**Urszula WNUK**
Institute for Sustainable Technologies – National Research Institute in Radom
urszula.wnuk@itee.radom.pl

# RISK AND ITS MITIGATION IN TECHNOLOGY TRANSFER PROJECTS

**Key words**

Technology transfer, project risk, risk management, risk mitigation.

**Abstract**

Effective execution of technology transfer processes constitutes the foundations of contemporary innovation-based economies. As a result of these processes, novel technological, process and system solutions are brought to the market, which stimulates the development of better consumer-oriented products and services. The transfer of technologies is beneficial to both research organisations commercialising their intellectual property and companies in which research results are implemented. Therefore, the advantages the technology transfer brings to the R&D and business sectors directly contribute to the improved level of a country's innovation performance and competitiveness. However, there are a number of obstacles that can impede the execution of a technology transfer project. These pitfalls are referred to as project risk.

The author analyses the kinds of risk that can occur when carrying out exceptional types of R&D projects, i.e. technology transfer projects, and discusses how these risks can be mitigated.

## Introduction

As in the era of globalisation, knowledge has become increasingly important to national innovation performance and competitiveness, governments, as well as individual companies and research organisations have paid more attention to the importance of processes of transferring its assets to economic practice. Technology transfer has become an increasingly vital success factor for global entities, because it helps individual organisations build and maintain their competitive advantage.

Technology transfer is defined as the movement of know-how, research results and innovations from one organisation to another [1, 2, 3, 4, 5]. The focus of a technology transfer process is the dissemination of information regarding scientific and innovative practice to individual organisations to help them manage the challenges of using that information to create change within their work settings [6], add value to their operations, and therefore boost their competitiveness.

Technology transfer encompasses a complicated process involving the complexity of both technology and interactions between the transferor and the beneficiary originating from many different sources [7, 8, 9]. Technology transfer projects are exceptional R&D projects within which knowledge and experience are translated into material products, which then are transferred into business practice. Therefore, they encompass knowledge transformation and technology transfer processes, which are complex and time-consuming undertakings burdened with a lot of uncertainty concerning their outcomes. This uncertainty of success or the likelihood of failure is defined as risk [10].

When it comes to the analysis of risk in publications on organisation and management, there is no uniform definition of the term. Risk is incorporated into so many different disciplines that it is not surprising that it is defined differently by each one of them. The authors dealing with the complex issue of risk (e.g. Pfeffer [11], Kaplan and Garrick [12], Holton [13], Szumski [14], Nahotko [15], Kaczmarek [16]) usually define risk in terms of probability, uncertainty, threat or even danger. Risk associated with the execution of any project (project risk) is therefore any factor that can interfere with its successful completion. In the case of technology transfer projects, due to their complex nature, these factors can have technical, economic, organisational, social, political, and cultural characters [8, 9].

In this article, the author analyses the different types of risk that both technology transferors and beneficiaries are likely to encounter within the framework of a technology transfer project. She begins with the review of literature concerning risk in technology transfer projects and then lists detailed risk factors on the side of a technology transferor and the beneficiary. This is followed by the discussion on risk management with particular attention

paid to risk mitigation, since, in this paper, the author focuses on the probability of the occurrence of risk, not on its actual materialisation. Subsequently, practical examples of risk mitigation measures applied within technology transfer projects conducted at the Institute for Sustainable Technologies – National Research Institute (ITeE-PIB) in Radom are presented.

For the purpose of this paper, risk is defined in terms of the likelihood of the materialisation of situations, which can negatively influence the success of a technology transfer project, not in terms of the very occurrence of such an event. The author, therefore, distinguishes between a risk and a problem. For her, risk is the recognition that the problem may occur, and a problem is the materialisation of the risk.

## 1. Risk in technology transfer projects: Literature review

Authors and practitioners active in the field of project management (including technology transfer projects) (e.g. Saad, Cicmil, Greenwood [8], Prywata [17], Jancewicz [18]), define risk as an event, or a set of events, whose occurrence will have a negative impact on the project. This event may lead to severe delays in the execution of a project, increase its costs, or impede the implementation of its outcomes [17, 18]. As far as technology transfer projects from the R&D sector to industry are concerned, risk connected with them primarily concerns the uncertainty as to the results of the research, their market acceptance, and the opportunities for their application in business (industrial) practice. This uncertainty may stem from the scale of the project, the know-how and commitment of the stakeholders, the level of innovativeness of the developed technology, and its character (a mass production, a batch production or a one-off production technology), as well as the complexity of the proposed solution, and therefore the possibility of its multiplication and customisation [19]. In addition, the development of innovative technologies requires large investments, access to modern laboratory infrastructure, and the involvement of qualified personnel. Therefore, the risk in a technology transfer project is related to a number of technical, financial, market, organisational, political, as well as social and cultural factors [8, 9, 20] coming from inside a research organisation (the technology transferor) and the business sector (the beneficiary).

