SILESIAN UNIVERSITY OF TECHNOLOGY PUBLISHING HOUSE

SCIENTIFIC PAPERS OF SILESIAN UNIVERSITY OF TECHNOLOGY 2025
ORGANIZATION AND MANAGEMENT SERIES NO. 215

BARRIERS IN ACHIEVING PROJECT VALUE IN RESEARCH AND DEVELOPMENT PROJECTS AT UNIVERSITIES

Oksana BEZGIN[1], Dorota KUCHTA[2*]

[1] Faculty of Management, Wroclaw University of Science and Technology; oksana.bezgin@pwr.edu.pl
[2] Faculty of Management, Wroclaw University of Science and Technology; dorota.kuchta@pwr.edu.pl, ORCID: 0000-0002-9747-0759
* Correspondence author

Purpose: The primary aim of this article is to identify barriers to managing R&D projects conducted at universities, based on literature and case studies. Additionally, the paper aims to define the specificity of the concept of barriers in managing R&D projects conducted at universities in the context of the concepts of risks and uncertainties and to propose the fundamentals for barrier management in R&D projects conducted at universities.
Design/methodology/approach: A literature review and a case study were used to define and identify barriers in managing R&D projects conducted at universities. Conceptual analysis was applied to propose a system for managing the barriers.
Findings: Barriers are a concept worth analysing separately from that of risk and uncertainty, as they represent a fixed feature of R&D projects and their environment. The management of barriers is primarily future-oriented and is based on a learning process. At the same time, it can bring immediate benefits to the projects currently being implemented. This system should be embedded within a university-wide project management system.
Research limitations/implications: The findings described in the paper require case studies of practical application, through which the list of barriers and the corresponding immediate and future measures can be completed.
Originality/value: The targeted audience of this paper includes individuals involved in the management of R&D projects at universities, whether as project managers, project team members, university division managers, or employees of project funding institutions. The paper draws their attention to features of projects and their environment which, being of a fixed nature, present constant obstacles to achieving project success. It emphasises that steps should be taken to gradually remove these barriers.
Keywords: project value, project barrier, research project.
Category of the paper: research paper.

1. Introduction

Research and development (R&D) projects are inherently associated with risks, uncertainties, and barriers, which often manifest as threats (Parys, 2012), preventing the achievement of the value sought by project stakeholders. Today, it is widely accepted that the success of any project is tied to achieving the value sought by its stakeholders (Kerzner, 2017).

Risks and uncertainties in projects (defined in various ways), including R&D projects, are frequently analyzed (e.g. Klaus-Rosińska, 2019). However, the concept of barriers, which is indeed related to risks and uncertainties but is not synonymous with them, can offer new insights into the management of R&D projects and is less frequently a subject of scientific research. In R&D projects, barriers are closely linked to the project lifecycle, and the risk of their occurrence is typically associated with a specific timeframe during which the project is implemented (Szyjewski, 2004). Due to the complexity and characteristics of R&D projects, these barriers can be highly diverse and often arise unexpectedly during different phases of the project (Morris et al., 1991). To minimize the impact of these unforeseen failures, it is essential to plan corrective actions and select appropriate tools to support the process of overcoming encountered barriers (Duncan et al., 1983). The existence of barriers should not be viewed as obstacles that prevent project implementation but rather as a foundation for developing actions to address them effectively. Moreover, they can serve as potential sources for increasing the value generated by R&D projects.

The primary aim of this article is to identify barriers in managing R&D projects conducted at universities, based on literature and case studies. The secondary objectives are as follows:

- To define the specificity of the concept of barriers in managing R&D projects conducted at universities in the context of the concepts of risks and uncertainties.
- To propose the fundamentals for barrier management in R&D projects conducted at universities.

The achievement of these objectives is intended to serve the general purpose of maximizing the value delivered by R&D projects conducted at universities.

The structure of the article is as follows: In Section 2, we present the concept of barriers in project management. In Section 3, we discuss the issue of values sought to be attained in R&D projects implemented at universities, noting that without achieving the desired values, the projects will not be considered successful. In Section 4, we identify barriers to R&D projects conducted at universities, and in Section 5, we propose a concept for the management of R&D project barriers. The paper concludes with some final remarks.

