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INTEGRATED RISK MANAGEMENT IN METALLURGICAL ENTERPRISES – METHODICAL APPROACH

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The aim of the article is to outline the risk management issues in metallurgical enterprises. In particular, the paper deals with the implementation of integrated risk management (IMERM-model) in metallurgical enterprises, since comprehensive risk management needs to be handled in an integrated way. The most important thing, however, is the ability to use appropriate methodology to this end. Therefore, risk management in metallurgical enterprises should be analysed by adopting a functional approach.

Key words: metallurgy, risk management, measurement and risk evaluation, financial risk

INTRODUCTION

Currently, risk management has become a key element in the operations of big-scale enterprises [1]. Metallurgical enterprises, which strive to overcome a variety of difficulties and threats, have to be able to manage risks in an effective and efficient way. Effective and efficient, as used here, means an integrated approach to that issue, i.e. the approach which covers operating, investment and financial activities carried out by companies. Therefore, this is an integral part of the risk management process in a metallurgical enterprise, which should always be looked upon in terms of procedures, methods and systems involved.

In compliance with the general risk concept, which is used in the scientific theory as well as in practice, there are a number of sources risks may stem from, and when a risk occurs it brings about certain consequences [2]. In addition, industry specific risk in the metallurgical sector has its own unique profile, due to the character of industrial production carried out by metallurgical enterprises. The appropriate recognition of risks which are specific to the metallurgical industry is particularly important in the process of risk identification and risk quantification, as risk is described in science as the distribution of probability, i.e. $R = P \times C$, where R stands for a risk, P is the probability of occurrence of a specific risk, and C means its consequences, therefore, if a given type of risk does not occur the metallurgical enterprise does not have to bear its consequences, and vice versa [3, 4].

Irrespective of the way risk is defined, however, risk management methodology appears to be a fundamental issue [5]. In practical terms, integrated risk management in a metallurgical enterprise requires a good understanding of risk management methods and, on the other hand, an ability to use the methods in the right way. Therefore, the main aim of the paper is to present the concept of integrated risk management in metallurgical enterprises and, in particular, propose the modification of the traditional approach to Enterprise Risk Management (ERM) and its transformation into an integrated approach, which is illustrated in the paper by the Integrated Metallurgical Enterprise Risk Management Model (IMERM-model), to be applied in companies' operations.

INTEGRATED METALLURGICAL ENTERPRISE RISK MANAGEMENT – IMERM-MODEL

Figure 1 presents the concept of integrated metallurgical enterprise risk management (IMERM-model), where the modification of the traditional formula (ERM) – to make it evolve into the integrated metallurgical enterprise risk management – requires the application of a systemic approach, which means that a common denominator needs to be found in an enterprise, i.e. the common value around which risks should be estimated. Cash flows (CFs) may act as such a common denominator for every enterprise. All economic events, including risks, are reflected in financial reporting of the metallurgical enterprise. The acceptance of such a view in the attempts to solve this problem results also from the general definition of risk in science, based on which risk is a strictly quantitative category [6].

Irrespective of this definition, however, it should be kept in mind that risk has to be properly identified, first of all, in order to ensure its accurate quantification. Also, any mistakes made at this stage of a risk management process may lead to incorrect results of the final risk assessment. Risk identification (phase 1) is, therefore, the key stage in the risk management process. To make sure that this is done properly, the use of checklists may be recommended in enterprises, in order to

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specify and recognize factors which cause various risks. These factors may subsequently be classified and divided into the risks which are specific to a given metallurgical enterprise, i.e. controlled by the enterprise (quality risk of metallurgic products) and systemic risks, i.e. external risks which are beyond the enterprise's control, e.g. prices of raw materials used in metallurgic and casting processes (ore, coke and other heat carriers) or market prices of non-ferrous metals and iron. After that, the identified risks have to be quantified using appropriate quantitative and qualitative methods (phase 2). In particular, when quantifying risks in a metallurgical enterprise through cash flows (CFs), we may adopt the historical (*ex post*) approach, based on the financial reporting data, as well as the probabilistic approach, which seems more relevant and is based on the application of appropriate probabilistic methods.

