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## **Preface**

This book presents the results of Polish-Ukrainian scientific cooperation. It contains the papers prepared for the 10th international conference “Quantitative Methods in Accounting and Finance”. Accounting and finance face nowadays many challenges. They require both an international and local approach, they need to be considered from the theoretical and practical point of view, and they also encourage general and specific analysis.

Support from quantitative methods is needed in order to discover, implement and verify new finance and accounting trends, methods and instruments. The research papers which are part of this book present different aspects of accounting and finance combined with a quantitative, in particular Econometric, approach.

Some of the papers focus on methodology of measurement, estimation and forecasting of financial phenomena, especially those related to investment processes. Others address specific problems of accounting such as accounting solutions for different branches, legal issues of accounting, responsibility and reporting. An alternative approach was also undertaken and the roles of a narrative and culture in accounting were presented.

The variety of papers selected for this issue ensures the complexity of the book. It provides theoretical as well as empirical material which can be used in further research and in business practice, particularly in accounting and finance. We hope that the content of the book provides a starting point for scientific discussion and practical changes.

*Marta Nowak*

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# **RISK ASSOCIATED WITH RESEARCH AND DEVELOPMENT PROJECTS AND ITS CONSEQUENCES FOR THE FINANCIAL ACCOUNTING SYSTEM**

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## **RYZIKO W PROJEKTACH BADAWCZO- -ROZWOJOWYCH I JEGO KONSEKWENCJE DLA RACHUNKOWOŚCI FINANSOWEJ**

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**Summary:** Risk is inherent in every activity taken by an enterprise. Research and development activity, often implemented through projects, is by nature subject to greater risk than other areas – the goal and scope of such activity is more difficult to determine at the time of the project's beginning. Risk management in research and development activity (projects) requires the identification of risk, its measurement and evaluation and the choice of ways to impact on chosen risks, and then the preparation and implementation of a risk management plan. Measurement and evaluation of risk is an extremely important step, as it determines the choice of risk management methods and entail certain financial resources which may be reflected in the creation of reserves for the chosen risk management methods. The aim of this article is to identify risk areas in research and development projects and show the consequences of the chosen risk management strategies for the financial accounting system.

**Keywords:** research and development projects, risk, risk management, reserves, accounting.

**Streszczenie:** Ryzyko jest nieodłącznym elementem każdej działalności podejmowanej przez przedsiębiorstwo. Działalność badawczo-rozwojowa realizowana często przez projekty, z natury obciążona jest większym ryzykiem niż inne obszary działalności przedsiębiorstwa – cel i zakres takiej działalności jest trudniejszy do określenia w momencie jej rozpoczęcia. Zarządzanie ryzykiem w projektach badawczo-rozwojowych wymaga zidentyfikowania ryzyka, jego pomiaru i oceny (ewaluacji), wyboru sposobów oddziaływania na wybrane typy ryzyka, a następnie przygotowania i realizacji planu zarządzania ryzykiem. Pomiar i ocena ryzyka jest szczególnie istotnym etapem, gdyż determinuje wybór metody zarządzania ryzykiem oraz

pociąga za sobą określone skutki finansowe, które powinny znaleźć odzwierciedlenie w tworzeniu rezerw związanych z wyborem określonej metody zarządzania ryzykiem. Celem artykułu jest wskazanie obszarów ryzyka w projektach badawczo-rozwojowych i przedstawienie konsekwencji wyboru strategii zarządzania ryzykiem dla systemu rachunkowości finansowej.

**Słowa kluczowe:** projekty badawczo-rozwojowe, ryzyko, zarządzanie ryzykiem, rezerwy, rachunkowość.

*Risk is like fire: If controlled it will help you; if uncontrolled it will rise up and destroy you.*

Theodore Roosevelt

## 1. Introduction

Research and development are no longer exclusively the domain of scientific pursuit and have become an activity undertaken by the company, thus being one of the main drivers of growth and development<sup>1</sup>.

The National Development Strategy 2020 shows how important a part of the Polish economy is the research and development activity. Risk and uncertainty are inherent to each activity undertaken by the company in a market economy. Research and development activity, often implemented through projects, is by nature subject to greater risks and uncertainties than other areas of the company. Such an activity is distinguished by the element of novelty, the need to eliminate the scientific and technical uncertainty as well as uncertainty about the outcome, an attempt to solve a complex problem is usually at its core.

