

BARRIERS TO TECHNOLOGY TRANSFER AND COMMERCIALIZATION OF RESEARCH FINDINGS: CASE STUDY

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Purpose: Effective technology transfer and the commercialization of research results are vital components for bridging the gap between academia and industry. The aim of the work is to identify barriers to technology transfer and commercialization, as well as to assess them in terms of their importance for the both management staff and research workers at the research institute of the Łukasiewicz network.

Design/methodology/approach: This article delves into the realm of technology transfer and commercialization barriers, focusing on a case study conducted within the Łukasiewicz network's research institute. The study not only identifies these barriers but also assesses their significance from the perspectives of both management staff and research workers.

Findings: The study underscores the importance of understanding and addressing these barriers to enhance the efficiency and impact of technology transfer efforts. This investigation classifies the identified barriers into distinct categories, shedding light on potential variations in perception and prioritization between management and research personnel. By comparing and contrasting the viewpoints of these two key stakeholder groups, this study offers a nuanced view of the obstacles that can impede the problems in transformation of research innovations into tangible market solutions.

Originality/value: The study attempting to identify barriers to technology transfer and commercialization from the point of view of the management staff and researchers workers at the Łukasiewicz network's research institute is a new study that has not been conducted before. This proves the originality of the presented work.

Keywords: Commercialization, Barriers, Research institute, Knowledge transfer, Research-to-market transition.

Category of the paper: Case study.

1. Introduction

Innovation is a dynamic and intricate sequence of events. It commences with the exploratory phase, primarily rooted in the expansive realm of Research and Development (R&D) (Akis, 2015; Dziallas, Blind, 2019; Edwards-Schachter, 2018; Grebski, Mazur, 2022; Varadarajan, 2018). This initial phase is further augmented by insights gleaned from market dynamics and the strategic maneuvers of competitors, collectively shaping the innovation commences with a search phase, mainly within the expansive domain of Research and Development (R&D), as well as through the discernment of market signals and competitor behaviors.

Government expenditure on research and development across all the European Union (EU) has shown significant growth (How much money does your government allocate for R&D, 2002). In 2021, total government investments in research and development reached EUR 109.25 billion, accounting for 0.8% of GDP, marking a 6% increase from 2020 and a substantial 35% surge compared to 2011. Among EU member states, Luxembourg (EUR 689 per capita) and Denmark (EUR 530 per capita) lead in research and development investments, while Romania (EUR 19 per capita) and Bulgaria (EUR 24 per capita) allocate the least. Unfortunately, Poland also ranks really low, with a government expenditure of EUR 62 per capita. Only four EU countries exhibit lower investments than Poland, and some nations allocate up to ten times more funds to research and development.

Heightened investments in research and development positively influence economic growth (Minviel, Bouheni, 2022; Pessoa, 2010) and amplify productivity, consequently impacting wage levels. The cultivation of a robust innovation ecosystem is essential in the digital era, as it not only fosters competitive products but also facilitates innovative technologies.

Collaborations between academia and industry drive both competitiveness and quality of life improvements (Nyemba et al., 2021). Central to economic growth and innovation is the commercialization of research results (Slotfeldt-Ellingsen, 2023). This encompasses knowledge and technology transfer, research and development project creation, and collaborations between research institutions and businesses (Clarke, 2016; Madsen et al., 2017), all driving economic advancement. Commercialization involves the transfer of knowledge, ideas, and research outcomes from laboratories to the market, contributing to innovation dissemination (Jagusiak-Kocik, Janasik, 2023). As defined by the National Centre for Research and Development, commercialization encompasses the transfer and sale of research outcomes to the economic and social realm, enriching businesses with technical and organizational expertise. It involves building business models around technologies and new products, shaped by technological and innovative policies. The process generates added value for ideas, research outcomes, technologies, and new products, fostering innovation across economies and industries. Commercialization, like any phenomenon, has both positive and negative facets (Barski et al., 2010; Flisiuk, Gołabek, 2015; Kilian-Kowerko, 2013; Orłowski,

Tylzanowski, Leoński, 2017). While it activates various domains, it can yield specific economic benefits. However, barriers and obstacles can hinder the efficacy of the commercialization process, impeding economic growth and strategy implementation anchored in knowledge dissemination.

In summary, innovation's journey begins with exploration within R&D and the interpretation of market cues, propelling investments in research and development across the EU. Despite progress, barriers to effective commercialization persist, negatively influencing economic development and innovation dissemination.

