

Approaches to enterprise decision-making

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Abstract in Czech language

Problematika rozhodování managementu strojírenského podniku v době globální ekonomické krize je velmi aktuální, čím unikátně umožňuje získat informace a data o konkrétních přístupech současného managementu nejen k podnikatelskému riziku ale především k nejistotě v podnikání. Rozhodování manažerů v současnosti je zatíženo větší mírou nejistoty než v předešlých letech. Aktuální trendy v oblasti managementu kladou nové nároky na některé klíčové vlastnosti podniku jako pružnost, adaptabilitu nebo schopnost zvládat komplexnost procesů. Pro podniky v České republice a jejich managery je to nový fenomén. Z těchto důvodů považujeme za prioritní zkoumat tyto tendence v reálném životě podniku a tím po analýzách významně obohatit teoretické přístupy k této problematice a vytvořit metodiku specifických přístupů v rozhodování.

Key words

decision-making, decision-making under uncertainty, global crisis in Czech enterprises, real-life research, methodology of specific approaches in decision-making

1. Introduction

Sphere of an engineering enterprise is one of the most important branch of industry due to its characteristic of being an input to other business and industrial companies. Thus, crisis of and engineering enterprise could effect all others areas of industry. The impact of factors of risk and uncertainty is increasing during the time of global crisis. The need of risk identification, analysis and valuation trough scenarios and simulation is more important than in the past. Yet, the majority of all Czech engineering enterprises are without experience of using scenarios and simulations for decision-making process support (Kislingerová, 2010). A decision-making area of engineering enterprise management is very topical during the present global crisis and at the same time enables to gain information and data about particular approaches of engineering enterprise management not only to business risk but also to business uncertainty. Answering some sever questions about used decision-making tactics and its tendencies of management in Czech engineering enterprises is of high importance for understanding certain relations between decision-making and the crisis survival of the enterprise. From that reasons, we consider to research these tendencies in real life of the engineering enterprise as prior. The research should lead to analysis which will enrich theoretical approaches to this area significantly and formulation of the methodology of specific approaches in decision-making.

2. Structure and classification of decision-making processes

Decision-making is a process that represents the choice of optimal alternative from all possible set of alternatives. According to literature, the decision-making process consists of specific fazes of its actions. First step is an identification of the problem by the subject of the decision-making process, commonly called the decider. After the identification, the next prior step the analysis and formulation of the problem. There is a list of following actions in literature that are executed in particular phases, such as: definition of the valuation criteria, determination of the alternative and decisions' outcomes and its evaluation and choice. Fotr adds that the selection phase of the alternatives can lead to the most profitable (optimal) alternative or to the setting the order of alternatives according to preferences. He also considers realization and the control phase as parts of the decision-making process (Fotr, 2006). The decision-making process is determined by its elements: subject (decider) and the object (the set of alternatives) of decision-making, goals of the process, strategies, alternatives and values of its outcomes and criteria of evaluation. (Fotr, 2006; Duchoň, Šafránková, 2008).

There are several views and possibilities how to sort decision-making problems. Problems (processes) can be for example structured well or heavily. There are relations between the problem structure and levels of the engineering enterprise management. While heavily-structured problems are usually up to top management well structured problems are tasks to solve for operational management. Along the management level structure (from top to bottom of the enterprise), there are decision-making problems of strategic (conceptional), tactical and operational nature. Decision-making processes (problems) may also be independent or related to other actions. The related ones can depend on the organizational structure or the time factor of the past and the future. There are also variations in decision-making problems depend on whether they are solved by individual or by the collective subject, whether the decision is made by one (single criterial decision-making) or more (multi-criterial decision-making) criteria.

Nevertheless, there is one major factor that has main impact on success in decision-making. It is the factor of (un)certainty of the future outcomes of possible (chosen) alternatives. There are three types of decision-making given in literature:

- 1) decision-making under certainty
- 2) decision-making at risk
- 3) decision-making under uncertainty

3. Peripheral parts of the spectrum of decision-making process

There are two types of decision-making processes – under certainty and uncertainty – on edges of notional decision-making spectrum considering the level of uncertainty. Decision-making under certainty is the type of decision-making when the decider has all the information, i.e. future outcomes and its values are known for the decider. In other words, each decision made from the set of alternatives $d \in D$ leads to one specific value of future outcome $x \in X$

$$\rho(d) = x \in X. \quad (1)$$

The logic of the decision-making process is following: the decider chooses the alternative (decision) $d^* \in D$ which leads to the most profitable value x . Formally (Mareš, 2002)

$$\rho(d^*) = x^*, \text{ where } u(x^*) \geq u(x) \text{ for all values } x \in X. \quad (2)$$

Decision-making under certainty is suitable for decisions in relatively stable environment. There are about 30 – 40 % of strategic decision-making that are decision-making-under-certainty type. This area is commonly the source of errors in judgment of enterprise management (Kislingarová, 2010). There is an option the number of decision-making under certainty is minor presently.