2. The Concept of Barriers in Project Management

Let us begin by comparing the concepts of risk and barrier in the context of project management.

According to the *Polish Language Dictionary* (https://sjp.pwn.pl/), risk is defined as "the possibility that something will fail; also: an undertaking with uncertain outcomes" and "taking on a specific danger". Risk in a project is defined as the possibility of undesirable results or failure to achieve set goals, which may disrupt the course of the project (Smith, Merritt, 2002).

A barrier, on the other hand, is defined by the *Polish Language Dictionary* (https://sjp.pwn.pl/) as "a natural obstacle that hinders or prevents movement" and "a thing that hinders the occurrence of a phenomenon or situation". In the context of project management, barriers are defined in the literature as obstacles that prevent the occurrence or execution of a specific group of tasks within a given undertaking (Liebert, Trzeciak, 2016).

Based on a synthesis of the literature (Smith, Merritt, 2002, Kerzner, 2017), a definition of barriers tailored to the general understanding of project management and the needs of R&D projects can be proposed:

A barrier in a project is a condition or characteristic, existing at the time of project analysis and considered permanent, that pertains to the project or its environment, or a set of such conditions or characteristics. These factors may hinder or prevent the achievement of project objectives by causing delays, increasing costs, limiting resources, or negatively affecting the quality of outcomes. Barriers can be internal (e.g., lack of team competencies, insufficient planning) or external (e.g., changes in legal regulations, unforeseen events). In other words, a barrier may trigger a risk of not meeting project objectives. In this sense, a barrier is a source or cause of risk, though not every source or cause of risk qualifies as a barrier, as a barrier is characterized by its permanence and is an inherent feature of the project or its environment. A barrier ceases to be a source of risk once it is removed. Similarly, mitigating a barrier will positively influence the attributes of the risk it generates.

Bond and Houston (2013) identify three main types of barriers to innovation projects, which are also significant in the context of R&D projects:

1. Strategic-structural barriers, related to regulations and bureaucracy.
2. Technological-market barriers, stemming from technical limitations and market demands.
3. Socio-cultural barriers, associated with resistance to change and cultural differences.

Some researches (Grusza, Trocki, 2013) add that barriers can be categorized as internal or external. Internal barriers include organizational and project-specific issues, such as a lack of resources or inadequate management procedures. External barriers, whether closer to the project (e.g., stakeholder relations) or more distant (e.g., legal or economic environments), also significantly impact project progress.

Various barriers exist in new product development projects, arising from both internal company resources and external relationships (Liebert, Trzeciak, 2016). Research in different countries, such as Brazil (Feldens et al., 2012), Australia (Kotey, Sorensen, 2014), and Spain (Madrid-Guijarro et al., 2009), highlights severe financial constraints and insufficient intellectual capital as key obstacles in new product development. Additional challenges, such as corruption, lack of transparency (Feldens et al., 2012; Lekovic, 2013), improper resource allocation, or infrequent product updates (Engberg et al., 2015), further hinder R&D activities. Relationships with the company's environment, including suppliers and partners in strategic alliances, often lead to conflicts that can result in project abandonment (Athaide et al., 2011; Chin, Lam, 2004).

Communication barriers play a significant role in the idea selection process and project execution. These issues include difficulties in employee communication (Felekoglu et al., 2013; Lechler, Thomas, 2015; Sojkin, 2003), lack of specialized project teams (Gerwin, Barrowman, 2002; Sandmeier, 2008), and insufficient project manager competencies (Badir et al., 2012; Bonner et al., 2002; Nauman et al., 2010). Additionally, a lack of trust and differing perceptions of requirements for new products also pose significant challenges (Lynch et al., 2014).

3. Values associated with research and development projects

Research and development projects conducted at universities, like all projects, aim to deliver value to stakeholders. However, both the stakeholders of such projects and the values they expect are closely tied to the nature of these projects. These values are outlined in Table 1.

