Jerzy Zemke
Uniwersytet Gdański

MANAGEMENT UNDER RISK /THE CONCEPT OF SYSTEM ARCHITECTURE/

Introduction

The practice of management knows and uses risk management systems. As early as in the 1970's, management procedures were applied by the banking sector – the Basel Committee for Banking Supervision, 1974. In 2004, the New Capital Accord – Basel II – was signed (the first set of rules was issued in 1996). In the first half of the 1990-ies, JP Morgan investment bank published the RiskMetrics conception – a model for measuring the marketplace risk in banks. Concurrently, risk management systems were developed by the insurance sector. A complete system named Solvency I, setting requirements as regards minimum capital levels was introduced in 2002. A wider scope of issues is covered by Solvency II – a system due to be implemented in 2012. Non-finance organizations are operating CorporateMetrics (market place risk) and a system of the International Financial Reporting Standards (a requirement to identify risk related to financial instruments). Besides, since 2004, COSO – the Committee of Sponsoring Organizations of the Treadway Commission and IRM – the Association of Insurance and Risk Managers have been operating.

Despite the fact that management systems dedicated to risk conditions have been verified in practice, there is still enough space for new solutions there. What makes this suggestion even more noteworthy, is that the problem of managing in risk conditions occurs in many various decision-making areas that need to be operated within one coherent system. Moreover, the nature of risk, as well as methods to identify and measure risk still require further studies.

1. The essence of business management

To manage a business organization, no matter the size, whether measured by the equity, the employment, the market share, etc. is, in practical terms, to perform the decision making processes defined in the development plans. The decision making processes are performer within the areas delineated by the organizational structure. According to the conception outlined by Porter [1980] these are such basic areas as: inbound logistics, production, storing finished products, outbound logistics, marketing and pre-sales and after-sales servicing. Besides these Basic areas, Porter refers to auxiliary areas: the „internal logistics" areas guaranteeing continuity of production processes, the R&D area, the area of personnel decisions – HR management and the area of functions related to development of a business organization's infrastructure (planning, finance, legal support, IT, quality control, information management).

Any business organization operates in an environment determining its decision making processes. The theory distinguishes the microeconomic environment covering the market the business organization operates on, with all its elements defining the competition, the regional environment, the labour market, the culture. The macro environment, with its global coverage, includes political, economic, legal, financial, cultural and environmental determinants. The organization's most immediate environment includes the organization itself with its strategic resources, such as: knowledge, organizational factors, policies, human resources, assets, finance and perceptual resources.

The decision making processes are of a conditional nature, as they need to address the determinants existing within the organization's environment. These determinants, at least some of them, are characterized by variability, eg. purchasing prices, if these are constructed based on currency exchange rates. This variability of external determinants, as well as of strategic resources implies changes in quality of decision making processes, thus leading to discrepancies between the targets set in the development plans and the actual performance. The state accompanying decision making processes and caused by variability of determinants is defined by science as risk. Risk can have an adverse effect on the objectives and this means loss or the effect can be positive, meaning profit. Nevertheless, regardless the impact of determinants on the objectives, the problem of risk is an element central to managing a business organization. In particular, it is important for the management to be able to measure risk at the highest frequency possible. Risk measures and information about tendencies and dynamics of risk measures changes within the period of process realization, if interpreted properly, may and should constitute a foundation for adjustment of decision making processes and in extreme cases they the organization may give up the objective.

Another important problem of business management is controlling decision making processes implementation. The basic functions of this control include:

1. Comparing performance against standards.
2. Identifying and analysing variances from the expected states (standards) together with taking corrective actions aimed at achievement of the objectives planned [Gołębiewski, 2001].

The essence of both control functions is perfectly described in the following statement: "(...) strategic control is a process of managing change through response to and exercising impact on factors determining instability [Lorange, Morton Scott, Ghoshal, 1986]. The core of strategic control is continual control of strategic planning processes, exercised in the context of feasibility. The conclusion is that this is not about controlling performance, and another one – that strategic control is expressed through analysis and assessment of internal and external determinants of strategy implementation [Krupski, 1998].

The strategic control system is a set of decisions and actions intended to ensure continual monitoring of external and internal determinants of the strategy and to keep track of the strategy implementation progress. It covers the organization's functional areas, but also closer and more distant environment of decision making processes the strategy consists of.

