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Estimation of Manufacturing Enterprise Development Risks in Process of Operational Activity

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Abstract: The paper offers a comprehensive methodology for estimating the risks of a manufacturing enterprise developement in the process of the operational activity formed within the neural network technology in the format of four-fimensional integral estimation indigator including particular indicators of organizational, personnel and investment risks as well as external environment risks. Economic reasonability of the methodology use is explained by alternate scenario calculaitons.

Key words: Risk management · Operational activity · Manufacturing enterprise · Investment · Personnel · Organizational and external risks · Total balance · Risk field

INTRODUCTION

In contemporary conditions the manufacturing enterprises risk field is complicated by unenforced problems which include among others the high level of moral and physical obsolescence of basic productive assets, disbalance of the resources' provision of their operative activity, high level of the state regulation of the current activity and strategic perspectives and a number of other factors [1]. Efficient management of a manufacturing economic entity upon such conditions means the inclusion of the risk management block into the operative management subsystem that will allow to minimize total expenses of a manufacturing enterprise subject to the maintenance of the working level.

RESULT

In spite of the rather wide range of works in the area of manufacturing enterprises management, the issues of forming the system of a manufacturing enterprise operative management on the basis of the risk management remain understudied that stipulated the choice of the study theme as well as its urgency in theoretic and practical aspects.

The risk management with the necessity includes planning stage within which the following is done: the problem definition, setting of general goals and parameters within which a specific risk or a group of risks can be studied and on which decisions can be made, collecting and processing of information on various probable risk aspects where all aspects can be regarded from two positions.

Strategic aspects are, above all, the determination of interrelations between the manufacturing enterprise and the external environment surrounding it and the discovery of the enterprise weak and strong points [4].

Organizational aspects mean setting of goals and tasks for various hierarchal degrees of the organization management, distribution of the responsibility between them for various types of the decision making.

The organization stage seems to be the most capacious and complicated and requires maximum of labor efforts from the specialists in the area of the risk management (risk managers). At this stage the following tasks are solved:

Risks Identification: At this stage it is necessary to make up the list of those risks the subject can be exposed to and determine which of them are more and less important.

Risks Analysis and Estimation: Risks analysis consists of two stages: determination of the risks possibility from the point of view of their probability and estimation of possible consequences, i.e. it is necessary to discover which risks are "hardly probable" and which are "highly probable" as well as to estimate possible consequences of the risks impact on the subject's activity in general.

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Development of Measures to Mitigate the Risk: It includes the development of steps to decrease the possibility of a possible risk, exclusion or attempt to avoid it as well as to decrease the risk seriousness in case of its arising.

Control Stage: As the risk management is made in the context of incomplete information about possible future consequences of the made decision, it is quite probable that many aspects of the accepted risk management strategy may happen to be unsatisfactory. That's why "the control" stage is obligatory; its goal is to determine how the accepted strategy and risk management tactics work as well as to take into account the committed errors further at the planning stage [6].

The main goal of the risk management in the organization is to get maximum profit on the basis of the balanced combination of commercial risks of the decision (project) liquidity in general. On the assumption of the main goal, the risk management must solve the following principle tasks:

- To find areas of potential risks,
- To identify the organization internal and external risks,
- To estimate the degree (level) of separate types of risks and the organization general risk as a whole;
- To develop and perform preventive events to get protection against potential risks;
- To use methods of optimizing the sizes of possible compensation of damages that arose as a result of risks,
- To form the system of effective risks monitoring and reporting being particular of both separate operation and production activity in general,
- To create the optimal structure of the risk management functioning.

All tasks of the risk management are interrelated with one another. In addition to the main goal the risk management system has a number of secondary aims:

- To provide the efficiency of the performed events on the risk management that means the comparison of the total expenses for the risk management with the expected effect.
- To define the appropriate indefiniteness level as far as it concerns the possible damage arising that stipulates the risk decrease to the acceptable level for the organization,
- Legality of acts on the risk management.

The analysis of the manufacturing enterprise development risks made in this study showed that one of the key risks is the personnel one estimated by the experts in 6-9 points on the ten-point scale (depending on the manufacturing sub-industry).