2. Functionality of the Scientific Research Market

The notably low level of private expenditures on Research and Development (R&D) in Poland underscores the core issue of an underperforming or inadequately functional scientific research market. In economic terms, a market is an amalgamation of voluntary transactions aimed at optimizing income and utility for all participants.

Modelled as such, the scientific research market (Dömeová, 2008; Kalcheva et al., 2018; Liu, Li, 2017) can be schematically presented as follows, encompassing four distinct areas:

1. Supply-side (Generation of Knowledge):

- Inventor: their pivotal role is inventing (scientific work), with their primary resource being knowledge.
- University/Research Institute: primarily tasked with providing research infrastructure and aiding in research organization, their main resource is infrastructure.

2. Demand-side (Demand for Knowledge):

- Entrepreneur: their primary function is the application of inventions, with managerial skills and market/production insights being their main resources. The other, not less important function is giving signals to inventors, what solutions are/will be required by the market.
- Investor: their central role is financing the application of inventions, with capital as their main resource aiming in gaining positive financial outcome from those investments.

3. Transmittal Mechanism (Matching Demand and Supply):

- Science Broker: facilitating the connection between demand for knowledge and the supply of knowledge (mediating between academia and entrepreneurs), their key resource is managerial skills.

4. Market Regulation Policy: Ensuring that the commercializational activities being performed on the market will be aligned with governmental strategies regarding that market:
 - Government/Local Government Institutions: principally encouraging the creation/utilization of knowledge through the execution of scientific/development policies and appropriate regulations for the research market, their main resources are public funds and regulatory authority.
 - Entrepreneurship Support Institutions: mainly encouraging entrepreneurship and innovation through state economic policies, their main resources are public funds.
 - Science Funding Institutions: incentivizing research in line with scientific policy, their primary resource is public funding.
5. The principal actors within the scientific research market belong to spheres:
 - Institute Sphere: comprising Inventors and Research Institutes. Their actions are driven by scientific ambitions and financial interests. Business Sphere: Encompassing Entrepreneurs, Investors, and Science Brokers. Profit serves as their primary motivation.
 - Government Sphere: encompassing Government/Local Government Institutions, Entrepreneurship Support Institutions, and Science Funding Institutions. Their actions are motivated by the execution of scientific/developmental policies and legal regulations.

Research institutes play a pivotal role in fostering innovation among their employees through several strategic mechanisms (Dahm et al., 2021). These mechanisms encompass the cultivation of an environment that not only ensures a high degree of intellectual and organizational freedom but also should offer strong financial incentives for commercialization efforts. The intricate interplay of these factors creates an ecosystem that empowers researchers to channel their innovative endeavors toward impactful outcomes. A central element in stimulating innovation is the provision of a considerable level of intellectual and organizational freedom. Research institutes need to afford researchers the autonomy to explore uncharted territories, experiment with novel ideas, and collaborate across disciplinary boundaries. This freedom fosters a culture of creativity and curiosity, laying the groundwork for innovative breakthroughs. Financial incentives also play a crucial role in driving innovation. While there exists an evident conflict of interest between individual researchers and the institution regarding the allocation of direct revenues from commercialization, the alignment of interests through direct, understandable and sustained incentives can yield sustainable benefits. Encouraging researchers to focus on long-term gains, where the institution benefits from the collective efforts of active researchers, ensures a healthier collaboration between individual goals and institutional objectives. Another dynamic incentive is the enforcement of mechanisms that necessitate active pursuit of long-term benefits from research commercialization. This financial compulsion encourages researchers to engage proactively in exploring avenues for generating

value from their research findings. This motivation is particularly relevant in a time when innovation is at the heart of economic growth and technological advancement. Furthermore, creating the right incentives within the regulatory framework enhances activities in the scientific research market. Regulatory bodies can stimulate interest and participation by facilitating a conducive environment for research market engagement. These incentives can range from streamlined intellectual property policies to supportive mechanisms for innovation-driven activities.

