Rational Decision-Making

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4.1 Sequence of Events in Decision-Making Procedures

In practice, finding the solution to a decision problem is often time-consuming. This is because a great deal of thought is required between the discovery of the problem and the choice of the optimal action to be realized. The problem must be grasped, the solutions to the problem must be discovered and the best option must be evaluated. Therefore, it is appropriate to interpret decisions as thought processes and to see rational decisions as the outcome of rational decision-making procedures. Therefore, to work out the specific characteristics of rational decisions, the operation of decision-making processes must first be shown.

The following example illustrates the sequence of events of a decision-making procedure. Mr. Mordasini is the head of production at Autotech Inc., a Swiss manufacturer of metal components for automobiles. Apart from looking after approximately 100 manufacturing and production planning employees, Mr. Mordasini is responsible for the maintenance of the plant's installations. For metalworking, the department has a number of lathes, milling machines and drills. The production department also has equipment to polish metal parts and galvanized baths to treat the parts for corrosion damage.

On Monday afternoon at 4.15 p.m., a quarter of an hour before the end of the working day, Mr. Mordasini is called to the lathe section. One of the five lathes is on fire! When he arrives a few minutes later, Mr. Jäk, the foreman of the section, has already succeeded in putting out the fire in the lathe's electric motor with a fire extinguisher. An hour later, the machine has cooled down sufficiently for Mr. Mordasini and Mr. Jäk to determine the extent of the damage. The fire in the motor has heated the lathe to such an extent that individual parts have been slightly deformed. The two men immediately agree that the machine will never again produce parts to the required quality and the value of the machine is therefore reduced to scrap metal.

As the lathe section is working at 100 % capacity, Mr. Mordasini orders an impromptu two-shift operation starting from Wednesday. Mr. Jäk must ensure on

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Tuesday that one of the remaining machines is working from Wednesday on from 5.00 to 7.00 a.m., during midday and from 4.30 to 9.00 p.m. Moreover, workers in the lathe section will have to work overtime on Saturday mornings, if required.

On Tuesday morning, Mr. Mordasini informs the managing director, Mr. Kämpf, about the incident and the response measures. The two agree that the machine, which was insured, must be replaced. Mr. Kämpf also believes it might be possible to replace the manual lathe with a semi-automated or automated machine. Mr. Kämpf gives Mr. Mordasini the task of developing and evaluating different options. He expects a comprehensive proposal from him as soon as possible.

Mr. Mordasini begins the job immediately and first defines the basic conditions for the new lathe:

- In recent years, the lathe section, with its five machines, was always working to full capacity. Last year, it yielded a gross profit of 1,776,500 Swiss francs (this corresponds to the five manual lathes working 220 days for 8.5 h per day, each making 190 Swiss francs gross profit per hour). From a discussion with Mr. Kessler, Autotech Inc.'s sales manager, it is apparent that additional orders could be obtained, corresponding to approximately 1 year's gross profit of 600,000 Swiss francs. In order to not to have to make price concessions, the increase in order volume should be distributed gradually over 3 years. To be on the safe side, Mr. Kessler and Mr. Mordasini decide to count only on additional orders that correspond to a gross profit of 300,000 Swiss francs. They also assume that this pessimistic increase in volume will take place gradually over 3 years. Based on these considerations, Mr. Mordasini determines the capacity of the new lathe with a gross profit of minimum 360,000 Swiss francs and maximum 660,000 Swiss francs. He then converts these economic capacity values into technical capacity requirements.
- Regarding precision, Mr. Mordasini sees no reason to change from the previous standard of 1/100 mm.
- It is Autotech Inc.'s policy to only purchase machinery that fully meets the safety requirements of the Swiss accident insurance company.
- Finally, after consulting with his superior, Mr. Mordasini decides that the only options that come into question are those which are realizable within 3 months. It would not appear to be reasonable to ask the employees of the lathe section to work overtime during the two-shift operation and on Saturdays for more than 3 months.