On the other hand, 10% of all strategic decisions made in enterprises are burdened with the factor of uncertainty and more than 50% of all strategic decisions of enterprise management are decision processes at risk (Kislingarová, 2010). Decision-making under uncertainty is the case of decision-making under which are the future outcomes to the decider unknown. There is not very strict line between uncertainty and risk in enterprise practice despite there is certainly a difference between these terms. In enterprise practice is more appropriate to consider the rate of risk or the rate of uncertainty. According to this, uncertainty can be described as the inability to define probabilities of expected outcomes (Fotr, 2006). Formally, the objective function ρ determines for every decision $d \in D$ the specific set of outcomes X_d of all future outcomes X (Mareš, 2002),

$$\rho(d) = X_d \subset X. \quad (3)$$

There are several methods for optimizing the future outcome, however, the problem solving gets more difficult when more than one criterion is considered while the single-criterion decision-making process lacks the accuracy of the modeled problem and is generally tentative.

4. Decision-making at risk

Even though the risk is usually considered as the harm of the future outcome or the probability (possibility) of the negative future outcome (also called Pure Risk), there is relatively unified definition of the risk of common type (called Business Risk) (Hnilica, Fotr, 2009). Generally, the business risk is the probability (possibility) of the occurrence of the result deviation from the expected value of the future outcome (Hnilica, Fotr, 2009; Smejkal, Rais, 2010).

Decision-making at risk is the decision-making in which the future outcomes of possible alternatives are known with related value of the outcome and its probability of occurrence. Formally, the outcome of the each decision $d \in D$ is the probability distribution on set of possible outcome X . The objective function ρ determines the probability distribution for each decision d

$$\rho(d) = P_d. \quad (4)$$

Finding the optimal alternative can be quite difficult. Formally, it is the decision which leads to the highest mean value of the utility with the given probability distribution P_d . Mean value EP_d for discrete set of outcomes X (Mareš, 2002)

$$EP_d = \sum_{x \in X} u(x) \cdot P_d(x). \quad (5)$$

The value of outcome which is equal to the mean value of the (expected) alternative utility is called the equivalent of certainty (Fotr, 2006).

Mean value for continuous set of outcomes X (Mareš, 2002)

$$EP_d = \int_X u(x) dP_d = \int_X u(x) \cdot P_d(x) dx. \quad (6)$$

Thus, the decider should choose the alternative $d^* \in P$ that satisfies the formula (Mareš, 2002)

$$EP_{d^*} \geq EP_d \text{ for each } d \in D. \quad (7)$$

Optimization of the mean value gives reasonable results only in case of high number of repeats of the decision-making process. Success of results also depends on appropriate formulation of the decision-making problem and other factors influencing the subject's decision-making.

Subjective probabilities are the key element for usage of decision-making support tools like probability trees and decision trees, which can be used for problems with discrete values, or the simulation by Monte Carlo method used for simulation of non-discrete problems. Subjective probabilities are based on presumption that each subject has particular level of personal belief that the desired future outcome will actually happen. Subjective probability then represents the rate of subject's personal conviction of the expected outcome occurrence (Fotr, 2006). The subject's knowledge, experience, intuition and other forms of information is used in defying the subjective probability that can be defined as qualitative or quantitative (Fotr, 2006).

There are actually continuous risk factors in engineering enterprise practice than the discrete ones. However, it is simpler for decider to choose from few alternatives. While scenarios used for discrete problems are in count of tens, simulations of non-discrete problems leads to hundreds of possible alternatives with different future outcomes. Therefore Czech engineering enterprises are usually inexperienced with using simulations as the support tool for effective decision-making (Kislingerová, 2010). Nevertheless, there are some methods for defining subjective probabilities in literature and in some cases there is an option to transform the continuous risk factors of the decision-making problem to discrete risk factors (Fotr, 2006). The correct subjective probability definition process should consist of a dialog between the analyst and the experts from particular fields concerned about risk factors. As the psychological experiments shows, there are usual errors in risk factors judgment in enterprise practice. According to these experiments, the subjects of decision-making tend to (Kislingerová, 2010):

- make relatively correct estimations about the mean value position but are wrong in dispersion estimation of the probability distribution
- provide symmetrical estimations of probability distribution
- overestimate conjugate probabilities of independent events and underestimate probabilities of disjoint events
- ignore the edge of probability distribution
- forget to update the distribution after obtaining additional information
- overestimate the accuracy of estimations

As it is shown, the psychology in decision-making process is highly represented. There is a severe influence of deciders' experience and future expectations (intuition) in their decisions.

