The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational and Social Sciences (EPESS), 2025

Volume 47, Pages 261-268

IConSE 2025: International Conference on Science and Education

Exploring the Impact of Innovation Support Mechanisms on RDI Result Utilization: Survey Evidence from Hungary

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Abstract: The effective economic and societal exploitation of research, development, and innovation (RDI) project outcomes plays a critical role in the performance of national innovation ecosystems. In recent years, national policy frameworks in Hungary have introduced a wide range of support schemes designed to promote diverse commercialization strategies. These mechanisms include resource mobilization support, utilization through RDI grants, independent technology transfer, as well as collaborative approaches involving industrial or academic partners. This study investigates the extent to which these distinct forms of support facilitate the practical application and utilization of project-based research results. Primary data were collected through a structured questionnaire survey administered to domestic innovation-oriented organizations (n = 287), assessing their experiences with various utilization pathways. Quantitative statistical methods were applied to explore the relationship between support types and utilization outcomes. The findings indicate that consortium-based and industry-partnered models are significantly associated with enhanced market-oriented exploitation, whereas independently pursued commercialization efforts tend to lead primarily to academic or scientific outputs. Furthermore, the institutional presence of structured innovation management functions emerged as a key moderating factor influencing utilization success. This study contributes to the ongoing refinement of innovation policy instruments by offering empirical insights into the effectiveness of targeted support mechanisms, and by highlighting critical enablers of successful RDI result exploitation in the Hungarian innovation landscape.

Keywords: RDI result utilization, Innovation support mechanisms, University-industry collaboration, Technology transfer, Innovation policy

Introduction

The theoretical foundations of university-industry-government collaboration were established by Etzkowitz and Leydesdorff (2000) through the Triple Helix model, which posits that innovation dynamics emerge from spiral interactions among the three sectors, transcending earlier linear innovation models. This approach goes beyond both the National Innovation Systems (NIS) concept and the Mode 2 knowledge production paradigm, outlining an integrated, interdependent system. As a further development of this model, Carayannis and Campbell (2009) introduced the Mode 3 and Quadruple Helix concepts, which integrate the perspective of media-based and culture-based public spheres into the innovation ecosystem, thus creating a 21st-century fractal innovation ecosystem.

Cohen and Levinthal's (1990) pioneering work introduced the concept of absorptive capacity, which refers to an organization's ability to recognize, assimilate, and apply new external knowledge. This concept is fundamentally important for understanding RDI result utilization, as corporate and research institute R&D investments not only generate new knowledge but also enhance the capacity to absorb and apply external knowledge sources, including results from collaborative partners.

Knowledge transfer and university-industry interactions can take various forms, serving market-oriented or scientific utilization to different extents. Perkmann et al. (2013) systematized the different channels of academic

engagement and commercialization in their comprehensive literature review, including joint research, consultation, informal relationships, and patenting. They found that consortial and industry-partnered models typically lead to stronger market-oriented utilization, while independently pursued commercialization activities tend to lead to academic or scientific outputs. D'Este and Patel (2007), in their empirical research conducted in the United Kingdom, identified factors determining the diversity of university-industry interactions, highlighting the role of research characteristics and disciplinary differences in choosing utilization pathways.

Literature Review

Santoro and Chakrabarti (2002) examined the impact of company size and technological centrality on industry-university collaborations, finding that larger companies tend to form strategic, long-term relationships with university research centers, while smaller companies prefer more specific, shorter-term collaborations. This finding is relevant for the design of RDI support mechanisms, as organizations of different sizes can benefit from different forms of support. Scandura (2016) showed that publicly funded university-industry collaborations have a positive impact on companies' R&D efforts, especially in cases where structured collaboration frameworks are in place. Bozeman (2000), examining the relationship between technology transfer and public policy, introduced the "contingent effectiveness" model, according to which the effectiveness of technology transfer depends on contextual and institutional factors. This model was later further developed by Bozeman et al. (2015), who integrated the aspect of public value into the evaluation criteria, emphasizing that the success of utilization can be measured not only in terms of market revenues but also in terms of social impacts.

Siegel et al. (2003) analyzed the organizational practices that influence the productivity of technology transfer offices (TTOs), finding that the effectiveness of TTOs depends largely on organizational culture, incentive systems, and staff competencies. This finding supports the view that the institutional presence of structured innovation management functions is a key moderating factor influencing exploitation success. Holgersson and Aaboen (2019) examined the intellectual property management practices of TTOs in their systematic literature review, criticizing the overly patent-centric approach and emphasizing the need for increased focus on value creation and practical application. Bradley et al. (2013) pointed out in their critical analysis that the traditional linear technology transfer model is no longer adequate to describe the complex commercialization activities of modern research organizations and proposed alternative, more interactive models.

Barriers and Enablers to Collaboration

In their systematic literature review, Ankrah and Al-Tabbaa (2015) systematized the forms, motivations, barriers, and outcomes of university-industry collaborations, emphasizing the role of cultural differences, lack of trust, and differing time horizons among the potential constraints. Rossoni et al. (2023) further refined the typology of barriers and enablers in the context of RDI collaborations in their more recent review, identifying the organizational and systemic conditions that facilitate successful exploitation. In their qualitative research, O'Dwyer et al. (2022) explored the evolutionary phases of successful university-industry collaboration in the pharmaceutical industry, identifying phase-specific barriers and mechanisms that lead from initial mistrust to institutionalized collaboration. The results of this research are relevant for understanding the success of consortium models.