Based on these requirements, Mr. Mordasini contacts three lathe producers, as well as a dealer in second-hand machinery. Since the dealer has no lathes in stock which fulfill the four requirements, he is removed from the list of potential suppliers. Representatives of the other three manufacturers visit Autotech Inc. within the week and, bearing in mind the urgency of the situation, promise to send a written quote by the end of the following week.

The quotes come in on schedule. First, Mr. Mordasini checks whether they fulfill the basic conditions he set, and this is the case for all offers. Then, Mr. Mordasini produces a table with the finance director, Mr. Wälti, as in Fig. 4.1, showing the years of use and the financial effects of the options. The manual lathe from

Options	Years of use	Investment including installation in thousands of Swiss francs	Annual difference in gross profit in thousands of Swiss francs	Annual difference in personnel costs in thousands of Swiss francs	Annual difference in energy and maintenance costs in thousands of Swiss francs
A: Manual lathe from the previous supplier	8	180	0	0	0
B: Semi-automated lathe from Kunz	8	360	0	-40	0
C: Automated lathe from Hinz	6	1070	Year 1: +100 Year 2: +200 Year 3 + ff: +300	-60	+10

Negative value = Decreases in expenditure in comparison with option A
Positive value = Increases in revenue or expenditure in comparison with option A

Fig. 4.1 Years of use and financial effects of the three options

the previous supplier is the closest option to the damaged machine and thus represents a simple replacement investment. The investment of 180,000 Swiss francs is covered by the fire insurance policy. The semi-automated lathe from the Kunz company has the same capacity as the manual machine and therefore qualifies as a rationalization investment. Finally, the automated machine from the Hinz company represents an investment for both rationalization and expansion.

As can be seen from the figure, the annual revenues and expenditures of options B and C are not fully known, but increases in revenue and increases or decreases in expenditure are displayed in comparison to option A. Option A therefore serves as the reference option.

Since the damaged lathe must in any case be replaced and this replacement will be paid for by the insurance company, Option A is the zero option for Mr. Mordasini.

Options	Net present value	Revenue and expenditure differences for options B and C compared with option A in years 0 to 8								
		0	1	2	3	4	5	6	7	8
B	-	-180	+40	+40	+40	+40	+40	+40	+40	+40
	+34	-180	+36	+33	+30	+27	+25	+23	+21	+19
C	-	-890	+150	+250	+350	+350	+350	+350	-	-
	+369	-890	+136	+207	+263	+239	+217	+197	-	-

Upper figure = Revenue and expenditure differences in thousands of Swiss francs
Lower figure = Revenue and expenditure differences in thousands of Swiss francs discountedby the internal rate of return of 10%

Fig. 4.2 Net present value calculations for options B and C

It will be realized if neither of the other two options proves to be economically more advantageous than a straightforward replacement. Mr. Mordasini evaluates the economic effects of options B and C, as is usual in Autotech Inc., with the help of a calculation of the net present values. Figure 4.2 shows the result of the calculations. The following comments appear to be necessary:

- The net present values are based on an internal rate of return of 10 %. This not only covers the interest on the capital invested but also includes a risk surcharge.
- Since the defective lathe must in any case be replaced and the required investment of 180,000 Swiss francs is covered by insurance, Mr. Mordasini reduces the investment expenditure of options B and C in the calculation by this amount.
- As the figure shows, both options yield a positive net present value. However, the net present value of option C is better than the net present value of option B, both in absolute terms and in relation to the invested capital.

On the basis of these calculations, Mr. Mordasini advises the managing director, Mr. Kämpf, to go for option C. Mr. Kämpf agrees with this suggestion. Accordingly, Mr. Mordasini gives the order to the Hinz company, organizes the disposal of the old lathe and hires local builders to prepare the foundation and the electrical and water connections for the new machine. He also oversees the preparation and installation work, inspects the new lathe and checks the incoming invoices.

After describing how a concrete decision problem is dealt with, a general descriptive model of a decision-making procedure, which allows a systematization of decision-making considerations in practice, is now introduced.