An R&D project will be deemed successful by stakeholders to the extent that the desired values have been achieved. Barriers are obstacles of a permanent nature that impede the attainment of these values. Therefore, it is essential to identify barriers in relation to these values and implement measures to manage them effectively.

Table 1.
Values desired to be achieved in research and development projects conducted at universities

Types of value			
Material	**Non-material**		
	Professional	**Psychological**	**Social**
Compensation from the project, functional remuneration for managing the project, profit (or indirect profit) from the sale (or leasing) of new technology, additional remuneration for employees, salary bonuses, bonuses for employees, additional remuneration for employees from the project, acquisition of new research equipment, profits from leasing research equipment, indirect revenues, profit (or indirect profit) from the implementation of new technology, increase in base salary, awards, increase in internal funding for the unit, increase in external funding for the unit, revenue from the sale of new technology, revenue from cost reductions or simplification of production processes, increase in the total value of the enterprise.	Gaining professional experience through performing managerial functions, improving the qualifications of one's employees, affiliation with published scientific articles, gaining professional experience through publishing scientific papers, career advancement, obtaining an academic title, improving the qualifications of one's employees, achieving a better result in categorization, creating opportunities for the development and dissemination of new technology (spin-off), creating opportunities for the development and dissemination of new technology (spin-out).	Gaining new experiences, enriching skills and personal development, enhancing employee skills, establishing new business relationships, building the brand of products or services, social advancement, prestige, recognition, prestige for the unit, gaining new experiences, prestige for enterprises, increasing enterprise innovation, higher market position.	Enabling the research team to fulfill their professional aspirations, creating the project's goal as a response to societal or market needs, shaping intellectual capital, providing public access to scientific publications, making new technology available as a response to societal or market needs, indirect participation in creating opportunities for new knowledge, improving quality of life, simplifying production processes, indirect participation in creating opportunities for new knowledge, indirect participation in improving quality of life, simplifying production processes.

Source: own elaboration based on Eckes-Kondak, 2021.

4. Barriers in research and development projects conducted at universities

4.1. Barriers identified in the literature

Research and development projects carried out at universities encounter numerous barriers that can limit the maximization of their value. It is important for these barriers to be viewed multidimensionally, and their minimization should be a priority for both the project manager and other stakeholders. The active involvement of all interested parties during the project planning stage allows for better preparation to address barriers in the later phases of the endeavor.

According to Eckes-Kondak (2021), considering the specifics of research and development projects at universities, the following barriers to maximizing their value can identified:

A. improperly defined project goals,
B. lack of a realistic project plan, including scope, timelines, and budget,
C. insufficient resource base,
D. inadequate competence and experience of the project manager,
E. insufficient skills and misalignment of the project execution team,
F. improper or limited communication,
G. lack of or inappropriate use of project management methodologies,
H. complex administrative structure and prolonged procedures,
I. ineffective collaboration with stakeholders and failure to consider their expectations in the project.

The phenomena or circumstances listed above will be considered barriers only if they are of a permanent nature. For instance, ineffective collaboration with stakeholders must have persisted over a significant period despite efforts made to improve it. Each of the listed barriers significantly impacts the maximization of the value generated by research and development projects. Managing these barriers requires a comprehensive approach that includes planning, monitoring, and collaboration with stakeholders. Early identification of these barriers and appropriate responses to them can significantly increase the chances of project success and the maximization of its value.

4.2. Barriers identified in the case study

Case study description

The case study pertains to an R&D project conducted at one of the largest Polish universities between 2009 and 2011. The objective of the project was to develop a concept for a costing system tailored to the university's needs. The problem intended to be partially addressed through the project was that the costs associated with all university activities—teaching, research, and administration—and all cost objects, such as students, employees, courses, and projects, were calculated in a manner that did not accurately reflect the actual utilisation of financial and material resources.

The proposed concept was based on the Activity-Based Costing (ABC) approach, which measures the resource usage for each activity individually, ensuring that the resulting costs of activities and cost objects are more closely aligned with reality. This approach necessitates a significant amount of detailed information regarding how individual activities are performed, the resources consumed, and the time spent on them. The design of such a system could not succeed without the active involvement of all university employees across all departments. It is worth emphasising that interviews and thorough documentation reviews were conducted,

requiring complete transparency and the potential exposure of hidden inefficiencies in the current cost calculation system.