Despite these stimulants, research institutes may exhibit limited interest in maximizing the sale of research outcomes for various reasons. Challenges stemming from resource constraints, either in terms of human capital and technological infrastructure. Complicated and ineffective commercialization remuneration systems and or insufficiently qualified and demotivated managing personnel can easily hinder the effective offering of research outputs to meet the economy's demands. Additionally, a scarcity of skills and experiences in commercialization efforts, coupled with a reluctance to acquire them (with unavoidable presence of factors mentioned above), can dampen the potential for successful knowledge transfer. Institutional disinterest in commercialization can also stem from an overreliance on easily accessible "soft" funding sources which are much more easier to get and then to process and settle. When readily available sources fulfill an institution's operational needs without necessitating robust commercialization efforts, there usually is less incentive to actively engage in knowledge transfer to the market which requires much more of scarce available skills and organizational effort. Institutes may encounter structural barriers impeding the commercialization process. Administrative hurdles that seem essential on the surface can obscure or hinder the exploration of commercialization opportunities. Moreover, an apparent concern for safeguarding the quality of fundamental research may mask the reluctance of passive stakeholders to embrace commercialization efforts. In some instances, there might be an inclination towards rapid profit realization through maximum cost imposition on inventors for infrastructure utilization, aiming to maximize direct income from commercialization. Research institutes serve as catalysts for innovation by nurturing an environment of intellectual freedom, providing financial incentives, and facilitating the alignment of researcher and institutional interests. However, challenges such as resource constraints, outdated and unmotivating remuneration systems, skill gaps (especially in the area of sales, marketing and customer relations management), reluctance to commercialize, and lack of institutional dynamics can act as barriers. Addressing those challenges is pivotal to creating a thriving ecosystem that efficiently translates research outcomes into real-world impact.

3. Barriers to the commercialization of research results

Barriers to commercialization encompass a spectrum of constraints and characteristics that hinder the smooth and efficient operation of the innovation system, leading to an impasse in the collaboration between academic institutions and businesses (Matusiak, Guliński, 2010). These barriers are encountered both externally, within the business environment, and internally, within the enterprise itself (Panek, 2009).

In existing literature, four distinct categories of barriers have been identified (Barski, Bartosik, 2010; Matusiak, Guliński, 2010):

1. Structural Barriers.
2. Systemic Barriers.
3. Awareness and Cultural Barriers.
4. Competency Barriers in Technology Transfer.

To surmount these barriers, fostering effective collaboration between academic institutions and businesses is essential. Overcoming structural barriers necessitates the formulation of comprehensive strategies and policies that align the goals of both sectors. Addressing systemic barriers calls for streamlining regulatory frameworks to ensure they nurture innovation rather than inhibit it.

Structural barriers (Barski, Bartosik, 2010; Matusiak, Guliński, 2010) manifest when well-defined strategies and executed policies are absent due to the limitations imposed by the business environment. Examples of structural barriers include:

- Stringent Formalization of Procedures.
A highly formalized procedure for accessing EU funds can hamper innovation initiatives. Excessive bureaucracy and procedural rigidity within administrative support mechanisms can diminish efficiency by adhering to administrative formulas. This leads to the allocation of funds without achieving developmental goals and a preference for safe and conventional projects, bypassing innovative and risky endeavors, which contradicts the essence of innovation.
- Implementation Discrepancy.
Gaps between program implementation and design can disrupt the seamless execution of supportive instruments and programs. This disparity impedes the effective realization of the intended objectives.
- Outdated Institutional Frameworks.
Some academic institutions and research centers retain legal foundations, organizational structures, remuneration systems, managing culture and characteristics from the 1970s and 1980s. Taking into account the fact that those were the times of totally different political and economic regime, adhering to extremely different economic goals and

values. This hinders the adaptation of research and development infrastructure to contemporary market conditions, thwarting innovation.

- **Inflexible High-Budget Projects.**
Funding high-budget projects without considering economic trends or business environment needs can lead to investments that lack relevance and potential growth trajectories, limiting the effectiveness of innovation initiatives.
- **Limited Support for Academic Entrepreneurship.**
Inadequate support for bridging academic innovation and entrepreneurship hinders engagement in self-employment-based strategies. This limits the potential for simplified forms of innovation within academic environments.
- **Inadequate Impact of Implementations and Patents.**
The limited impact of technology implementations and commercialized patents on the career trajectory of scientific professionals dampens the motivation for research commercialization.
- **Low Adaptability and Commercial Readiness.**
Reduced flexibility among academic institutions to adapt to changing market conditions and a lack of preparedness for commercial activities restricts innovation.
- **Restricted Investment Grant Opportunities.**
Limited options for academic community members to access investment grants hinder the advancement of research and development initiatives.
- **Emphasis on Pedagogy Over Research.**
Prioritizing pedagogical tasks over research, collaboration with the business sector, technology transfer, and knowledge commercialization diminishes the overall research environment's potential for innovation.
- **Reluctance Toward Innovation.**
The inclination of most modern businesses to merely adapt proven solutions from more developed countries, influenced by customer conservatism and limited market size, impedes the demand for innovative products.