This circumstance proves the necessity to detalize personnel risks and allocate them according to the types of the controlled (i.e. the personnel risk that can be discovered before it arises through monitoring of the enterprise operational activity) and uncontrolled (i.e. the personnel risk that cannot be discovered through expedient monitoring of the operational activity, this type of risk can be discovered before it arises only in a casual manner) risk [8].

The matrix of the personnel risks depending on the arising probability and potential damage in percentage to the manufacturing enterprise annual turnover is shown in Table 1.

As you can see from the Table above, the uncontrolled risks include inadequate reaction risk (Ê1), social and psychological risk (Ê2), coding and decoding risks (Ê3), each of which cannot be discovered through the monitoring procedures; while the controlled risks

Table 1: Matrix of personnel risks of a manufacturing enterprise (Uncontrolled risks are italicized)

	Potential disbenefit, % to the annual turnover									
Risk possibility, %	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-95	≥95
0-10	Ê6	Ê6								
10-20						Ê4	Ê4	Ê4	Ê4	*Ê1*
20-30		*Ê2, Ê3*	*Ê2, Ê3*	*Ê2, Ê3*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1*
30-40		*Ê3*, Ê5	*Ê2, Ê3*, Ê5	*Ê2, Ê3*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	*Ê1, Ê2*	
40-50		*Ê3*, Ê5	*Ê3*	*Ê3*	*Ê1*	*Ê1*	*Ê1*	*Ê1*	*Ê1*	
50-60		*Ê3*, Ê5	*Ê3*	*Ê3*	*Ê1*	*Ê1*	*Ê1*	*Ê1*	*Ê1*	
60-70		Ê7	Ê7	Ê7	*Ê1*	*Ê1*	*Ê1*	*Ê1*	*Ê1*	
70-80		Ê7	Ê7	Ê7			*Ê2*	*Ê2*		
80-90										
90-100										

include innovation personnel risk (Ê4), education and development risk (Ê5), motivation lack risk (Ê6) and inadequate stimulation risk (Ê7).

It goes from the provided data that the most considerable risks are personnel's inadequate reaction that can cause the damage up to 100% of the manufacturing enterprise annual turnover; herewith, as this category of risks is referred to uncontrolled risks, there is a necessity to single out typical methods of decreasing this risk as well as other uncontrolled risks:

the use of methods estimating the personnel's activity quality within the enterprise operational activity that contemplates the discovery of non-system mistakes (for example, 6 sigma) which arising witnesses about the possibility of an uncontrolled personnel risk;

the creation of a resources' reserve to eliminate the consequences of the manufacturing enterprise uncontrolled personnel risk when it arises,

increasing of the procedures and methodologies quality that are applied at the personnel selection and assessment on the basis of the inclusion of the personnel valuables estimation methods, correspondence of the personality specialization to the organizational culture of the enterprise, etc. that will allow to decrease the possibility of uncontrolled risks.

In case of the development risks enforcing, the scheme of making decisions in the processes of the operational activity must be based on the minimization of not only obvious but hidden expenses, too that witnesses about the necessity to estimate the risk component of the expenses in the context of the potentially possible damage. Thus, the estimation of total expenses of the management decision will be as follows:

$$C_{obv} = C_{fix} + C_{var} \quad (1)$$

$$C_{hid} = k_1 C_{fix} + k_2 C_{var} + C_{ext} \quad (2),$$

where Cobv is obvious expenses of the management decision including conditionally constant expenses (C_{fix}) that arise as a result of the management decision implementation and conditionally variable expenses (C_{var}) that arise as a result of the management decision implementation, RUR thous.;

k_1 is a scaling factor defined as the multiplication of the increasing coefficients on particular risks that arise as a result of the management decision implementation and has the conditionally constant expenses increasing as a consequence, minus 1 (the correction for the obvious expenses taken into account in the first part of the simultaneous equation), share;

k_2 is a scaling factor defined as the multiplication of the increasing coefficients on particular risks that arise as a result of the management decision implementation and has the conditionally variable expenses increasing as a consequence, minus 1 (the correction for the obvious expenses taken into account in the first part of the simultaneous equation), share;

Cext is additional expenses contemplated by the risk of management mistakes while implementing the decision on the manufacturing enterprise operational activity defined by the expert estimates method, predominantly within the hierarchy analysis technology, RUR, thous.