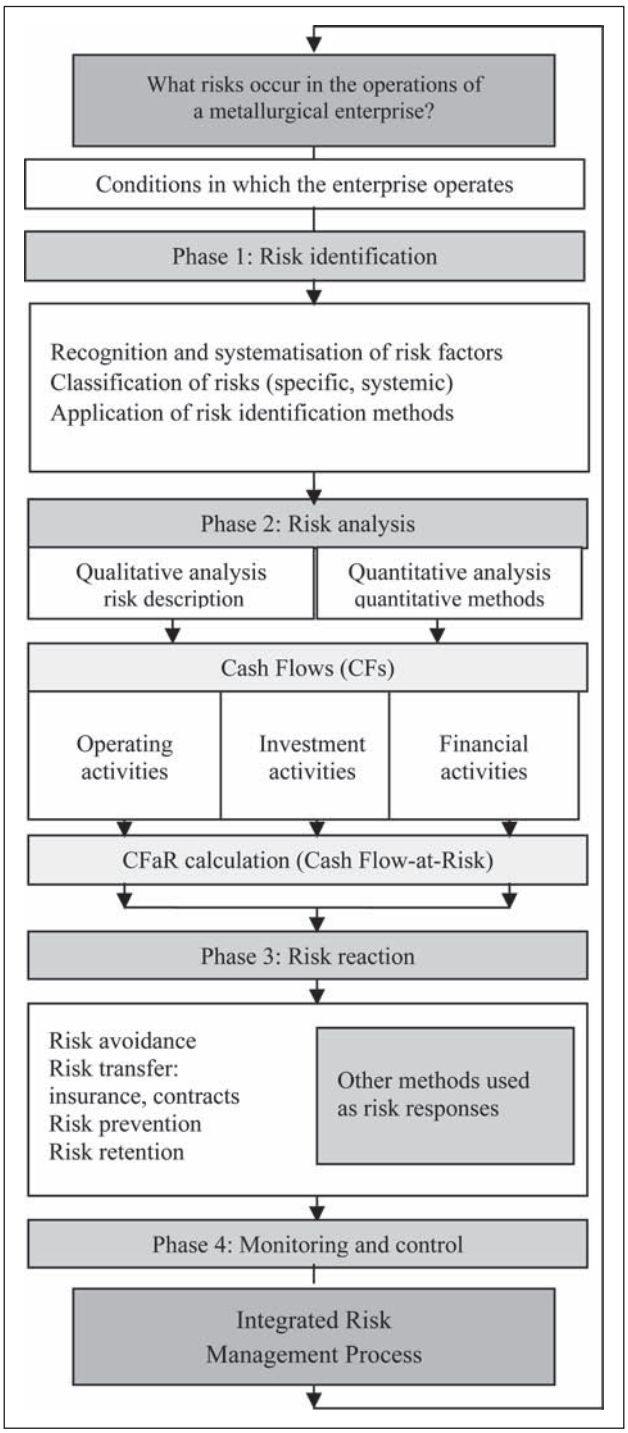

Figure 1 IMERM-model: integrated metallurgical enterprise risk management

For the former approach, the methodological armoury of corporate finance may be suggested, in particular an index analysis, supplemented by such methods as financial and operating leverages. When looking at manufacturing operations of metallurgical enterprises, it may be assumed that the higher the operating leverage, the higher the operating risk for the enterprise. According to the probabilistic approach, however, where net cash flows and a net profit generated by the metallurgical enterprise are chosen as the risk measurement criteria, it is suggested that two methods may apply respectively. The first and, at the same time, more important one is Cash Flow-at-Risk (CFaR). These are risky cash flows in an enterprise, i.e. $P(CF \leq CF_0 - CFaR) = \alpha$, where: CF is a cash flow in an analysed period, i.e. a random variable, CFaR is a risky cash flow, CF_0 is a planned cash flow in the analysed period and α is the tolerance level [7]. In the other method Earnings-at-Risk (EaR) – it is assumed that there are earnings at risk in the enterprise, which may be described using the following formula: $P(E \leq E_0 - EaR) = \alpha$, where: E means the net profit in the analysed period, i.e. a random variable, EaR is a net profit at risk, E_0 is a planned net profit in the analysed period and α is the tolerance level [7]. These methods are basically the extension and modification of the Value-at-Risk (VaR) concept, and their selection for risk estimation in a metallurgical enterprise, in line with the IMERM-model, seems to be justified as net cash flows may add value to the entity [8].