Systemic barriers (Barski, Bartosik, 2010; Matusiak, Guliński, 2010) are closely linked to the excessive number of legal acts and regulatory overload within the business environment. Moreover, they stem from the absence of legal measures that could mobilize the economy towards innovative development and enable adaptation to changing economic circumstances. Systemic barriers encompass challenges such as:

- **Challenges in Handling EU Procedures.** Difficulties in managing EU contest procedures due to unclear rules, errors in application forms, varied interpretations of regulations, and delayed payments by government and regional administrations.

- **Lack of Familiarity with EU Aid Principles:** Insufficient awareness of EU rules governing public assistance within both public administration and innovation centers. Ambiguities in these regulations can further exacerbate the issue.
- **Complex Legal Frameworks:** Complicated and numerous legal acts regulating various facets of business activity and growth deter interest in entrepreneurship and business development.
- **Absence of Comprehensive Innovation Policy:** The absence of a holistic and cohesive innovation policy aligned with sectoral policies results in an inability to coordinate and define strategic directions for technological advancement and economic modernization.
- **Imperfect Financial Support Mechanisms:** The existing system of exemptions, reliefs and subsidies remains controversial and imperfect.
- **Lack of Methodological Foundations:** Insufficient methodological frameworks that leverage scientific accomplishments to formulate policies that support innovative entrepreneurship.
- **Limited Information Flow and Collaboration:** Weak information sharing and collaboration between regional government bodies and central authorities in innovation policy formulation.
- **Internal Academic Barriers:** Obstacles within academic institutions that hinder or sometimes prevent engagement in research and implementation tasks for commercial clients.
- **Incompatibility of Legal Provisions:** Certain clauses of the "Higher Education Law" conflict with other legal acts.
- **Absence of Institutional Regulations:** The absence of university regulations and contractual templates for intellectual property rights transfer, service activities, research contracts, profit-sharing from commercialization, etc.
- **Conflicting Laws and Funding Evaluation:** Laws that contradict each other in terms of evaluating academic staff and research funding.
- **Deterioration of Research-Oriented Units:** The existence of research institutions that have lost their scientific-research character, relying on revenue streams unrelated to research activities.
- **Limited Intellectual Property (IP) Benefits:** Often, intellectual property protection in scientific institutions does not aim to generate benefits from future commercialization.
- **Complex Decision-Making Processes:** Decision-making processes concerning contributing IP as equity to a company are often beyond the scope of ordinary academic management. This significantly elongates the commercialization process.
- **Barriers in Financial Pro-Innovation Actions:** Regulations concerning public financial pro-innovation actions, posing obstacles in the form of public assistance regulations.

- **Inflexible Organizational Structure:** Inertia in embracing organizational changes and bureaucracy within academic institutions.
- **Regulatory Transformation Challenges:** Issues related to the speed of adjusting regulations concerning the offering and transformation of certain financial instruments tied to technology commercialization.
- **Fragmented Approach to Support:** A predominant focus on perfecting individual forms of support for innovation and entrepreneurship at the expense of creating effective synergy between them (lacking a systemic approach).
- **Organizational Constraints in Institutions:** The internal organizational structure of Institutes may hinder the development and implementation of entrepreneurship programs.

Cultural and awareness barriers (Barski, Bartosik, 2010; Matusiak, Guliński, 2010) revolve around the lack of trust, awareness, and societal acceptance of innovative attitudes, juxtaposed with the participants' high self-esteem in the science-business relationship. These barriers encompass:

- **Risk Avoidance Mindset.** Entrepreneurs and individuals in academia often lack the motivation to undertake risks associated with technology transfer, research result commercialization, establishing enterprises, and fostering innovation.
- **Absence of Partnership and Low Trust.** Insufficient partnership and a low level of societal trust hinder collaboration and actions in the economic sphere, as well as within the science-business relationship.
- **Trust Deficiency Affecting Business Utilization.** Low societal trust leads to reduced utilization of pro-innovation services by businesses, even when these services are non-commercial or partially subsidized.
- **Regional Authorities' Traditional Focus.** Regional authorities' emphasis on traditional policy tools and support areas is often distant from contemporary economic needs.
- **Undervaluation of Innovation Support Institutions.** Regional authorities might overlook innovation support institutions and fail to recognize their significant role in regional innovative development and capacity-building.
- **Weak SME-Academic Collaboration.** Limited cooperation between SMEs and national science and technology institutions.
- **Insufficient Qualifications for Advanced Collaboration.** Inadequate qualifications for engaging in advanced collaboration formats within EU countries.
- **Ineffective Adoption of Foreign Practices.** Inability to effectively adopt technologies, organizational solutions, and best practices from more developed countries.
- **Lack of Entrepreneur Trust in Academic Knowledge.** Entrepreneurs often lack trust in knowledge from Polish universities and apprehensions about collaborating with academic institutions. They believe these institutions are not adequately prepared

organizationally for collaboration with industry, even when possessing modern and enticing technologies.

- **Ignorance of IP's Competitive Advantage.** Entrepreneurs lack understanding of the role of intellectual property (IP) in building competitive positions and adding value to companies.
- **Academic-Business Cooperation Hesitance.** Academic reluctance to collaborate with business, sometimes viewed as profit-oriented and at odds with the ethos of scholarly activities.
- **Perception of Universities and Research Centers.** Universities and Research Centers are often perceived as entities fundamentally uninterested in promoting entrepreneurial activities.
- **Risk Aversion among Academics.** Academic staff and doctoral candidates are hesitant to embrace entrepreneurial activities as part of their career plans.
- **Vulnerability of Entrepreneurial Staff.** Despite their competencies and task completion, those engaged in business activities are often the first to face redundancy during reorganization or downsizing. That happens because either the more entrepreneurial workers cannot stand the organizational culture and they leave or their superiors fire them first hoping they easier find a new job.
- **Undervaluation of Applied Research.** Applied research is often considered less prestigious within academic circles, where "true science" pertains to fundamental research, while developmental work and business-related services are considered inferior.
- **Misplaced Role of Universities and Research Centers.** The belief that universities and Research Centers should focus on benevolent knowledge sharing rather than seeking mechanisms for profitable commercialization.
- **Financial Self-Sufficiency Expectations.** Imposing financial self-sufficiency on academic innovation centres compels them to generate short-term revenues, restricting their long-term potential.
- **Weak R&D-Industry Ties Restrict Service Growth.** Weak connections between research and development and innovation centers impede pro-innovation service development, innovative idea creation, and their translation into the SME sector.
- **Being passive in innovation Offerings and IP Protection.** Academic institutions and Research centers show passivity in developing innovative solutions and protecting them legally.
- **Limited Commercialization Efforts by Research Institutes.** Research institutions usually remain passive in commercializing intellectual property by contributing inventions to companies in exchange for shares or stocks.

Competency barriers (Barski, Bartosik, 2010; Matusiak, Guliński, 2010) are frequently linked to the incompetence of local government bodies, research institutes authorities and administrations, and novice (as well as experienced) entrepreneurs. Within these barriers, the following can be identified:

- Regional Authorities' Limited Industry Awareness. Lack of regional authorities' knowledge about growth industries and creative sectors.
- Scarcity of Expertise for Market Analysis and Strategy. Absence of skilled specialists capable of conducting market analysis and devising effective marketing strategies.
- Inadequate Legal Understanding among Entrepreneurs. Lack of awareness about legal regulations concerning intellectual property (IP) usage among entrepreneurs, leading to erroneous decisions such as neglecting IP protection or selecting inappropriate protection forms.
- Inefficient Utilization of Time for Patent Approval. Ineffectual use of time between filing an application and patent approval by nascent entrepreneurs.
- Research institute Administration's Collaboration Inefficacy. Institute administrations struggling to formalize business collaboration and equitable distribution of resultant benefits.
- Resource Insufficiency for Microenterprises' IP Management. Microenterprises lacking the necessary personnel and resources for effective intellectual property management.
- Institute Staff's Limited Technology Transfer Knowledge. Institute staff's inadequate understanding of technology transfer mechanisms and intellectual property protection principles. And the institutes' management are not adequately remunerated and motivated to be ready to carry and solve much bigger managerial problems in commercialization than those which are to encounter when managing the staff in realization the basic research.
- Lack of Entrepreneurial Knowledge and Entrepreneurial Skills among employees of the institute. Insufficient knowledge of innovative enterprise functioning, technology management, technology transfer, legal matters, accounting, and marketing.
- Institut Staff's Limited Industry Interaction and Experience: Low engagement and limited experience of institute staff in business collaboration and engagement with the institute environment.
- Limited Commercialization Support from Institutions. General failure of research institutions to develop comprehensive offerings for intellectual property commercialization, where protected solutions are often under-promoted and their implementation is inadequately described.
- High Personnel Turnover in Innovation Centers and research institutes. High staff turnover, low practical business knowledge, and lack of substantial business experiences among a significant portion of innovation center staff and collaborators.