In a descriptive model of a decision-making procedure, a distinction must first be made between the actor and the decision situation:

- When speaking of the actor, we refer to the person or group of people who analyzes, evaluates and acts. Even though the foreman, Mr. Jäk, the sales manager, Mr. Kessler, the finance director, Mr. Wälti, and the managing director, Mr. Kämpf, were all partially involved in this work, Mr. Mordasini is the actor in this example. As head of production, he takes urgent measures and guides the analysis, the development of options and their assessment. He is the de facto decision-maker and organizes its implementation.
- The decision situation comprises all areas of the situation which are relevant to the decision. These often include certain parts of the company, purchasing and sales markets, as well as environmental factors that are relevant to their development. In the example, the decision situation is the lathe section with its resources, processes and performances. However, the connections between the lathe section and other parts of the company, such as sales, and connections with the outside environment, such as the machine suppliers, are also part of the decision situation.

In addition to the distinction between the actor and the decision situation, different ideal phases or sub-tasks in the decision-making process can be distinguished:

- The actor continuously receives information from or about the decision situation. The actor takes in most of this information without seeing any cause for analysis, decisions or actions. Particular pieces of information, however, can trigger a decision-making process. A decision problem arises when information produces an essential discrepancy between the current state and the desired perceptions of the actor. The information about the fire in the example leads to a significant difference between the expected performance of the lathe section and the capacity that exists without the improvised two-shift operation.
- After the discovery of a decision problem, its analysis normally follows. The actor must understand the problem before he can solve it. In the example, the problem is relatively simple to understand. It consists in the replacement of the damaged machine. Mr. Mordasini can therefore concentrate on specifying the basic conditions that the problem solution must fulfill. The analysis results form the basis for the development of solution options to the problem. In the example, Mr. Mordasini asks machine manufacturers to submit offers. They are then evaluated on the basis of net present value. The analysis, the development of options and the assessment of options cannot take place behind closed doors; they require interaction with the decision situation. This is the only way to obtain the information necessary to reach a good decision. In the example, Mr. Mordasini contacts the sales manager, the finance director and the various potential machine suppliers.