5. New risks in enterprise practice

Term of quality of decision-making is a significant parameter in decision theory with broad impacts on engineering enterprise. The quality of decision-making cannot be valued according to the only one decision process even though the quality of decision has positive impact on enterprise profits. The greatest significance on future outcomes have factors of risk and uncertainty that are not always easy to manage by the decider. Thus, positive or negative results of chosen alternatives are not given only by decisions that are made but also by those factors of uncertainty. The quality of decision-making should be valued by its specific characteristics in a way that contributes to enterprise profits in a long term point of view. Factors influencing the quality of decisions are goals of solving the decision-making problem which should be coherent with enterprise goals, the amount and the quality of information, the level of using tools of decision theory, quality of the project for solving the decision-making problem, the count and the difference between alternatives of proposed solution and the quality of the process itself (Fotr, 2006).

There is some kind of obstacles that prevents the rise of the quality of decision-making in engineering enterprise practice. These obstacles are usually called the Rationality barriers (Fotr, 2006). Rationality barriers have commonly the source in the subject of decision-making or in the organization which is managed or lead by the subject of decision-making. Origin of subject rationality barriers are usually caused by the subject's biological potential, resp. limits. I.e. limits of subject's information processing, solving complex knowledge or subject's knowledge. There is also limited skill to identify subject's self with the value system of group in decision-making as well as repeated decision that are according to past little or not effective. Among the organization barriers it is possible to find factors of low quality of information basis, inflexible organization structure, high level of management hierarchy and unclear responsibilities (Fotr, 2006).

Identification of risks is the complete recognition of all risk factors that could possible influence (both in positive and negative ways) engineering enterprise profits. Risk identification and its evaluation should be the responsibility as wide range of employees as possible. Of course, the main role in risk identification should have the top management with cooperation with other departments within the engineering enterprise (Hnilica, Fotr, 2009).

There are lots of business risks even in relatively stable business environment. However, during the last years of the global crisis some of the have increased its weighted impact or even there are some new risks of present times. Literature (Kislingerová, 2010) presents the major ones:

- risk of management irresponsibility – in its new strong impact on enterprise and negative results it is considered as relatively new phenomena; it has two major manifestation – the case when managers are not managing the enterprise to its long-term and stable profitability but are focused on short and quick task progress and the case when managers ignored the errors in enterprise communication so they do not have the required support in times of crises
- political risks – in present times, when its impact is not so fatal immediate
- risks of modern markets – there is a high level of uncertainty about the markets evolution

in the future; starting with oil crises previous centuries continuing during the global economical crisis and states economical crisis

- risks of interest rates movement – state intervention in state economic regulation that is more stronger in stable times leading in violations of balance on markets
- illiquidity risk – markets with low level of liquidity lead to decreasing the assets value and collapse of prices with impact on methods of savings
- insolvency risk – the risk has moved from developing to developed countries

6. Conclusions

Decision-making in engineering enterprise depends on similar factors as in other enterprises. However, its outputs are key inputs of some specific areas of business and industry. As known from theory, there are three basic types of decision-making process considering the level of uncertainty – decision-making under certainty or uncertainty and decision-making at risk. The last one has been the major type of decision-making in relatively stable environment of last years. As mentioned in article, many errors were made in management decision-making due to ignoring the potential risk. In first case deciders usually considered (wrongly) the future outcomes of alternatives with well-known outcome values or decider overestimated the level of uncertainty in order to avoid any concerns about potential risks (decisions made on basis of intuition). However, there are mainly problems to solve burdened with factors of risk and uncertainty in engineering enterprise as both theory and enterprise practice shows. These decision-making problems with high level of risk and uncertainty are necessarily related to global economic crisis. There are also new types of risk or new weights of impact of well-know risks. Still, some Czech engineering enterprises are fighting for its survival not very successfully. Therefore, it is of high importance to research the current situation in Czech engineering enterprises to find and develop new approaches to risk and uncertainty in decision-making processes that could enrich theory and be at the same time useful support tool for enterprise practice in decision processes.

References

- DUCHOŇ, B., ŠAFRÁNKOVÁ, J. *Management. Integrace tvrdých a měkkých prvků řízení*. 1. vydání. Praha: C. H. BECK, 2008. ISBN 978-80-7400-003-4. Kapitola 3, Rozhodování, p. 115-163.
- FOTR, J. a kol. *Manažerské rozhodování. Postupy, metody a nástroje*. Ekopress, 2006. ISBN 80-86929-15-9.
- HNILICA, J., FOTR, J. *Aplikovaná analýza rizika ve finančním managementu a investičním rozhodování*. I. vydání. Praha: Grada Publishing, 2009. ISBN 978-80-247-2560-4.
- KISLINGEROVÁ, E. *Podnik v časech krize. Jak se dostat do potíží a jak se dostat z potíží: zkušenosti ze světové recese let 2007 až 2009*. I. vydání. Praha: Grada Publishing, 2010. ISBN 978-80-247-3136-0.
- MAREŠ, M. *Principy strategického chování. Učební texty UK v Praze*. Praha: Nakladatelství Karolinum, 2002. ISBN 80-246-0616-X.
- SMEJKAL, V., RAIS, K. *Řízení rizik ve firmách a jiných organizacích*. Třetí, rozšířené a aktualizované vydání. Praha: Grada Publishing, 2010. ISBN 978-80-247-3051-6.