Regrettably, the project was only partially successful. The primary reason for this was the lack of willingness among employees to collaborate and disclose information. They were not motivated to dedicate time to providing the necessary data and were apprehensive about revealing details of the existing costing systems, which they perceived to be far from ideal.

Case study results

In hindsight, barriers inherent to the project were identified in the case study in a post factum analysis, and are presented in Table 2.

Table 2.
Barriers identified in the case study

Id	Barriers	Project implementation stages
1	Lack of tools for rewarding/motivating the project team	Stage 4: Implementation, control, and completion of the research project
2	Lack of clear rules/recommendations for project management methods	All stages
3	Insufficient informational support from administration	All stages
4	Researchers are difficult-to-manage employees (individualists)	Stage 4: Implementation, control, and completion of the research project
5	Lack of procedures for hiring members for the project team	Stage 2: Approval and initiation of the research project
6	Overburdening project managers with administrative tasks	All stages
7	Lack of project management training for project managers	All stages
8	Inability to fully plan research (results are uncertain)	Stage 1: Initiation and planning of the research project
9	Lack of knowledge of project management methods or techniques	All stages
10	Administrative resistance due to concerns about greater/new responsibilities	Stage 2: Approval and initiation of the research project. Stage 4: Implementation, control, and completion of the research project
11	Resistance to sharing data	Stages 2, 3, 4
12	Ineffective communication with the administration of the organization implementing the project	All stages
13	Requirement for overly detailed preparation of project documentation	Stage 1, sub-stage: Preparation of the project proposal
14	Inability (funding institutions do not allow this) to introduce corrections to financing applications	Stage 2: Approval and initiation of the research project. Sub-stage: Approval
15	Failure to provide exemptions from other duties for the project manager and/or project team members	Stage 4: Implementation, control, and completion of the research project. Sub-stage: Project implementation
16	Lack of predisposition of managers to lead project teams (they are researchers, not management specialists)	All stages
17	Lack of or insufficient procedures for monitoring and controlling results during project implementation	Stage 4: Implementation, control, and completion of the research project. Sub-stage: Monitoring and verification

Source: Yakivets, 2022

The occurrence of specific problems is closely related to the lifecycle of a research and development project. The risk of encountering a particular problem is associated with a specific timeframe during which the project is being implemented. However, it should be emphasized that, due to the nature of research and development projects, these problems are highly diverse and may arise unexpectedly and randomly at different points in time.

In summary, managing the barriers and problems encountered during the implementation of a research and development project is one of the key elements in generating the value of such projects at universities. Early identification of barriers, problems, and difficulties in a project not only minimizes their undesirable impact on the project and its success but also allows for the identification of unforeseen sources of value generation within the research and development project. In the next section, the initial idea of a system of barriers management in R&D projects implemented ate universities will be sketched.

5. Managing barriers to achieve values in research and development projects conducted at higher education institutions

To minimize value losses resulting from emerging problems, the key task of the project manager is to structure the approach to managing these uncertainties by implementing risk management. The foundation of this process involves identifying project barriers, evaluating them, planning potential responses in case of their occurrence, and controlling corrective actions (Smith, Merritt, 2002). Early identification of barriers in the initial phases of the project allows for their monitoring and control throughout the project lifecycle (Wang et al., 2010). This enables the planning of appropriate responses that help minimize the effects of project uncertainties and increase the project's value.

In Table 3, responses to the barriers identified in the previous section are proposed. All responses have been developed under the assumption that we are addressing a barrier—a permanent characteristic of the project or its environment that cannot be quickly resolved, for instance, by replacing one or two team members or by suggesting the use of Excel for project management. Letters in the ID column refer to the barriers identified based on the literature, while numbers correspond to those identified in the case study.