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<sup>1</sup> According to the study, “Opłacalność inwestowania w badania i rozwój” (‘Cost-effectiveness of investing in research and development’) developed by PwC on behalf of the National Research and Development Centre, up to 80% of companies intend to increase spending on research and development in the near or medium term. The data collected in the report show that the share of revenues generated from the results of R&D in total revenues of Polish enterprises is increasing and in 2014 stood at an average of 16.62%. This means that the share of revenues from R&D increased from 9.74% in 2008 by nearly 7 percentage points in 2014. The effects of investment in research and development are evident fairly rapidly – 32% of the companies surveyed confirmed that the first gains are achieved after one year of implementation of the results of R&D, and 27% that achieved gains after 2 years. This means that almost 60% of companies achieved profits of R&D activities during the two years of implementation of the results. As many as 41% of the new product entering the market in 2014 were the result of R&D. The vast majority, up to 80% of the surveyed companies, predicts an increase in spending on research and development, both in the short term (1-2 years) – 11%, and medium (3-5 years) – 13%. These trends are reflected in the strategic national documents – according to the National Development Strategy 2020, a rate of GERD (Gross Domestic Expenditure on Research and Development) should by 2020 reach a level of 1.7% (approx. 35 billion PLN), which is more than double in 2013.

The aim of the article is to identify ways to hedge against risks in research and development projects depending on the type of research and presentation of the consequences of the choice of risk management strategies for the financial accounting system. The aim determined the choice of research methods. Analysis methods of legal acts and literature were used and the conclusions were drawn on the basis of the method of deduction and reasoning by analogy.

## **2. Implementation of research and development activities through projects**

Because of the novelty of the results and the level of risk, research and development activities are carried out mostly in the form of projects, defined as:

- a temporary endeavor undertaken to create a unique product, service or results [PMBOK 2013, p. 3],
- a temporary organization that is created for the purpose of delivering one or more business products according to an agreed business case [PRINCE 2 2010, p. 3],
- a unique set of coordinated activities, limited by time and costs, aimed at obtaining a set of predetermined products (project range that meets the objectives of the project), while maintaining the standards of quality and requirements [Dałkowski, Staśto, Zalewski (eds.) 2009, p. 3].

Effective project management is ‘meeting the objectives of the project within a given time, at a certain level of costs while maintaining quality requirements and the economical use of resources’ [Krawiec 2000, p. 29]. The essence of the projects is their specificity by parameters: the intended result of the project (performance), scope, cost and time/date of the project.

One of the main features that distinguish the project from routine activity is a clearly marked beginning and end, which determine the project life cycle – the sequence of phases through which the project must pass from the beginning to the end in order to achieve the project goals. Usually, the project consists of four phases<sup>2</sup>:

1. Initiation is the concept phase during which the project and its stakeholders are defined, the purpose and scope of the project is initially established, the project cost, time, risk are initially estimated (roughly). During this phase a feasibility study (or business case) of the project is created – a description of the reasons and justification of the project with listed the benefits that the project is expected to bring.

2. The objective of the next phase – planning – is to transform the approved goals, objectives and requirements of the project into an execution plan. In this phase, a detailed project budgeting is carried out, after determining its purpose, scope, schedule, project team risks. All detailed project plans (concerning schedule, risk, communication, quality, team, work breakdown structure etc.) are prepared and accepted.

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<sup>2</sup> According to PMBOK and National Competences Baseline there must be at least two phases.



3. In the implementation phase all activities aimed at providing project product are carried out in order to achieve the project goals.

4. Approval of the execution of the project goal determines the transition to the stage of completion, during which stakeholders are reported with the results of the project and an assessment of the project (on the basis of criteria accepted in the initiation and planning phase) is made [Łada, Kozarkiewicz 2010, pp. 62-81; Świętoniowska, Warzybok 2013].

### 3. Risk and uncertainty in projects

The word 'risk' comes from ancient Italian *risicare*, which means 'dare' – this definition suggests that risk taking is associated with the conscious activity of the decision maker, not chance. The creator of the first economic theory of risk defined it as 'the state of the environment, which is objective and correlated with subjective uncertainty, and the impression (or illusion) of randomness is only the result of the imperfections of human knowledge of the objective laws that rule the outside world' [Willet 1901]. The concept of risk is often associated with the concept of uncertainty – if the event cannot be described using probability theory, and therefore cannot determine the associated risks [Nahotko 2001, p. 47]. Meanwhile, only the risk is measurable, while uncertainty is immeasurable [Knight 1921]. For the purposes of this article an assumption was made that we face the risk when uncertainty transforms into the likelihood (or not likelihood) of certain consequences – risk as opposed to the uncertainty is characterized by the possibility of early identification, measurement, and the ability to manage it [Dudziak, Szpakowska 2013, p. 120] so it is possible to link risk with the probability of occurrence (or not occurrence) specific effects that can be expressed as probabilities [Sierpińska, Jachna 2006, p. 387]. In literature the view can be found that the distinction between risk and uncertainty in research and development project is in practice not needed and only obscures the issue of decision-making [Kisielnicki 2013, p. 88].