The contents of the control system reflects the set of controlled variables that have been selected. Its elements include strategic goals, criteria for their selection, determinants of the organization's environment and characteristics of the organization's resources. Controlled variables can be described in terms of quantities (strategic financial or market goals) or quality. The latter category of description is difficult to evaluate, what statement can be made in a case like this therefore? Reliable information can be provided through identification of controlled variables tendencies – whether they follow the plan, or on the contrary and this is a significant complication indeed.

In theory, the organization's management controls changes in internal and external determinants [Gołębiewski, 2001]. The problem is that these changes have some features pof random processes. This is where one can construct a thesis that the risk involved in decision making processes is a state defined by random variables, therefore the problem of measuring risk is indirectly linked to the task of measuring random variables.

A "remedy" phase is the last phase of decision making processes. This is when measurements, interpreted and analysed, are used for evaluation of the decision making processes quality. In this phase, the management may – if necessary – "reinforce" the decision making processes with instruments protecting them against negative effects of changes in the environment, while continuing these processes without any changes, or they may make adjustments to decision making proc-

esses, or even, facing radical, unplanned changes in the environment, they may decide the decision making processes to be discontinued.

2. Risk in management processes

Management processes include planning. Plans define the organization's development strategy for a specific time period, setting strategic goals for this period, intended to strengthen the organization's competitive position on its market [Gołębiewski, 2001, p. 211-218]. The plan, approved by the organization's owners, sets forth the broad potential to be used in the processes of plan execution. Plans specify details of decision making processes as regards involvement of the intellectual, technical, technological and organizational potential, as well as resources needed in the processes of achieving the goals. Besides the elements listed above, development plans set forth micro- and macro-environmental determinants. Their impact cannot be ignored. Besides changes in the environment, the level of risk taken by the organization's management is determined by changes in the organization's own resources [Zemke, 2009, p. 43].

Decision making processes take place in business organization's all structural areas. Added value generated in these areas defines the so-called value chain, the value of which indicates organization's competitive position on the market [Rokita, 2005, p. 140].

Execution of plans, especially those of a long-term nature, requires control enabling one to answer the question whether the performance follows the plan. Controlled variables are carriers of reliable information [Kroll, Wright, Toombs, Leavel, 1997, p. 85-96]. These variables are identified and defined and at the same time they are recorded in the business organization's strategic development plans. These are symptomatic variables of the risk effects[1].

2.1. Decision areas

We are not making a mistake stating that decision making areas are the same as the organization's structural areas. In the conception constructed by Porter, where the criterion of maximizing the organization's competitive position on its market is accepted, decision making areas form a value chain [Porter, 1994, p. 22]. Porter distinguishes a chain of primary activities and support activities.

The chain of primary activities covers the areas directly related to production or provision of services. Thus, its links include decision making areas of purchasing materials, components, sub-assemblies, etc., the area of decisions concerning direct-

[1] In practice, they often do not represent any direct effect of the process, but include relevant and reliable process performance information.

ly resources processing, the area of decisions as regards storage of finished products and distribution of products to sales networks, the area of marketing decisions covering market research, market segmentation, demand estimation, identification of the lifecycle phase of organization's own products and of competitors' products. The last link of the value chain distinguished by Porter is the area of decisions relating to selling activities and in particular – operations performed to prepare the product for sale (pre-sales servicing), selling proper and after-sales support and maintenance, including warranty and guarantee terms and procedures.

The areas of decisions defined by Porter as support decisions include: the area of support functions related to procurement departments' "internal" logistics, the area of decisions concerning research and development of new production technologies and implementation of innovative solutions, the area of decisions regarding personnel policy, including recruitment, training and promotion procedures, as well as motivation mechanisms. Depending on the organizational structure, the area of infrastructure development includes: planning functions, finance, legal department, quality control functions, information flow management.