The author presents a detailed review of types of risk accompanying technology transfer projects and list detailed risk factors on the side of the technology transferor and the beneficiary (Table 1).

Table 1. Risk types and factors in technology transfer projects

| Risk type | Risk factors with respect to the type of technology transfer project Stakeholder | |
|---|---|---|
| | **Transferor (R&D unit)** | **Beneficiary (Business)** |
| **Technical** | – "Aging" of technology - decreasing innovativeness and competitiveness of a technology;<br>– Lack of advanced R&D potential and technical infrastructure to further develop the technology, verify it, or conduct certification tests;<br>– Possibility of the occurrence of problems with obtaining the planned technical and performance parameters;<br>– No possibility to use the technology in alternative areas of application;<br>– Solution of a unitary character (one-off production, no possibility of technology's multiplication);<br>– Possibility of the occurrence of unpredicted faults and defects;<br>– High complexity of technology hindering or preventing its customisation;<br>– High complexity of technology delaying the execution of the technology transfer project and hampering its effective practical implementation (alternative technologies may emerge in the meantime);<br>– High complexity of a technology discouraging the end user from its application. | – Insufficient technological capability and capacity (i.e. lack of technical professionals, inappropriate infrastructure preventing the application of the technology in practice (e.g. obsolete technology lines, incompatible software, etc.));<br>– Slow technology capability-building;<br>– Solution of a unitary character (one-off production, no possibility of technology's multiplication);<br>– High complexity of technology hindering or preventing its customisation;<br>– Possibility of occurrence of unpredicted faults and defects. |
| **Financial** | – Cost of developing the technology surpassing provided funds;<br>– Shortage of funds for the execution of the transfer process (too much spent on the technology development and verification phases);<br>– Need for additional costly verification, certification and environmental tests;<br>– Need for additional scientific / technical staff for the development of the technology. | – High cost of technology acquisition and adaptation;<br>– Low rate of return on investment;<br>– Tax rates changeable in time. |

| Risk type | Risk factors with respect to the type of technology transfer project Stakeholder | |
|---|---|---|
| | **Transferor (R&D unit)** | **Beneficiary (Business)** |
| **Market** | – Wrongly assessed market demand or market needs changed during the execution of the project;<br>– No possibility for the technology to compete with technologies existing on the market;<br>– No possibility to compete with the monopoly and the recognized brand of international corporations. | – No or small influence of the acquired technology on the future development of the enterprise;<br>– No or small influence of the acquired technology on the creation of competitive advantage of the enterprise. |
| **Organisational** | – Schedule delays;<br>– Wrong assignment of tasks;<br>– No possibility of finding subcontractors or the need to rely on unprofessional and incompetent subcontractors;<br>– Insufficient people capability (e.g. lack of competence in the field of commercialisation of research results (e.g. lack of skills in negotiations, the application of inappropriate marketing strategies, lack of competence in the field of protection of intellectual property rights, etc.));<br>– Application of inefficient structures and strategies for the management of the technology transfer process; | – Schedule delays;<br>– Difficulty in adapting technology management tools and strategies to rapidly changing technologies;<br>– Insufficient people capability (e.g. lack of knowledge and competencies on how to operate and maintain the technology) |
| **Social/ cultural** | – Communication gap between the R&D and the business sector;<br>– Focus on different priorities. | – Communication gap between the R&D and the business sector;<br>– Focus on different priorities; |
| **Political** | – Changeable regulations;<br>– Bureaucracy. | – Changeable regulations;<br>– Bureaucracy. |

Source: Author based on [19, 20, 21, 22, 23, 24].

## 2. Risk management and mitigation: Literature review

Risk management involves a series of well-defined steps that support better decision-making and contribute to greater insight into risks and their likely impacts [25]. Risk management is the process whereby organisations methodically address the problems associated with the risk that accompanies their activities in such a way that these activities bring lasting benefits [26]. The main steps of risk management are as follows [27]:

– Risk identification,
– Risk assessment,

– Responding to risk, and
– Risk review and reporting.