Table 3.
Barriers in R&D projects implemented at universities and responses to them

Id	Immediate responses	Responses for the future
A	Modifying the phrasing of the goal for the purposes of internal project management	Proposal for training programmes for research and administrative staff
B	Adjusting the plan within feasible limits to align with the needs of internal project management	Proposal for training programmes for research and administrative staff
C, H, 5	none	Proposal submitted to senior management to address this issue in the future
D, E, G, 9, 16	Minimum competencies quick course	Proposal for training programmes for research and administrative staff
F, H, 10, 11, 12	Identifying supportive individuals through personal connections	Proposal for training programmes or recruitment policies for administrative staff to foster a change in mentality
1	Conducting individual conversations with team members	Proposal submitted to senior management to address this issue in the future
2	Implementing several minimal recommendations	Proposal submitted to senior management to address this issue in the future
3	Identifying supportive individuals through personal connections	Proposal of trainings or recruitment rules for administrative staff to change their mentaility
4	Conducting individual conversations with team members	Proposal for training programmes or recruitment policies for research staff to foster a change in mentality
6, 15	Making an attempt to minimise the administrative or other workload	Proposal submitted to senior management to address this issue in the future
7	none	Proposal for training programmes for research and administrative staff
8	Applying elements of modern uncertainty management methods	Proposal submitted to senior management to implement contemporary uncertainty management approaches.
13	Selecting an individual with the appropriate competencies and mindset	Proposal submitted to the programme owner regarding a reduction in documentation
14	none	Proposal submitted to the programme owner regarding a reduction in documentation
17	Introducing minimum procedures	Proposal submitted to senior management to address this issue in the future

We observe that barriers often necessitate changes in the system or environment that can only be implemented in the future and by departments, groups, or organisations outside the project team. These changes may be challenging or even nearly impossible to execute, but effective barrier management requires long-term planning and efforts to address systemic or inherent issues. Only through such an approach to barrier management can future university projects become significantly less risky.

For each barrier identified in a R&D project implemented at the university, we therefore propose the following steps:

1) To identify possibilities for immediate implementation.
2) To identify steps for the future, and for each such step to identify:
   a) the owner of the change,
   b) the degree of feasibility,

c) the time horizon within which the change might be implemented,
d) the stakeholders (both supportive and obstructive) associated with the change.

Each university should maintain a record of barrier management proposals arising from each project and utilise this record as input for developing its tactical and strategic decisions.

6. Conclusions

In this paper, we propose addressing barriers that hinder the creation of desired values in R&D projects implemented at universities. Barriers are defined as permanent obstacles or issues whose removal requires time and must be strategically planned for the future. The approach involves using lessons learned from each R&D project at universities to contribute to the stepwise elimination of these barriers. In the long term, this will reduce the risks associated with R&D projects and enhance the benefits they deliver to both the university and society.

A proposal for a barrier management system has been outlined. Naturally, further case studies are required to verify and refine the system to ensure its practical effectiveness.

Without such a system, problems related to R&D projects will not be mitigated but will recur repeatedly. This leads to a waste of money, effort, and enthusiasm, while also diminishing the societal benefits derived from R&D projects. For this reason, we hope that our research will contribute to enhancing the effectiveness of R&D activities at universities.

Acknowledgements

Wroclaw University of Science and Technology, Minigrant for doctoral students, Grant title: Identification of Metrics for Hard-to-Measure Human Factors Negatively Affecting the Implementation of Research Projects, 2024