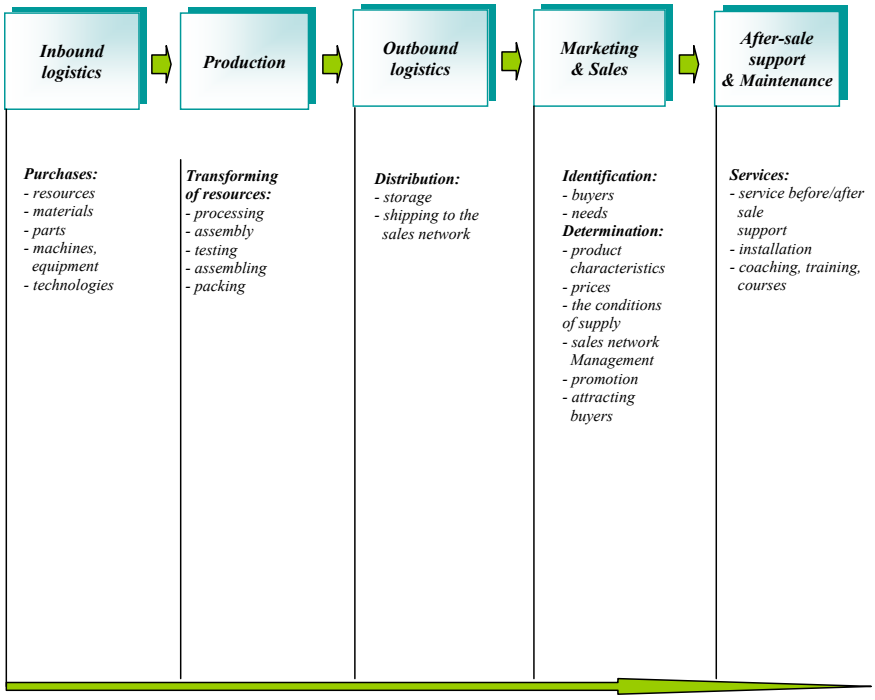

Fig. 1. Primary value chain

Source: *Author's own analysis based on* [Zemke, 2009, p. 203].

Division into the primary and support value chain does not affect the outcomes of its overall value estimation. Referring to Porter's conception solves the

problem of identifying decision making processes in organization's all structural areas and is relevant to identification of risk involved in decision processes, as well as to identification of the risk's controlled variables.

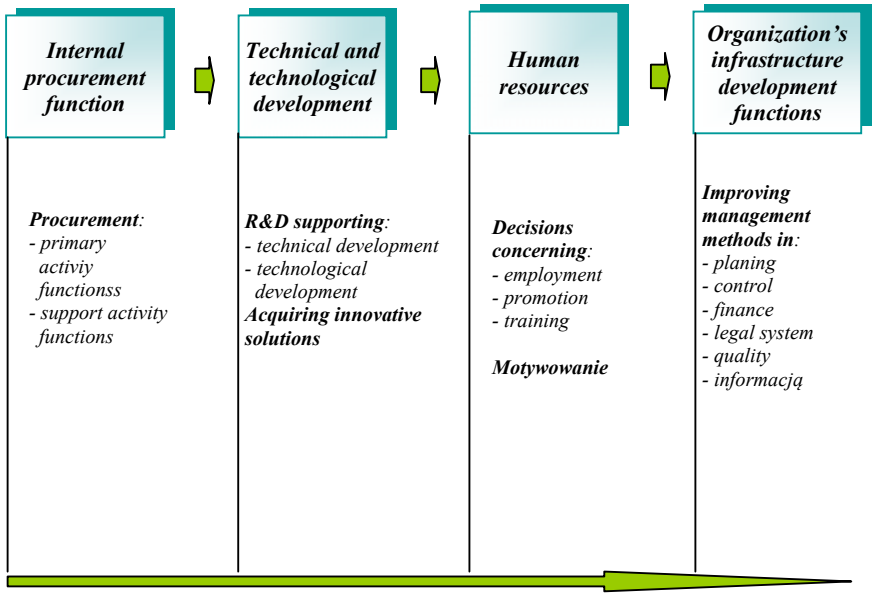

Fig. 2. Support value chain

Source: Ibid, s. 204.

2.2. The risk of decision-making processes

The essence of decision making processes is closed within the relation between the performance and the assumptions provided for in the plan. Thus, risk is the state accompanying decision making processes and concerns the activities taken as a result of this process [Jajuga, 2009, p. 13].

Changes in determinants of the business organization's environment are the main source of risk. The strategic plan (and also the operational plan) specifies limits for macro-environmental and micro-environmental determinants and the organization's own resources – changes within them imply differences between the plan and the performance[2].

[2] Macroenvironmental determinants: political, economic, legal, financial, cultural, environmental. Microenvironmental determinants – relating to the market, the organization operates on: competitors, suppliers, buyers. Own resources: knowledge, organizational circumstances, employees, assets, finance, perceptual determinants, see: David [1997, p. 102 and following pages].