Irrespective of the attitude to quantitative risk management (the *ex post* approach or the probabilistic approach) and the selection of a specific method, metallurgical enterprises, in their operations, should be aware that all the methods of risk identification, quantification and response need to be used in a complementary way. From the practical point of view, as shown in Figure 1 – the IMERM-model, the main issues are risk analysis and risk assessment (phase 2). A particularly important probabilistic and statistical measure here is the standard deviation (σ) as a risk measure, which shows how much, on average, the future income (financial result) generated by a metallurgical enterprise may deviate from the calculated value of the enterprise's expected income $E(X)$. Another important way is the application of risk simulation, i.e. the use of the stochastic method of Monte Carlo risk simulation [9, 10].

After the risks in the metallurgical enterprise have been identified and estimated, they need to be responded to in the right way (phase 3). In this respect, insurance is a versatile method, which can be widely used in the metallurgical and smelting industries and which may also be considered as a separate method of risk fi-

nancing in the operations of metallurgical enterprises. Commercial insurance, offered in the heavy industry sector, allows companies to transfer the risk onto insurers. In the metallurgical sector, *all risks* insurance plays a special role as it covers, in a comprehensive way, the entire company's operations. All the risk management measures and activities are subject to control and monitoring (phase 4), as due to the nature of metallurgical production processes, certain additional and unpredicted risks may occur.

DISCUSSION OF RESULTS

The advantage offered by the IMERM-model is its universal character. It may be applied not only in a metallurgical enterprise as a whole but also in some specific types of activities carried out by this enterprise, i.e. the CFaR method may be used separately, in connection with investment, operating and financial activities of the company (Figure 1). This may be illustrated by the following calculations: if the metallurgical enterprise forecasts that its annual net cash flows in the three subsequent years will reach 21 million euros (in year 1), 12 million euros (in year 2) and 6 million euros (in year 3), then the expected net income should amount to 12 million euros, whereas the CFaR value, when calculated with the standard deviation *(σ)*, will be 5,2 million euros, and when calculated with a risk measure such as semi-variance (the downside variance), it will amount to 10,8 million euros [11]. In another scenario for the projected financial performance of the metallurgical enterprise, i.e. when annual net cash flows in the three subsequent years of its operation amount to 15 million euros (in year 1), 12 million euros (in year 2) and 4 million euros (in year 3), then the value of the expected net income will be 10,2 million euros, while the value of CFaR, when calculated with the standard deviation *(σ)* will be 4,21 million euros, and when calculated with the semi-variance measure, it will be 11,5 million euros [11]. This proves that the second scenario is less favourable for the enterprise, as the net income generated from its metallurgical production is lower and, at the same time, the enterprise bears a higher financial risk.

As a comparison, when estimating the risk for investment activities carried out by the metallurgical enterprise, we can see that if the estimated net present value (NPV) for a completed investment project (e.g. the construction of a new coking plant) is 9,2 million euros, then the project risk calculated with the standard deviation *(σ)* will equal 3,34 million euros [12]. However, if the enterprise chooses another project (e.g. modernisation of an existing coking plant), where net present value (NPV) generated within the same period of time and described with the same distribution of probability *(p)* – is 9,2 million euros, then the standard deviation *(σ)* will equal 2,74 million euros [12]. The situation is different here, i.e. both metallurgical projects generate the same NPV, but the latter project carries a lesser risk. That is why the enterprise should opt for the second investment option.