The subject of proper risk management is the identification of the likelihood of the occurrence of uncertainty or threat and then the undertaking of effective measures when these problems materialise. Therefore, objective of the risk management process is to ensure the maximum benefits in all areas of an organisation's operation.

Risk identification can be carried out by the organisation itself or on its behalf by a team of professionals. At this stage of the risk management process, possible risk factors that can impede future effective execution of the project are identified with the use of qualitative methods (i.e. brainstorming, risk mapping, or comparison of analogies).

Once the core risks associated with a certain activity (e.g. a project) have been identified, the scale or importance of each risk needs to be quantified. This is the scope of the risk assessment stage at which the two following elements are analysed and assessed:

– The likelihood of the risk materialising, and
– The impact if the risk does materialize (the impact of the problem occurring during the execution of the project).

Risk assessment is therefore a process in which risk is assessed in respect to the combination of the likelihood and the impact of its occurrence. By bridging the likelihood and the impact of risk occurrence, organisations can assess the importance of risks prior to any mitigating actions. Understanding the likelihood of the risk materialising is key to assessing its relative importance. A risk may have a huge potential impact, but if the likelihood of it happening is very small, it may not be worth devoting much effort to mitigating the risk [25]. However, if the likelihood of risk materialising and its impact are high (i.e. the importance of risk is crucial for the effective execution of the undertaken action), the benefits that may be derived from its reduction through enhanced risk mitigation procedures increase.

The importance of risk can be assessed with the use of yet another qualitative method – a risk matrix. This is one of the most commonly applied tools in a risk management process. With the use of it, the likelihood and the impact of risk are estimated and then the scores are applied onto the matrix. The scores concerning the importance of risk can have a descriptive form (i.e. low, medium, high, extreme) or be represented by digits (each element, i.e. the likelihood and the impact, is scored on a 1-5 scale and then the two scores are multiplied to arrive at a final 'risk score').

When responding to risk, the organisation decides whether the risk can be tolerated, or whether certain measures to mitigate it, transfer or terminate the activity (e.g. the execution of the project) should be taken.

The stages of identification, risk assessment, and the response to risk must be properly documented so that, in the future, when performing similar activities or executing similar projects, it can be easily checked whether there are changes in the types and intensity of risk and verified whether risk management procedures applied were effective.

For the purpose of this paper, and in accordance with the definition of risk adopted (i.e. risk as the likelihood of the materialisation of uncertainty and threat to the success of a technology transfer project), the author concentrates on the means of risk identification and assessment aimed at risk mitigation in an exceptional type of an R&D project, i.e. a technology transfer project. *Risk mitigation* is defined as a *systematic reduction in the extent of exposure to a risk or/ and the likelihood of its occurrence* [28].

The application of risk management procedures in a technology transfer project helps to identify and eliminate the gaps in the transfer plan and successfully finalise it. However, the success of a technology transfer project does not only depend on stringent risk management procedures. Other success factors encompass clear business processes, including milestones and deliverables, appropriate governance structure with a team of knowledgeable people with roles and responsibilities clearly assigned to them, and effective knowledge and technology management [29]. All these factors help to minimise or eliminate the possibility of the occurrence of risk, or deal with the consequences of its occurrence, and thus ensure the efficiency of a technology transfer project in terms of budget, schedule, and business application.

## 3. Project risk mitigation in practice: Evidence from the Institute for Sustainable Technologies – National Research Institute

In this section, the author discusses risk management procedures applied at the Institute for Sustainable Technologies – National Research Institute (ITeE – PIB) in Radom in the *"Innovative Systems of Technical Support for Sustainable Development of Economy"* Strategic Programme (further referred to as the Strategic Programme) 2010–2014, executed within the Innovative Economy Operational Programme and co-financed from EU structural funds.

The Strategic Programme is divided into 60 individual research tasks executed within four main technological areas of

- The advanced technologies supporting production and maintenance processes;
- The test apparatus and unique technological devices;
- The methods and systems for the utilisation of natural resources; and,
- Diagnostic and safe maintenance systems and a system support area of systems of knowledge transformation, advanced technologies transfer and commercialisation of innovative solutions.

The risk management procedure applied for the Strategic Programme is used at the level of individual research tasks, not the programme as a whole. The procedure enables the identification of risk factors that can impede the effective execution of the tasks and helps to undertake proper measures aimed at their modification or elimination [30]. The steps of the risk management procedure in question include:

- Risk identification,
- Risk quantification,
- Preventive measures,
- Corrective measures, and
- Risk monitoring.