2.3. Monitoring – control variables in decision-making processes

The process control system includes gathering of decision making processes control variables data. These variables constitute symptomatic assessments of the decision making processes risk. The variables can be quantitative or qualitative and are collected at a pre-defined frequency. Their evolution enables one to estimate, how risk involved in the processes changes.

3. System foundations

For management to be conscious and effective, it requires one to accept a definition of risk and a definition of risk measures. The risk measuring system is insufficient for the efficient business management, it it is not supported by a set of instruments protecting the objectives against the negative impacts of risk. It is a significant assumption for the risk management system "architecture" to define a reference basis which makes it possible to evaluate changes in the state of risk within the horizon of decision making processes.

3.1. Measurement of risk in decision-making

1. Accepting an axiom of risk involved in the decision making processes.
2. Constructing the main thesis of the study, i.e. the source of risk is in changes of the business organization's environment determinants.
3. Changes of determinants are monitored through measuring the identified control variables of the decision making processes.

3.2. Instruments of management under risk

Acceptance of the risk axiom solves the problem of defining risk, as there are many definitions of the concept in the literature of the subject. Many of them have the disadvantage of being ambiguous and find it problematic to define risk measures, while this definition should follow from the definition of risk. The solution is in using controlled variables of activities taken under decision making processes. Control variables depict the effects of risk that has been taken, therefore they constitute a significant element of the risk model structure[3].

[3] Let us assume that components $\{x_1, x_2, \ldots, x_k\}$ are control variables of decision ma king processes. The set of all control variables defines a certain space Ω. The set of all subsets of this space $F = 2^{\Omega}$ is relevant to the risk model being constructed, as its elements $\{x_{\alpha_1}, x_{\alpha_2}, \ldots, x_{\alpha_k}\}$ can be identified with sets of control variables of explicitly defined decision ma king processes, therefore they represent a picture of risk effects. Let us define a certain mapping *P,* where real values from the closed interval set [0, 1] are assigned to elements of set *F*, then set (Ω, F, P)defines a probabilistic space, where random vectors $\{x_{\alpha_1}, x_{\alpha_2}, \ldots, x_{\alpha_k}\}$ are this space elements, therefore the vector is a risk model. Mapping *P* has the following properties: 1. $P(\Theta) = 0$ – zbiór pusty, Θ – empty set

With some assumptions concerning the random vector probability density function, we are defining the random vector statistic measures:

1. The probability that vector components take values from certain variability intervals.
2. The vector of random vector components expected values.
3. The vector of random vector component variances.
4. The random vector component covariances matrix.

Definition: The set of vector's four defined measures is the measure of risk state at the given moment of the decision making process.

Decision making processes based on instruments of protection against the effects of risk play a preventive role, but also mitigate the effects of risk. Instruments supporting management processes constitute two sets: one of them consists of the business organization's own instruments and the other one – of external instruments[4].

Internal instruments are defined by the business organization and in practice they are of a temporary nature, as they are available almost immediately, except for those that are defined together with institutions whose statutory activities include defining risk and selling risk transfer instruments.

External instruments are available on the risk carriers market. It take time to acquire them, as they are sold according to strict procedures requiring verification of the organization's standing. In the period when the entity's legal and financial status is being verified, its management processes are supported by means of internal instruments[5].

4. System architecture

The system conception is based on a fundamental assumption of monitoring the risk state changes against the risk state standard. The monitoring system gathers and analyses information about changes in risk sources states in effect of changes of determinants occurring at the time of decision making processes. This assumption gives to the system design a feature, which distinguishes the conception from among other solutions, namely normativity of the system. This feature of the conception refers to classical definitions of risk, perceiving it as a "gap" between the expectation – the plan – and the performance.

2. $P(\Omega) = 1$, Ω – przestrzeń zdarzeń elementarnych, Ω – space of elementary events 3. P measure is additive.

[4] The distinction is a matter of convention here and its criterion results from mutual relations between decision making areas; procurement, production and sales, support areas.

[5] An overview of instruments is presented in Zemke [2009 p.115 and following pages].

Another important assumption involves specifying the type of system's data bases and the rules for gathering and updating the base resources. The database type determines normativity – this means that along with a control variables database updated at a pre-defined frequency, a database of controlled variables standards should be operated.