- Weaknesses in Protective and Claim Procedures. Weaknesses in the specialist group responsible for preparing and executing protective and claim procedures.
- Overemphasis on Formal IP Protection. Excessive focus on formal industrial property protection methods, often undervaluing the wide array of informal solutions that can prove more effective in specific scenarios.
- HR Challenges in Innovation Centers. Difficulty in recruiting and retaining skilled employees within academic innovation centers due to unattractive financial offers and limited time-bound project positions. Similar situation in research institutes, whilst realizing fundamental research usually cannot provide them with good remuneration conditions.
- Lack of Performance Monitoring in Innovation Centers. Many innovation centers exhibit low activity in monitoring and evaluating their operations and outcomes.
- Competency Gaps in Public Support in Innovation Centers. Substantial competency deficits within innovation centers related to public assistance. Analogical situation among the researchers in research institutes.
- Outdated and inadequate remuneration systems, completely not motivating researchers in institutes to bear the hardships of implementation activities, which are much more difficult and demanding than basic research.

4. Research methodology

The research was conducted in the first quarter of 2023 at one of the institutes within the Łukasiewicz network. A total of 102 individuals participated in the study, comprising 42 members of the management team and 60 scientific employees, accounting for nearly one-third of all institute personnel. The research was structured into three phases. During the initial phase, a selection was made of the 10 most frequently identified barriers to commercializing research results by the institute's employees. Preliminary selection was based on interviews conducted with the employees, as well as a voluntary survey form designed to highlight the most significant barriers faced by employees in the context of research outcome commercialization. To facilitate this, the survey form included a guide with explanations of the most commonly encountered barriers, as described in Section 3 of this article.

Utilizing the 10 most frequently mentioned barriers that emerged from the selection process, a structured form was created, and respondents were asked to position specific barriers within a hierarchy of importance. The analysis of the results was facilitated by the Importance Index (W) (Karaszewski, 2001), calculated using formula (1):

$$W = \frac{\sum_{i=1}^k n_i w_i}{k \cdot N} \quad (1)$$

where:

W - importance index,

i - indication of the place of the barrier,

k - maximum weight (indicating the order of the instrument meant assigning the weights in reverse order,

n_i - the number of indications of a given method (technique) on the i -th place,

w_i - weight corresponding to the site of the technique I ,

N - number of respondents.

In the third phase, a comparison was made between the prioritization of barriers from the perspective of the management team and the scientific staff. Additionally, an analysis was conducted to uncover disparities in the perception of the competency-related barrier.

This phase involved a comprehensive examination of the identified barriers, considering how their importance was perceived differently by the management personnel and the scientific researchers. The aim was to explore potential variations in viewpoints and priorities between these two distinct groups within the institute.

The analysis also focused specifically on the competency-related barrier, aiming to delve deeper into any divergences between the management and scientific staff regarding their understanding, assessment, and significance of this particular obstacle. By scrutinizing the discrepancies, the research aimed to identify potential areas for targeted improvement strategies and interventions related to competency-building activities.

5. Result and Discussion

Based on the conducted analysis, the 10 most frequently mentioned barriers to research outcome commercialization by institute employees were selected. These include:

1. Lack of awareness of commercialization.
2. Lack of cooperation with the private sector.
3. Difficulties in protecting intellectual property.
4. Lack of financing at the stage of commercialization.
5. Academic and publishing culture.
6. Complex administrative procedures.
7. Lack of commercialization project management skills.
8. Investment risk.

9. International competition.
10. Lack of entrepreneurial culture.

The compilation of obtained responses for the importance rankings (W importance index) for individual barriers from the perspective of the management team is presented in Fig. 1, while from the perspective of the employees in Fig. 2.