References

1. Athaide, G., Zhang, J. (2011). The Determinants of Seller-Buyer Interactions during New Product Development in Technology-Based Industrial Markets. *The Journal of Product Innovation Management*, *Vol. 28*.
2. Badir, Y., Büchel, B., Tucci, C. (2012). A conceptual framework of the impact of NPD project team and leader empowerment on communication and performance: An alliance case context. *International Journal of Project Management*, *Vol. 30*.
3. Bond, E.U., Houston, M.B. (2003). Barriers to Matching New Technologies and Market Opportunities in Established Firms. *Journal of Product Innovation Management*, *Vol. 20, Iss. 2*.
4. Bonner, J., Ruekert, W., Walker, O. (2002). Upper management control of new product development projects and project performance. *Journal of Product Innovation Management*, *Vol. 19, Iss. 3*. Elsevier.
5. Chin, K., Lam, P. (2004). Project Factors Influencing Conflict Intensity and Handling Styles in Collaborative NPD. *Creativity and Innovation Management*, *Vol. 13, Iss. 1*.
6. Engberg, R., Altmann, P. (2015). Regulation and Technology Innovation: A Comparison of Stated and Formal Regulatory Barriers throughout the Technology Innovation Process. *Journal of Technology Management and Innovation*, *Vol. 10, Iss. 3*.
7. Feldens, M., Maccari, E., Garcez, M. (2012). Barriers for production innovation in small and medium technology-based firms in Brazil. *Brazilian Business Review*, *Vol. 9*, *Iss. 3*.
8. Felekoglu, B., Maier, A., Moultrie, J. (2013). Interactions in new product development: How the nature of the NPD process influences interaction between teams and management. *Journal of Engineering and Technology Management*, *Vol. 30*.
9. Gerwin, D., Barrowman, N. (2002). An Evaluation of Research on Integrated Product Development. *Journal Management Science*, *Vol. 48, Iss. 7*.
10. Henard, D., Szymanski, D. (2001). Why some new products are more successful than others. *Journal of Marketing Research*, *Vol. 38, Iss. 3*.
11. Kerzner, H. (2017). *Project Management Metrics, KPIs, and Dashboards*. Wiley.
12. Kotey, B., Sorensen, T. (2014). Barriers to Small Business Innovation in Rural Australia. *Australasian Journal of Regional Studies*, *Vol. 20*.
13. Le Dain, M., Merminod, V. (2014). A knowledge sharing framework for black, grey, and white box supplier configurations in new product development. *Technovation*, *Vol. 34, Iss. 11*. Elsevier.
14. Lechler, T., Thomas, J. (2015). Examining new product development project termination decision quality at the portfolio level: Consequences of dysfunctional executive advocacy. *International Journal of Project Management*, *Vol. 33, Iss. 7*.

15. Leković, B. (2013). Entrepreneurs perception of barriers for development of innovation: Analysis of data from Northern Bačka county. *Megatrend Review*, *Vol. 10*.
16. Liebert, F., Trzeciak, M. (2016). Bariery realizowania projektów rozwoju nowych produktów MSP – część teoretyczna. *Zeszyty Naukowe Politechniki Śląskiej, Organizacja i Zarządzanie*, *nr 1963*, Zabrze, p. 100.
17. Lynch, P., O'Toole, T., Biemans, W. (2014). From conflict to crisis in collaborative NPD. *Journal of Business Research*, *Vol. 67, Iss. 6.* Elsevier.
18. Nauman, S., Mansur, K., Ehsan, N. (2010). Patterns of empowerment and leadership style in project environment. *International Journal of Project Management*, *Vol. 28, Iss. 7*.
19. Parys, T. (2012). Ryzyko w projektach wdrożeniowych zintegrowanych systemów informatycznych – próba klasyfikacji pod kątem barier i działań nim obarczonych. *Problemy Zarządzania*, *nr 3(38),* p. 42.
20. Pattikawa, L., Verwaal, E., Commandeur, H. (2006). Understanding new product project performance. *European Journal of Marketing*, *Vol. 40*.
21. *Polish Language Dictionary*. Retrieved from: (https://sjp.pwn.pl/), 20.10.2024.
22. Sisodiya, S., Johnson, J. (2014). Resources in NPD: An Investigation of Resource Capabilities. *International Journal of Business and Management*, *Vol. 9, No. 2*.
23. Smith, P.G., Merritt, G.M. (2002). *Proactive Risk Management: Controlling Uncertainty in Product Development*. New York: Productivity Press.
24. Sojkin, B. (2003). *Zarządzanie produktem*. Warszawa: PWE.
25. Takeishi, A. (2001). Bridging inter- and intra-firm boundaries: Management of supplier involvement in automobile product development. *Strategic Management Journal*, *Vol. 22, Iss. 5*.