As in the paper the author focuses on the risk understood as the likelihood of the occurrence of an uncertainty or threat to the success of a project, and the examples of risk mitigation through the application of preventive measures (i.e. before the materialisation of a risk) are further discussed based on the aforementioned Strategic Programme.

The subject matter of the Strategic Programme was determined by priorities indicated in the following:

- EU and national strategic documents,
- The national foresight project,
- ITeE – PIB's sectoral foresight project concerning advanced industrial and ecological technologies [31], and
- ITeE – PIB's corporate foresight project [32].

Close coherence with the above listed priorities ensured correspondence of the subject matter of the Strategic Programme with the government R&D policy, market demand, and the global and national trends in technology development. This helped to mitigate the risk of undertaking a technology transfer project in a non-perspective and commercially unattractive domain, and particularly reduce the likelihood of political and market risks.

Prior to the execution of R&D tasks within each of the research tasks encompassed by the Strategic Programme, in-depth market analyses and literature reviews were conducted to indicate the actual market needs, and check the competitors (e.g. verify whether there are competitive solutions on the market and what their performance and utility parameters are). These measures contributed to the mitigation of the probability of the materialisation of market risks.

Prior to their transfer, all technologies, systems and innovative devices developed within the abovementioned Strategic Programme undergo a rigid and in-depth assessment to prove that they can be turned into manufacturable, marketable, and profitable end products [33]. The assessment is particularly focused on three aspects of a new technology: the level of its implementation maturity [34], its commercial potential [35], and the level of its innovativeness

[36]. The assessments are carried out using a model complex technology assessment system [37], which is used to assess all technologies at the consecutive stages of their development process. The system allows comparative analyses of the results of individual assessments, all of which support strategic decisions concerning the future of a given technology, help determine the opportunities and constraints to its industrial application, give feedback on whether further development of a given solution should be pursued or abandoned and the commercialisation process initiated or not, and support decisions concerning the selection of preferred commercial and non-commercial knowledge and technology transfer mechanisms. The assessments of the implementation maturity, the commercial potential, and the level of the innovativeness of technologies developed in the Strategic Programme are accompanied by their thorough cost-effectiveness analysis (the solutions are valuated and the costs of R&D tasks and the productions costs are estimated). In the stringent assessment of all material results of the Strategic Programme, internal and external experts and specialists in the technological areas covered by the programme are employed as well as the representatives of the business sector, which helps to mitigate the materialisation of technical risks and also financial and market risks in particular.

Social and cultural risk (i.e. the risk of communication gap between the Institute and the business sector) are reduced through the implementation of the Technological Platform [38]. The main aim of the Platform is to disseminate information about ITeE – PIB's R&D activity, the undertaken implementation tasks, innovative projects, and new technologies, particularly those developed within the Strategic Programme. The operation of the platform facilitates cooperation and networking between the R&D and the business sector, stimulates the flow and exchange of knowledge and experience, thereby minimising the gap between the two environments and mitigating the risk of lack of understanding between them. Additionally, the Platform facilitates the commercialisation of research results, because activities are conducted within it that are associated with the promotion of innovative product and process solutions, the creation of effective structures and mechanisms of the transfer of innovations, and the assessment of the effectiveness of these structures.

## Conclusions

Technology transfer projects are a unique kind of R&D projects. They are dynamic undertakings shaped by interactions between numerous sources (e.g. with competing R&D centres, authorities, or business representatives). Their complexity means that they convey a great deal of uncertainty, because their success is concerned and burdened with the likelihood of the occurrence of numerous risks, i.e. risks of a technical, financial, market, political, or social

nature. In order to minimise the likelihood of the occurrence of these risks, several steps aimed at the identification and assessment of risk need to be undertaken. In the article, the author discussed the means used to mitigate the probability of risk materialisation. The article also presents a literature review of the standard and original measures that are practically utilised at the Institute for Sustainable Technologies – National Research Institute for the reduction of the likelihood of problems in technology transfer projects executed by this R&D institution.