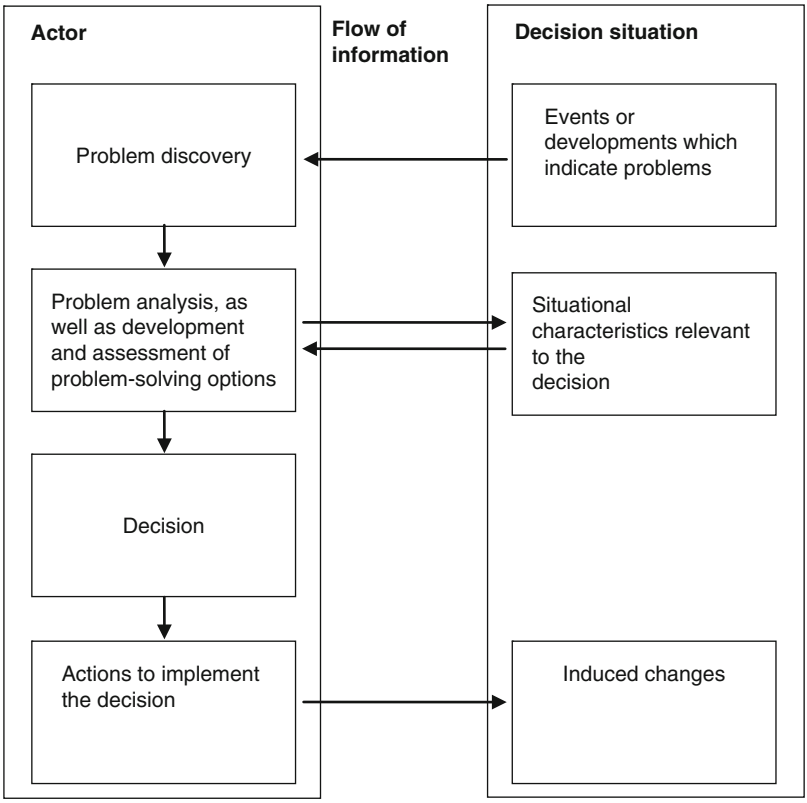

Fig. 4.3 Descriptive model of the decision-making process

- The last step in the decision-making process is the decision. The better the analysis and the development and assessment of options, the easier it usually is to take the actual decision. In the example, Mr. Mordasini and Mr. Kämpf have no difficulty in choosing option C on the basis of its high net present value.
- After the decision is made, its implementation must be assured. In the example, Mr. Mordasini takes on the ordering, the coordination of the installation and the inspection of the new lathe.

Figure 4.3 summarizes the explanations in graphic form. The result is a descriptive model of a decision-making process.

4.2 Requirements of a Rational Decision-Making Process

Having developed a descriptive model of a decision-making process on the basis of an example, the question of when such a process can be characterized as rational is now discussed.

The distinction between formal rationality and substantial or content-based rationality must first be made (Bamberg and Coenenberg 2002, p. 3 f.; Brauchlin 1990, p. 344 f.; Pfohl and Braun 1981, p. 129 f.):

- In formal rationality, objectives are not questioned in terms of their rationality. Therefore, the rationality requirements only refer to the decision-making process.
- In contrast, substantial or content-based rationality presupposes that goals are rational, because they constitute the only acceptable and "right" goals. The required rationality refers not only to the decision-making process, but also to the goals that are being pursued. They are the only "justified" goals, alongside which all other goals appear to be "wrong" (e.g. Pfohl and Braun 1981, p. 129).

Most researchers assume that the choice of the overriding goals for decisions represent subjective values, which cannot, from a scientific point of view, be qualified as objectively right or wrong. They therefore accept that goals in decision-making are predetermined. Accordingly, the only meaningful basis for the development of decision-making procedures is the formal rationality of the decision-making processes themselves.

So what requirements must a decision process fulfill if it is to be justly called a "formally rational" process?

As Eisenführ and Weber state, later success or failure is no yardstick. A distinction must clearly be made between a rational and a successful decision. A rational approach should produce more successful decisions. However, to assume that with formal rationality one could overcome the many uncertainties inherent in a decision and guarantee success would represent a false understanding of rationality. Eisenführ and Weber clarify the difference between successful and rational decisions with the following simple examples: If after careful analysis, you make an investment in shares and your investment later takes a nose dive, the decision does not later become less rational because of this. If a student puts down his last 100 Euro on number 17 in a roulette game and actually wins, the decision is no more rational because of this success than it was before (Eisenführ and Weber 2003, p. 4).

Rationality does not refer to the success of the chosen and realized option; rather it refers to how thoroughly and systematically the decision-making process is carried out. It is generally assumed that a decision can be qualified as "rational" if the decision-making process has the following characteristics:

(1) The decision-making process is continuously goal-oriented; it consistently focuses on overriding goals.
(2) The considerations in the decision-making process are based on information which is as objective and complete as possible.
(3) The decision-making process follows a systematic procedure of action and uses clear methodical rules; it is comprehensible to non-participants.

These characteristics must be briefly commented on.

The goal orientation requirement for formal rational decisions – characteristic (1) – affects all of the essential considerations in the decision-making process. The very first step, problem discovery, is already based on unachieved goals or goals that are easier to achieve. Problem analysis seeks explanations for the

non-achievement of goals. Only means and measures that promise some degree of improvement in the fulfillment of the goals should be discussed as solution options. Finally, the evaluation of options is based on decision criteria which have been derived from goals (Eisenhardt and Zbaracki 1992, p. 18; Kühn 1969, p. 6 ff.).