4.1. The base of control variables

A database of control variables is constructed based on macro- and micro-environmental determinants and based on a set of determinants defining the organization's resources. The database elements include factors that have been found to be relevant to evaluation of the decision making processes quality that enable one to specify the state of risk that has been taken. This element of system "architecture" admits openness to the possibility for the set of control variables to be supplemented whenever relevant information about the risk state changes is contributed.

4.2. The base of risk measures

The module resources constitute a mapping of the control variables module resources. Variables measures are defined based on assumptions for the business organization development plan[6]. The module resources can be changed only in case if development plans are adjusted or the control variables module is supplemented with new elements. This requires also definition of standards for their equivalents.

4.3. The base of the decision-making monitoring results

The module contains two subsets: a set of risk standards states $Zs^{r(w)}$ and a set of risk states $Zs^{r(q)}$ w in the phase of decision making processes implementation q, updated at the pre-defined frequency. According to the risk state definition accepted for the present study:

$$Zs^{r(w)} = P^{w}(X \in \prod_{i=1}^{k}[a_i, b_i]), E^{w}(X), Var^{w}(X), Cov^{w}(X_i, X_j)$$

$$Zs^{r(q)} = P^{q}(X \in \prod_{i=1}^{k}[a_i, b_i]), E^{q}(X), Var^{q}(X), Cov^{q}(X_i, X_j)$$

4.4. The base of management instruments implemented under risk

Operation of the verification module is of high significance in the system conception, as it enables one to assess its practical utility. This is where differences between risk standard states and the current risk state are identified. The assessment outcome enables one to diagnose the decision making processes im-

[6] Along with quantitative description of control variables, qualitative description is also possible.

plementation, to answer the important question about differences between the performance and the actual state. It depends on the findings of the assessment, whether the assumptions will have to be adjusted or instrument protecting against the effects of risk will have to be launched.

The idea of this module operation includes the option of multiple re-verification. This requirement results from the need to verify remedy procedures. The protection instruments effectiveness should be known, but managing an organization under risk conditions has the nature of random processes and as such, it is not entirely predictable.

The module of protection instruments base is a set of products, the organization's management selects individually, based on verification of the decision making processes quality. Protection instruments should be selected based on assessment of the "gap" between the plan and the performance, with the effectiveness criterion used. Instruments "strength" is a function of their purchasing cost and this means that there can be no doubt as regards the selection: effectiveness of protection is a matter of importance here, while the financial aspect emerges in the background.

4.5. Management under risk condition – the system conception "architecture"

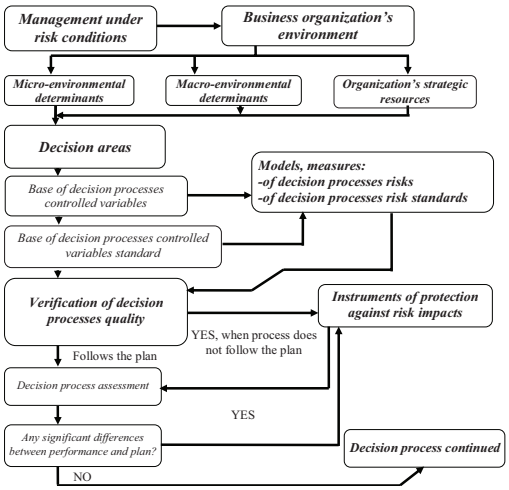

Fig. 3. System conception chart

Conclusion

The structure of the system presented here is based directly on the assumptions resulting from the contemporary business management conception. Foundations of the conception consist of the assumptions made in development plans

and verified as a result of decision making processes. The decision making processes are of a conditional nature, as they need to address the determinants existing within the organization's environment.

Changes in determinants in the period of decision making processes execution cause that they are accompanied by a certain special state, referred to as the risk state. As a result of this state, differences between planned expectations and the actual performance are emerging. These differences have given direction to the management system for the risk conditions, where difference – the so-called gap between the expectation recorded in the plan and the reality – has been used for constructing a normative system of managing under risk conditions.

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Summary

Despite the fact that management systems dedicated to risk conditions have been verified in practice, there is still enough space for new solutions there. What makes this suggestion even more noteworthy, is that the problem of managing in risk conditions occurs in many various decision-making areas that need to be operated within one coherent system. Moreover, the nature of risk, as well as methods to identify and measure risk still require further studies.