Because of the interdisciplinary nature of the concept of risk, as there is no uniform definition of risk, so its classification depends on the particular field [Korzeniowski 2002, pp. 90-128; Pritchard 2002, pp. 1-53], although there are also views that the risk must be taken into account, but it should not be grouped but be broken down into the smallest category, because the risk should be analyzed as low as possible. With the practical application of this theory a certain centering seems reasonable to protect the company against excessive fragmentation of risk, which can make it difficult or even impossible to measure and working out procedures for the management in this area [Borkowski 2008, pp. 74-75].

From the point of view of risk management in the context of the creation of reserves, the following risk classes might be taken [Nahotko 2001, pp. 36-66]:

- normal risk – that needs to be taken and which lies in the nature of economic processes,

- acceptable risk – that is affordable,
- unacceptable risk – the risk that the company cannot afford,
- necessary risk – the risk that cannot be not undertaken.

From the viewpoint of effect, there are two approaches to risk: negative and positive. The first risk is the possibility of incurring losses, which accentuates its negative effects and should be treated as a threat (an expression of protection against this type of risk include the creation of reserves). In the second approach, the risk is the possibility of the occurring effect incompatible with expectations. Therefore, the risk in certain situations is a chance and in some, risk [Jajuga 1996, p. 99].

It should be emphasized that the degree of uncertainty and risk is highest when making strategic decisions for companies operating in unstable environments or when the effect of measures taken cannot be precisely determined – this situation occurs in the case of research and development projects.

The main definition of research and development activity in Poland is assumed for statistical definition by the Central Statistical Office, according to which R&D is ‘systematically conducted creative work, carried out in order to increase knowledge, including knowledge of man, culture and society, and also to find new opportunities for the application of discovered knowledge’ [Główny Urząd Statystyczny 2014]. It includes three types of research:

- Basic research – experimental or theoretical work undertaken primarily to acquire new knowledge, without any direct commercial use.
- Applied research – the planned research or critical investigation aimed at the acquisition of new knowledge and skills for developing new products, processes or services or bringing about a significant improvement in existing products, processes or services.
- Experimental development – the acquiring, combining, shaping and using existing knowledge and skills in science, technology, and business and other relevant knowledge and skills in order to develop new or improved products, processes or services. They may also include, for example, the development of prototypes, demonstrations, development of pilot projects, testing and validation of new or improved products, processes or services [EC Regulation No. 651/2014, pp. 114-115; Ustawa z dnia 30 kwietnia 2010 r. ...]<sup>3</sup>.

#### 4. Risk management in R&D projects

Risk in research and development projects (and generally, in R&D activity) has a significant impact on the company. Greater uncertainty as to the design and carrying out the project within the accepted plans (the biggest in the case of basic research,

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<sup>3</sup> The division into the types of research is widely used not only by the GUS, but it is also the basis for determining the level of financing for research projects within the Structural Funds.

the smallest in the case of experimental development) requires incurring risk costs (costs that the company would not incur in a world of certainty). These are e.g. the cost of losses related to the termination of the project due to a lack of obtaining satisfactory results, the cost of additional security related to the possibility of loss of liquidity and the cost associated with the wrong resource allocation and project selection.

The first step that should be taken to initiate the process of risk management is the clear and precise indication of the objectives of the project or activity. Only after careful determination of the objective of the project (from the point of view of the stakeholders, mission and strategy of the company the project should be beneficial, feasible and necessary) it is possible to determine the factors and areas of risk for the project. At this stage, the project manager needs to identify carriers of the risk, or develop a catalog of variables that have an impact on the financial results of companies exposed to risk factors [Nowaczyk 2006, p. 285].

Project risk management includes the processes of [Project... 2013, p. 308]:

- planning project risk – defining how to conduct risk management activities for a project,
- risk identification – determining which risks may affect the project and documenting their characteristics (all documents available in the organization might be used in this process, for example the stakeholders analysis, experts opinion, project plans such as quality management plan, communication plan, project team plan, work breakdown structure, project timetables, financial plans etc.),
- performing qualitative risk analysis – the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact,
- performing quantitative risk analysis – to analyze numerically the effect of identified risks on overall project objectives,
- planning risk responses – developing options and action to enhance opportunities and to reduce threats to the project objectives,
- risk controlling – the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks and evaluating risks processes effectiveness throughout the project.