**References**

1. Rogers E.M. (ed.): Inducing technological change for economic growth and development. East Lansing, MI, Michigan University Press, 1972.
2. Johnson S.D., Gatz E.F., Hicks D.: Expanding the Content Base of Technology Education: Technology Transfer as a Topic of Study, Journal of Technology Education Vol. 8 No. 2, Spring 1997.
3. Matusiak K.B. (red.): Innowacje i transfer technologii. Słownik pojęć, wydanie III zaktualizowane, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2011, pp. 301–303.
4. Poznańska K., Łobejko S., Brdulak J., Chinowska K.: Systemy wspierania innowacji i transferu technologii w krajach UE i w Polsce, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2003, pp. 42.
5. Mazurkiewicz A.: Modelowanie transformacji wiedzy do praktyki w budowie i eksploatacji maszyn, Studia i Rozprawy, Instytut Technologii Eksploatacji, Radom – Poznań 1999.
6. Backer T.E.: The failure of success: challenges of disseminating effective substance abuse prevention Programmes, Journal of Community Psychology, Vol. 28, No. 3, (2000) 363–373, pp. 364.
7. Lee A.H.I., Wang W-M., Lin T-Y.: An evaluation framework for technology transfer of new equipment in high technology industry, Technological Forecasting and Social Change 77(2010) 135–150, pp. 135.
8. Saad M., Cicmil S., Greenwood M.: Technology transfer projects in developing countries – furthering the Project Management perspectives, International Journal of Project Management 20 (2002) 617–625, pp. 625.
9. Gudek A.: Czy warto podejmować ryzyko związane z prowadzeniem projektów badawczych, 2013, http://laboratoria.net/pl/artykul/zarzadzanie_projektami [accessed: 31.01.2014].
10. Dubisz S. (ed.): Słownik języka polskiego, Wydawnictwo PWN, Warszawa 2006, pp. 1108.
11. Pfeffer I.: Insurance and Economic Theory, Illinois, 1956.
12. Kaplan S. and Garrick B.J.: On the Quantitative Definition of Risk, Risk Analysis, Vol. 1, No. 1 (1981) 11–27, http://josiah.berkeley.edu/2007Fall/NE275/CourseReader/3.pdf [accessed: 08.01.2014].

13. Holton G.A.: Defining Risk, Financial Analysts Journal, 60 (6) (2004) pp. 19–25.
14. Szumski W.: Ryzyko i świadomość ryzyka, [in:] L. Zacher, A. Kiepas (eds.), Społeczeństwo a ryzyko, Fundacja Edukacyjna Transformacje w Warszawie, Centrum Studiów nad Człowiekiem i Środowiskiem Uniwersytetu Śląskiego, Warszawa – Katowice 1994.
15. Nahotko S.: Ryzyko ekonomiczne w działalności gospodarczej, Oficyna Wydawnicza Ośrodka Postępu Organizacyjnego, Bydgoszcz 2001.
16. Kaczmarek T.: Ryzyko i zarządzanie ryzykiem. Ujęcie interdyscyplinarne, Wydawnictwo Diffin, Warszawa 2005.
17. Prywata M.: Zarządzanie ryzykiem w małych projektach, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa 2010, pp. 4.
18. Jancewicz K., Jancewicz P.: Analiza ryzyka w projektach, Europe Direct Białystok, 2012, http://www.europe-direct.bialystok.pl/pdf/Analiza_ryzyka_w_projektach.pdf [accessed 02.02.2014].
19. Mazurkiewicz A., Poteralska B.: Problems of Development and Practical Implementation of Innovative Technological Solutions in Economy, 6th ISPIM Innovation Symposium – Innovation in the Asian Century, Melbourne, Australia, 8–11.12.2013.
20. Wnuk U.: Legal Regulations and Governmental Initiatives Fostering Research Results Commercialistion, Maintenance Problems 3/2010.
21. Ramanathan K.: An Overview of Technology Transfer and Technology Transfer Models, [in] Rmanathan K., Jacobs K., (eds.), Technology Transfer and Small & Medium Enterprises in Developing Countries, 2011.
22. Jarus T.: Nie ma ryzyka, nie ma innowacji, artykuły analityczne Portalu Innowacji, 2011, http://www.pi.gov.pl/parp/chapter_86196.asp?soid=A805BEAED1F24A8890FCF66E4AE57D13, [accessed: 16.12.2013].
23. Sushil, Strategic Risks in Planning and Implementing Technology Transfer Projects, Department of Management Studies, Indian Institute of Technology, New Delhi, www.business-asia.net/Pdf_Pages/Guidebook%20on%20Technology%20Transfer%20Mechanisms/Strategic%20Risks.pdf, [accessed: 16.12.2013].
24. Klajbor T., Koszałka J.: Poradnik dla przedsiębiorców – praktyczny transfer technologii w firmach, MSODI – Mazowiecka Sieć Innowacji, Warszawa, styczeń 2013.
25. National Audit Office, Good practice contract management framework, December 2008, http://www.nao.org.uk/wp-content/uploads/2013/03/Good_practice_contract_management_framework.pdf [accessed 31.01.2014].
26. Standard zarządzania ryzykiem, Federation of European Risk Management Associations (FERMA), 2003, http://www.theirm.org/publications/documents/rm_standard_polish_15_11_04.pdf [accessed 17.12.2013].
27. HM Treasury, The Orange Book Management of Risk – Principles and Concepts, October 2004.