The calculations presented above give an overview of the financial standing of the metallurgical enterprise, which is exposed to risks in its operations, allowing it to calculate the maximum loss which may be made and, consequently, providing the basis for appropriate risk responses (Figure 1).

SUMMARY

The modification of the traditional risk management formula (ERM), used in metallurgical companies, towards an integrated model (IMERM-model), as advocated in this paper, is a result of the positive experiences gained in this area by industrial companies operating in other lines of business (e.g. the US automotive industry) and managing their risks in an integrated way. Another reason for the adoption of the suggested approach may be the fact that metallurgical enterprises appear to lack any integrated risk management formula, to be applied in their business activities.

According to the findings of the empirical research conducted in Romania, 3,85 % of the metallurgical enterprises surveyed manage their risks at a strategic level and 7,69 % of these entities use financial derivatives in this respect [13]. The situation in Poland looks similar, but neither Romanian nor Polish metallurgical companies manage their risks with the use of any integrated methods.

In conclusion, the concept of integrated risk management in metallurgical enterprises may be understood as meaning that: risks, first of all, are managed in every area of the enterprise's activity (investment, operating and financial); secondly, the enterprise applies a common denominator, i.e. net cash flows, as the value around which risks can be estimated; thirdly, a wide range of risk management methods and techniques are employed in a complementary and comprehensive way; fourthly, a risk management process supports overall management across the entire company; fifthly, risk management, carried out on an ongoing basis, is perceived as a process; and sixthly, effective risk management reduces the total risk exposure and, consequently, adds value to the enterprise [8]. The bottom-line here, however, is the fact that risk estimation supports the management in a decision-making process, including investment decisions [14], while integrated risk management, tailored to our times, constitutes an integral part of governance in many companies all over the world.

REFERENCES

[1] J. C. Hull: Risk management and financial institutions, Pearson Education Inc., New York (2007), 1-2.

[2] R. M. Wideman: Project & Program Risk Management, Project Management Institute, Newtown Square (1992), IV-3 - IV-5.

[3] J. X. Wang, M. L. Roush: What Every Engineer Should Know about Risk Engineering and Management? Taylor & Francis, New York (2000), 5-6.
[4] R. Turner: Handbook of Project Management, Gower Publishing, Burlington (2007), 457-466.
[5] H. Simonsen, J. Perry: Risk Identification, Assessment and Management in the Mining and Metallurgical Industries, The South African Institute of Mining and Metallurgy, December (1999), 312-332.
[6] F. H. Knight: Risk, Uncertainty, and Profit. Hart, Schaffner & Marx, Boston (1921), 12-29.
[7] K. Jajuga: Zarządzanie ryzykiem. Wyd. PWN, Warszawa (2007), 383-384.
[8] P. Tworek: Reakcja na ryzyko w działalności przedsiębiorstwa budowlano-montażowego, Wyd. Difin, Warszawa (2013), 190-205.
[9] J. Bijańska, K. Wodarski: Risk management in the planning of development project in the industrial enterprises, Metalurgija 53 (2014) 2, 276-278.
[10] Y. Y. Haimes: Risk Modeling, Assessment and Management, John Wiley & Sons, Chichester (2004), 56-99.
[11] K. Marcinek: Ryzyko projektów inwestycyjnych. Wyd. Akademii Ekonomicznej, Katowice (2001), 154-157.
[12] M. T. Wilczek: Przedsięwzięcia inwestycyjne przedsiębiorstw. Wyd. WSZMiJO, Katowice (2001), 140-141.
[13] S. G. Anton: Who manages financial risk? An empirical examination of risk management practices in the Romanian metallurgical industry, Metalurgija 52 (2013) 4, 518 -520.
[14] J. C. Hartman: Engineering Economy and the Decision-Making Process. Pearson Education, New York (2007), 87 -112.

Note: The responsible sworn translator for English language is Beata Marcinkowska, Katowice, Poland