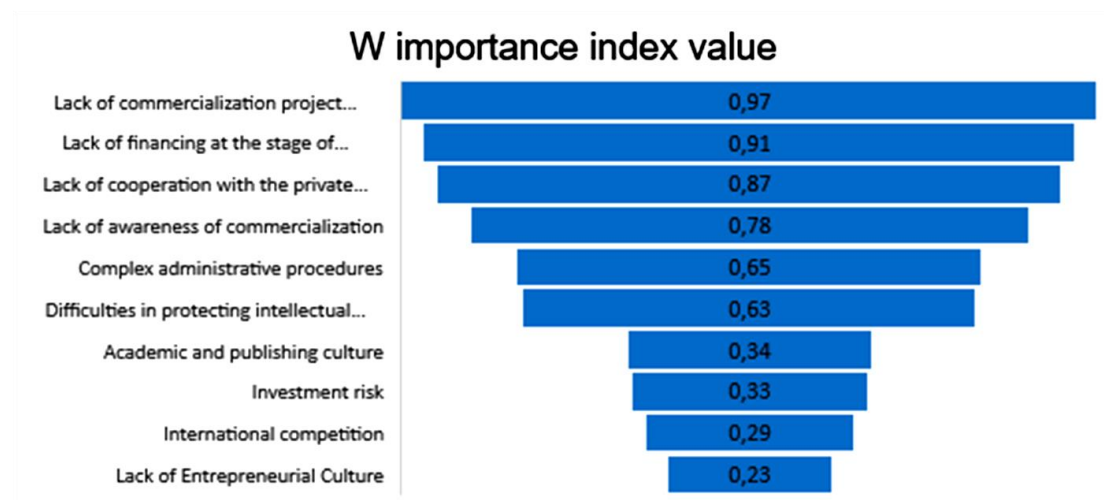


Figure 1. List of importance index W for selected barriers to the commercialization of research results - the management's team perspective.

Source: own study.

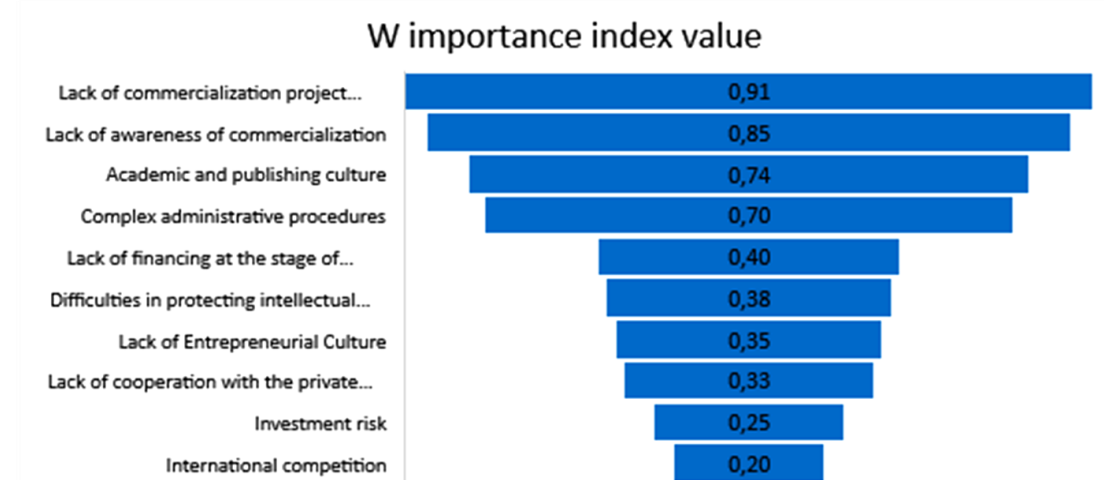


Figure 2. List of importance coefficients W for selected barriers to the commercialization of research results – employees' perspective.

Source: own study.

In the assessment provided by the management's team, the most significant barriers include:

1. Lack of commercialization project management skills: managers may perceive this as a pivotal barrier due to their awareness of the necessity for effective management throughout the commercialization process to attain success and secure funding.
2. Lack of financing at the stage of commercialization: managers generally possess a comprehensive understanding that insufficient funds could potentially lead to delays

or even hinder the commercialization process, subsequently impacting the institute's overall development.

