representation of reality must be obtained because of the" benefit/cost trade-off.

A simpler model leads to lower development costs, easier manipulation, and a faster solution but is less representative of the real problem and can produce inaccurate results. On the other hand, a simpler model generally requires fewer data, or the data are aggregated and easier to obtain.
The process of modelling is a combination of art and science. As a science, there are many standard model classes available, and with practice an analyst can determine which one is applicable to a given situation. As an art, a level of creativity and finesse is required when determining what simplifying assumptions can work, how to combine appropriate features of the model' classes, and how to integrate models to obtain valid solutions. [5]

2.1.3 Choice phase

Choice is the critical act of decision-making. The choice phase is the one in which the actual decision is made and where the commitment to follow a certain course of action is made. The boundary between the design and choice phases is often unclear because certain activities can be performed during both of them and because one can return frequently from choice activities to design activities. For example, one can generate new alternatives while performing an evaluation of existing ones. The choice phase includes the search, evaluation, and recommendation of an appropriate solution to the model. A solution to a model is a specific set of values for the decision variables in a selected alternative. [5]

Note: Solving the model is not the same as solving the problem the model represents.
The solution to the model yields a recommended solution to the problem. The problem is considered solved only if the recommended solution is successfully implemented. Solving a decision-making model involves searching for an appropriate course of action. Each alternative must be evaluated. If an alternative has multiple goals, these must all be examined and balanced off against the others. Sensitivity analysis is used to determine the robustness of any given alternative (slight changes in the parameters should ideally lead to slight or no changes in the alternative chosen). [5]

2.1.4 Implementation phase

In The Prince, Machiavelli astutely noted some 500 years ago that there was ‘nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things.’
The implementation of a proposed solution to a problem is, in effect, the initiation of a new order of things, or the introduction of change. And change must be managed. User expectations must be managed as part of change management. [5]

The definition of implementation is somewhat complicated because implementation is a long, involved process with vague boundaries. Simplistically, implementation means putting a recommended solution to work, not necessarily the implementation of a computer system. Many generic implementation issues, such as resistance to change, degree of support of top management, and user training, are important in dealing with management support systems. [5]

2.2 MAKING A GOOD DECISION AND A BAD DECISION

Is your decision a good decision? How would you find out?
What defines making a good decision and a bad decision?

On the basis of a need of a holistic perspective for a decision problem and application of Simon's four phases decision model for it we can express that 'the goodness' of a decision and its quality is a measure of how well informed the decision maker was, when he/she chose between the options available to his/her.
A bad decision is one in which the decision maker was poorly informed, because of bad information, incomplete information, or faulty reasoning.

What is a good decision?
Most people, when asked, define good decisions as the ones that turned out well [3]. But, must decisions be judged in hindsight-after the outcomes are apparent? Are we forced to wait until outcomes are apparent before knowing whether or not we made a good decision?
The short answer is no. Decisions do not need to be judged entirely in hindsight.
It is both possible and necessary to judge the quality of decisions before knowing the final outcomes. Excellent decision makers develop decisions that have a high probability of resulting in the desired outcomes. They judge quality in foresight and therefore have more happy endings. The paper [3] provides an overview of how to judge the rigor of one's decision making. It describes how anyone can make better (higher quality) decisions, in any situation.

But good decision do not always result in good outcomes.
What is an example of a good decision with a bad outcome?
The basic idea [2] behind this maxim is that most outcomes are partly a matter of chance. Say the weather forecast predicts a 95% chance of rain. Carrying an umbrella is a good decision. But if it doesn't rain, carrying the umbrella around all day will turn out to be a bad outcome. More explanations are in [2].

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