The requirement for a decision process to be based on data as objective and complete as possible – characteristic (2) – may seem obvious, but it must be clarified. Formal rationality does not require information to be complete, totally objective or even entirely reliable. In accordance with the goal-orientation characteristic, cost-benefit considerations are made when collecting information. It therefore depends on the financial importance of the problem to be solved, as well as on the risk associated with the decision, which determine how much expenditure is justified for information procurement. It would be simply unrealistic to demand information that is complete, exclusively objective and also based solely on future developments. In the first chapter, it was already pointed out that rationality should not replace intuition and experience, but – when appropriate – rationality should use them as well. It therefore seems logical that formal rationality seeks only the most objective and complete information possible, rather than objective and complete information (Kühn 1969, p. 6 ff.).

The requirement for a systematic procedure and clear methodical rules – characteristic (3) – should ensure that outsiders understand the actor's thought process. However, this accountability does not mean that every outsider has to agree with the decision. An outsider can pursue other goals, interpret certain unsure information differently or have information at his disposal that is different from that of the actor. Accordingly, he also decides differently (Kühn 1969, p. 6 ff.).

4.3 Support of Rational Decision-Making by Management Science

One of the main focuses of management science is to support the executives of companies in making rational decisions. In addition to this main goal – to bring more rationality to decisions – management science pursues the goal of describing and explaining reality.

Science basically contributes to practice in two ways:

- On the one hand, empirical-analytical research develops explanatory models. These explanations of reality can be used in decision-making to predict future developments and to determine the effects of options. Models of purchasing behavior are typical examples of such explanatory models. They show marketing managers how a buyer perceives the different offers in a market, how he assesses them and how he finally decides in favor of an offer.
- On the other hand, practical normative management science proposes decision-making procedures, which the actor can apply in order to deal with decision problems. The present book is assigned to this second group of contributions. The whole of Part II is dedicated to the presentation and explanation of a procedure to deal with complex decision problems.

Inset 4.1 shows in more detail what is understood by empirical-analytical and practical-normative management science and how the two research directions support practice in solving decision problems. At the same time, the inset presents the ethical-normative research direction of management science and explains why it could not prevail. In this context, substantive rationality is also once again discussed.

Inset 4.1

Three Lines of Research in Management Science and Their Evaluation

According to Köhler (1978, p. 186 ff.), there are three different views of objectives in management science:

- Ethical-normative management science aims to find the "right" goals and values of companies. It seeks standards to distinguish between ethically acceptable and ethically inacceptable behavior. With this scientific goal, ethical-normative management science seeks substantive rationality.
- Empirical-analytical or theoretical management science aims to explain reality. It formulates hypotheses and explanatory models and subjects them to empirical tests. The result of their testing is either a falsification or a confirmation. But a confirmation is only temporary, because the falsification of hypotheses in future empirical test can never be excluded. The hypotheses are partially developed and tested out of pure cognitive interest. Most of the scientists committed to the empirical-analytical research perspective, however, try to gain insights that are relevant to practice and can be used in the context of decision-making processes.
- Practical-normative or pragmatic management science aims to support practice in its decisions through the development of procedures, of recommendations with regards to content and of decision criteria.

The three scientific concepts thus differ in their scientific goals. It is not possible to objectively determine which scientific goals are right and therefore what the right view of science is. Finally, the scientific community designates scientific goals as scientific or unscientific, thus including representatives of the discipline in their circle or excluding them from it.

Ethical-normative management science is rarely accepted by the scientific community, because there are no right or wrong answers to the question of the right goals and values. "You live for values, you die for values if necessary. But you cannot prove values" (Sombart 1967, p. 83, translated by the authors).

The other two views are both accepted and stand side by side. Many scientists focus on empirical-analytical research. A considerable number of scientists combine the two research directions. Finally, there are representatives of management science who are assigned to the practical-normative view of science. In addition to being based on the findings of empirical-analytical research, the recommendations they develop are based on case research (Yin 2003) and action research (Kühn and Grünig 1986, p. 118 ff.; Stringer 2007). The poorer justification of explanations associated with these two methods is compensated by the higher practical orientation of the recommendations.