3. Lack of cooperation with the private sector: from a business perspective, institute managers can view collaboration as a key factor, recognizing its potential to bring about funding, resources, and a market-oriented perspective.

From the employees' perspective, the most critical barriers are:

1. Lack of commercialization project management skills: scientific staff might not perceive this barrier as prominently as the managers do, as their focus tends to lean more towards the scientific aspects of their work.
2. Lack of awareness of commercialization: scientific personnel could concentrate primarily on scientific research and publications, possibly not fully grasping the significance of transforming their research into viable products or services.
3. Academic and publishing culture: researchers may encounter considerable pressure related to scientific publications, which could potentially conflict with the necessity to maintain secrecy for the purpose of successful commercialization.

The disparities in perceiving these barriers across different domains arise from:

1. Lack of financing at the stage of commercialization: both managers and scientific staff might recognize this barrier as pivotal, as it directly impacts the feasibility of executing commercialization projects.
2. Lack of cooperation with the private sector: both teams might acknowledge the value of private sector collaboration, albeit from distinct viewpoints managers view it as a source of funding, while scientific staff see it as an avenue to access resources and market insight.
3. Lack of commercialization project management skills: while this issue holds more significance for managers, scientific staff might also appreciate that a lack of management skills can potentially delay or complicate the success of the commercialization process.

In summary, the study highlights differing perspectives between institute managers and scientific employees concerning the most notable barriers to successful commercialization. While management emphasizes project management skills, funding, and private sector collaboration, scientific employees underscore their need for improved awareness, a shift from pure research to commercial products, and a balance between academic and commercial priorities. These disparities underscore the complexity of the commercialization landscape, affected by diverse perspectives within research units and fields. Both groups of employees identified the competency barrier as the most significant. It refers to the lack or insufficient skills and knowledge needed for effective management of a commercialization project or the process of transforming scientific research into products or services.

Differences were identified in how the leadership and employees of research institutes may approach this barrier:

- **Perspective of Research Institute Leadership:** recognizing competency gaps: Institute leadership recognizes the need for possessing project management skills in commercialization and identifies it as a key element for achieving success in commercialization. Encouraging competency development: Leadership initiates and supports training programs and invests in developing project management skills among employees. Considering hiring experts: Leadership considers hiring specialists with experience in managing commercialization projects to fill competency gaps.
- **Perspective of Scientific Employees:** Lack of experience: Scientific employees may not realize the role that project management plays, leading to a lack of skills in this area. Time concerns: Scientific employees, focused on research, may worry that learning project management will take up a lot of their time and divert them from their research work. Resistance to change: Scientific employees accustomed to research work might resist acquiring new skills, especially if it's beyond their comfort zone.

In the area of competency gaps, there are also differences in the perception of barriers that stem from:

- **Differences in priorities:** Management may view the development of competencies as crucial for effective institute management, while scientific staff may see it as an additional responsibility.
- **Understanding the necessity:** Institute management typically possesses a deeper understanding of why possessing commercialization management skills is essential, whereas scientific employees may require education in this domain.
- **Role transition:** Scientific employees may harbor concerns that the need to acquire management skills will change their roles from researchers to project managers.

Competency gaps can lead to variations in the perception of barriers by both institute management and scientific staff. These differences arise from distinct perspectives, priorities, as well as understanding of needs and consequences related to managing commercialization projects.

6. Conclusion

The case study has shed light on the multifaceted nature of barriers that impede the successful transfer and commercialization of research findings. Recognizing and addressing these barriers is of paramount importance for maximizing the societal and economic impact of academic research.

The findings underscore the need for institutions and stakeholders involved in research and technology transfer to develop comprehensive strategies. These strategies should encompass skill development, improved collaboration with industry, and effective management of intellectual property rights to overcome the identified barriers. The diverse perspectives of management and scientific staff regarding barriers highlight the necessity of tailoring approaches for different stakeholders. Management needs to foster a culture that encourages skill development, while addressing the concerns of scientific staff regarding role transitions. The dynamic nature of the barriers suggests that strategies for technology transfer and commercialization should be continuously monitored and adapted. Regular assessments can help institutions stay responsive to emerging challenges and changing stakeholder perceptions.

The case study has provided valuable insights, yet there is room for further investigation into specific strategies that effectively mitigate the identified barriers. Future research could focus on evaluating the long-term impact of tailored interventions and examining successful case studies that have overcome similar challenges.

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