28. http://www.businessdictionary.com [accessed 03.02.2014].
29. Pohlscheidt M., Corrales M., Charanyia S., Fallon E., Bruch M., Jenzsch M., Sieblist C.: Avoiding Pitfalls during Technology Transfer of Cell Culture Manufacturing Processes in the Pharmaceutical Industry – Mitigating Risk and Optimising Performance, Pharmaceutical Outsourcing™ – The Journal of Pharmaceutical & Biopharmaceutical Contract Services (online), March 2013 [accessed: 29.01.2014].
30. Łopacińska L.: Raport z realizacji zadania badawczego I.4.1. pt.: „Modelowe procedury zarządzania oraz oceny efektywności realizacji strategicznych programów badawczych w obszarze zrównoważonego rozwoju gospodarki" nr RC/4/I.4.1/PS.
31. Mazurkiewicz, A.: (ed.), Techniczne wspomaganie zrównoważonego rozwoju. Kierunki badawcze i aplikacyjne. ITeE – PIB, Radom, 2011.
32. Sacio-Szymanska, A., Mazurkiewicz, A., Poteralska, B.: Setting priority R&D directions for the strategic research institutes, [in]: Huisingh K.R.E, Conn S., Torkkeli M., Bitran I (eds.) XXII ISPIM Conference. Sustainability in Innovation: Innovation Management Challenges, Hamburg, Germany, 2011.
33. Wnuk U., Łopacińska L.: Complex Technology Assessment as a Determinant for Marketing Activities in Innovation Commercialisation, Proceedings of the 8th European Conference on Innovation and Entrepreneurship, Academic Publishing Limited, Reading, UK, 2013.
34. Mazurkiewicz, A., Karsznia, W., Giesko, T., Belina, B.: Metodyka oceny stopnia dojrzałości wdrożeniowej innowacji technicznych, Problemy Eksploatacji, 1/2010, ITeE – PIB, Radom.
35. Belina B., Giesko T., Łopacińska L., Walasik M.: Dobór kryteriów w metodzie oceny potencjału komercyjnego rozwiązań innowacyjnych, Problemy Eksploatacji 2/2013.
36. Belina B., Łopacińska L.: Setting of Criteria in the Innovativeness Level Assessment Method of Technological Solutions (in print).
37. Mazurkiewicz A., Poteralska B.: System of a Complex Assessment of Technological Innovative Solutions, Maintenance Problems 4/2012, ITeE – PIB, Radom, 2012.
38. Walasik M.: Model technology platform for cooperation of research centres with the business sector, Transactions of the Institute of Aviation number 227, Warsaw 2012.

**Ryzyko i jego ograniczanie w projektach transferu technologii**

**Słowa kluczowe:**

Transfer technologii, ryzyko projektowe, zarządzanie ryzykiem, ograniczanie ryzyka.

**Streszczenie**

Skuteczna realizacja procesów transferu technologii stanowi podwaliny współczesnej gospodarki opartej na wiedzy. W rezultacie transferu technologii rynek zasilany jest innowacyjnymi rozwiązaniami technologicznymi, systemowymi i procesowymi, które stymulują rozwój lepszych produktów i usług odpowiadającym faktycznym zapotrzebowaniom konsumentów. Transfer technologii przynosi korzyści zarówno jednostkom badawczym komercjalizującym wyniki swych badań, jak i przedsiębiorcom, którzy wdrażają rozwiązania innowacyjne i tym samym odgrywa kluczową rolę w kreowaniu innowacyjności gospodarki i podnoszeniu poziomu jej konkurencyjności. Jednakże istnieje wiele przeszkód, które mogą negatywnie wpłynąć na efektywność prac podejmowanych w ramach projektów transferu technologii i tym samym na końcowy sukces tego typu przedsięwzięć. Przeszkody te określane są mianem ryzyka projektowego.

W artykule autorzy dokonują analizy rodzajów ryzyka, które może wystąpić podczas realizacji specyficznych projektów badawczych, tj. projektów transferu technologii, i przedstawiają sposoby jego ograniczenia.