The result of carrying out these activities is the risk management plan. This is developed in the initiation and planning phase of the project (when there are already available details on the timetable, work breakdown structure, requirements, etc.), and is approved (together with other plans) at the end of the planning phase. In the implementation phase, risk control is carried out and (if necessary) changes in the plan are applied. Finally, lessons learned related to the risk management plan shall be transmitted to the organization/program/portfolio management in the phase of completion of the project.

## 5. Risk in project and financial accounting system

Accounting aspects of the measurement, recognition and presentation of risks in the financial accounting system that function in accordance with the regulations of accounting law, must be seen against the recognition of R&D projects in the accounting and financial statements of the company. For accounting purposes for the research and development a clear distinction between basic research, applied research and experimental development, should be made.

Costs of research (basic and applied) directly affect the financial results of companies in the period they are incurred. Experimental development costs might be:

- recognized as expenses in the period they are incurred or,
- they can be activated.

Costs of experimental development are included in the period costs if the work ended with failure, that is, when the objectives were not achieved. If experimental development was completed with success, its costs can be activated.

According to the Accounting Act [Ustawa z dnia 29 września 1994 r. ..., art. 33 ust. 2], the company is not obliged to activate the costs of successful experimental development – it is a right granted to the company [Fedak 2015, p. 66]. If a company has no intention for activation of experimental development costs, the costs of these works are booked as current costs, affecting the financial results of the period they are incurred. In the case of a company's decision to activate experimental development costs, this process takes place in two stages:

1. of preliminary activating in the framework of dynamic accrued costs,
2. of categorizing into intangible assets or of bookkeeping into costs.

The costs of development are recognized on the accrual accounts and periodically reported in the balance sheet as a part of short dynamic accruals.

After completion of the development work that the brought assumed effects, their costs could be classified as intangible assets (after fulfillment of the conditions required for qualifying for the assets). The valuation of "Development costs" was estimated at production cost level (the working of own resources) or in the amount of the actual purchase price (with the subcontractor working), taking into account with possible recoveries and costs covered by the grant. If the work does not bring the desired effect or the success of this work could not be classified as assets – collected development costs under accruals refer to the financial result of the given period.

At every stage of research and development risk was taken. A properly functioning accounting system in enterprises should also have taken the problems associated with the risk. this is done by creating and presenting reserves [Szydełko 2010, p. 103] or doing write-downs.

A risky situation in work of research and development causes problems in accounting when trying to activate development costs. In this case of the research and development costs which are included directly in the expenses of the given period and charged to the financial result of the year, the cost reserves are unfounded. Only if

the obligation to return the subsidy on these tests which do not yield a positive result, it should be considered to set as a reserve for future liabilities in expenses when the probability of the obligation to return them was on the highest level.

At activating costs of developmental works, the problem of reserves to the risk connected with these works is usually occurring at the connection from balance sheet valuation. This applies accumulated cost of this work on the dynamic accrued costs accounts (after step 1) and development ended cost recognized as an asset in the framework of intangible assets (after step 2).

If the costs of unfinished development works at the balance sheet date are included in the dynamic accrued costs, there is in this case a high probability that the work will not bring the expected result in the future with unchanged decisions about their activation, this should, according to the principle of the conservative estimate, effect the write-down charged to costs of the given period. In the next periods, when indeed these works close with failure, into costs it should be deductible only costs of next periods with simultaneous liquidating the write-down and accruals for which they made this write-off. When in the future these works will close with success and the costs of these developmental works will be categorized into intangible assets, this should account for the previously made write-off of the income of the current period. Action of this type will allow correctly to present the cost value of developmental works accounted in the time and the correct amounts of the financial result in financial statements for a few periods. Instead of this action, creating also the capital reserve for this purpose at the division of the profit in the given year is possible, however this solution is not preserving the principle of the conservative estimate.

In the event when it is making the evaluation of costs of finished developmental works as the element of intangible assets, the principles of the balance sheet valuation are in force identical as for other assets, that is including possible write-downs.

## 6. Conclusion

Research and development projects and risk associated with them are a multifaceted problem. The accounting concerns particularly the experimental development projects, because the basic and applied research costs, in accordance with applicable accounting regulations, are recognized as expenses in the period they were incurred, thereby reducing the financial result of the period.

Experimental development costs may be activated on the basis on the enterprise decisions. This initially occurs within the prepayments, and if the effect of this work is satisfactory, prepayments are transferred and recognized as a part of intangible assets. Accounting should recognize the risk primarily for experimental development projects, using the tools in the form of provisions and impairment loss, enabling the creation of the correct picture of the assets, financial position and financial result of enterprises active in the R&D area.

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