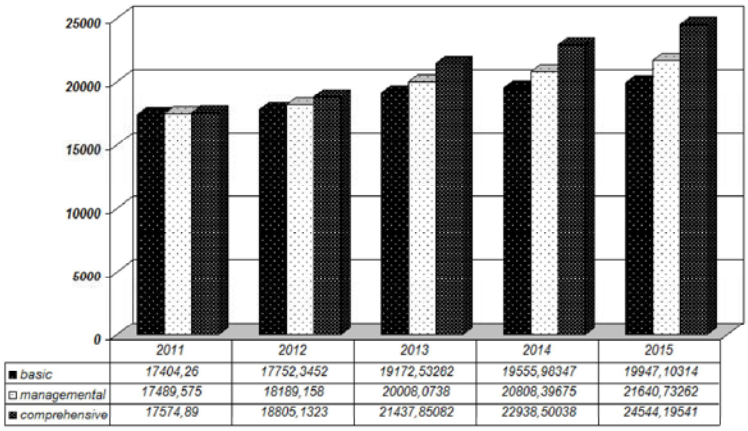
Thus, the criteria for making a management decision in the operational management must be total expenses related to its implementation that include not only the obvious part but also the hidden part of expenses stipulated by the controlled and uncontrolled risks of the manufacturing enterprise development.

In the process of the study it was revealed that under current conditions the most considerable risks of the manufacturing enterprise development can be grouped into four principle categories: organizational risks, personnel risks, investment risks and external environment risks. Thus, the comprehensive criteria of the risk estimation contemplates the formation of an integral indicator that takes into account all three mentioned components.

As the area of making decisions related to risks is dynamic, it was reasonable to form the mentioned comprehensive criteria in the context of the technology being easily adapted to the computer data processing; as a result of this we have chosen the neural network technology.

In the context of the integral indicator the results received in blocks are summed up and the result is interpreted as follows:

- If the integral indicator has a value from 0 to 1, the positive decision on the operational activity is made as the risk is minimal,
- If the integral indicator has a value from 1 to 2, the positive decision on the operational activity with the remarks related to the resources' provision as the risk is medium/high,
- If the integral indicator has a value from 2 to 3, the positive decision on the operational activity is made only when strictly necessary as the risk is very high,
- If the integral indicator has a value from 3 to 4, the decision on the operational activity is declined as the risk is unreasonably high.



	2011	2012	2013	2014	2015
basic	17404,26	17752,3452	19172,53262	19555,98347	19947,10314
managemental	17489,575	18189,158	20008,0738	20808,39675	21640,73262
comprehensive	17574,89	18805,1323	21437,85082	22938,50038	24544,19541

Fig. 1: Dynamics of the Generation Company OJSC total balance for 2011-2015, RUR MIO

The results of using tools and mechanisms of the operational activity management on the basis of the risk management presented in the paper were predicted in accordance with the following scenarios:

- Basic, at which it was contemplated to keep the current methods of managing the operational activity of manufacturing enterprises,
- Management, contemplating the estimation of key risks of the operational activity and implementation of the algorithm of operative management on the basis of the risk management at the manufacturing enterprise,
- Comprehensive, contemplating the implementation of the whole range of the tools and mechanisms of managing the manufacturing enterprises operative activity on the basis of the risk management.

The prediction was made on the basis of the Generation Company OJSC data. The prediction object was the dynamics of total balance of this system forming manufacturing enterprise (Fig. 1). As it can be seen from the mentioned figure, while implementing the comprehensive scenario for five years' development of the enterprise under consideration the total balance will increase by 23% with regard to the basic scenario that in absolute terms makes up the increment of more than RUR 4.5 billion in the five years' perspective; while implementing the management scenario, the relevant indicators are 8.5% and almost RUR 1.7 billion.

CONCLUSIONS

Thus, in the context of the performed study we presented a matrix of controlled (innovation personnel risk, education and development risk, motivation lack risk, inadequate stimulation risk) and uncontrolled (inadequate reaction risk, social and psychological risk, coding and decoding risk) personnel risks of a manufacturing enterprise arising in the processes of its operational activity within which their possibility and potential damage as well as key methods of decreasing of the significance of uncontrolled risks are determined.

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