Knowledge Exploitation

In their comparative analysis, Wennberg et al. (2011) examined the performance differences between university and corporate spin-offs, finding that corporate spin-offs generally outperform university spin-offs on several performance indicators. This result suggests that closer cooperation with industry and market experience significantly increase the chances of exploiting RDI results. Etzkowitz (2013) analyzed the anatomy of the "entrepreneurial university" and showed how this institutional form has evolved from narrowly defined commercialization to a more comprehensive, integrated model of knowledge production, dissemination, and utilization. Guerrero and Urbano (2012) developed a model for the development of the entrepreneurial university, integrating the perspectives of institutional economics and the resource-based view, emphasizing the impact on regional economic development. Klofsten et al. (2019) positioned the entrepreneurial university as a driver of economic growth and social change, identifying the strategic challenges these institutions face in expanding their utilization activities. Menter (2023) goes further, moving from technological innovation to social innovation, arguing for a "mission reorientation" of entrepreneurial universities, emphasizing the

importance of the social dimensions of the third mission in the wider utilization of RDI results. Salomaa (2019) examined the regional aspects of the third mission, analyzing the "entrepreneurial architecture" of universities and its adaptation to the local economic environment, which is particularly relevant in terms of the territorial differentiation of support mechanisms. Geuna and Muscio (2009) provided a critical review of knowledge transfer management, with a particular focus on the management of intellectual property rights and

When analyzing research trends in open innovation and the role of universities, it is important to highlight the importance of university-business collaboration in increasing the innovation capacity of SMEs and facilitating knowledge transfer. (Haidegger et al., 2024) The open innovation paradigm is particularly relevant when assessing the effectiveness of different exploitation routes—consortium, partnership, and independent models. (De las Heras-Rosas & Herrera, 2021)

Abramo et al. (2009) used bibliometric methods to examine university-industry collaborations in Italy and found that the performance of university researchers collaborating with industry exceeds that of their non-collaborating colleagues, although the impact factor of joint publications is generally lower. This result suggests that market-oriented collaborations produce different but valuable outcomes compared to purely academic activities.

Examining the characteristics of the Hungarian innovation ecosystem, based on the Triple Helix model, the impact of cooperation between academic and market players on the effectiveness of RDI projects is clearly visible. Research conducted on the partner base of the National Research, Development and Innovation Office (NKFIH) confirmed that projects implemented in consortium cooperation are more effective in terms of utilization than those where cooperation is of a subcontractor or supplier nature. This result is consistent with the findings of international literature, which states that models implemented in consortium and industry partnerships significantly increase the chances of market-oriented exploitation, while independent commercialization efforts typically lead to academic or scientific outputs. (Dobos, 2024)

Summary

The literature clearly supports the view that the effective exploitation of RDI results is a complex, context-dependent process influenced by a number of institutional, organizational, and relational factors. Theoretical frameworks ranging from the Triple Helix to the Quadruple Helix, the concept of absorption capacity, the diversity of technology transfer mechanisms, and the development of entrepreneurial universities all show that the effective flow and utilization of knowledge requires targeted support mechanisms. Models based on consortia and industrial partnerships lead to stronger market exploitation, while the institutional presence of structured innovation management functions is a key moderating factor influencing the success of exploitation. These findings contribute to the continuous refinement of innovation policy instruments and provide an empirical basis for the effectiveness of targeted support mechanisms in the Hungarian innovation environment.

Method

Research Design and Data Collection

This study employs a quantitative research design utilizing survey methodology. Primary data were collected through a structured questionnaire administered to innovation-oriented organizations in Hungary. The sample comprises 287 domestic organizations actively engaged in research, development, and innovation activities. The questionnaire was designed to assess organizations' experiences with various RDI result utilization pathways and their interactions with different types of support mechanisms.

Data Analysis

Quantitative statistical methods were applied to explore the relationship between support types and utilization outcomes. Variance analysis was conducted to examine the statistical significance of relationships between organizational RDI experience and innovation success across multiple dimensions. The analysis focused on three key areas: organizational experience, project portfolio characteristics, and collaboration patterns with innovation support mechanisms.

Results and Discussion

Non-linear Relationship Between Experience and Success

The most surprising and convincing empirical evidence relates to the successful involvement of investors and rapid scaling of results. Segmentation by time spent in R&D&I revealed significant differences between the groups ($F(6, 280) = 2.381$, $p = 0.029$, $\eta^2 = 0.048$)

Table 1. The relationship between the assessment of "successful investor engagement" and the organization's RDI experience (years)

Statement		Sum of squares	df	Mean square	F	Sig.
Successful investor engagement, rapid scaling of results.	Between groups	44,174	6	7,362	2,381	0.029
	Within groups	865,763	280	3,092		

Source: own research, N = 287 (One-way ANOVA)

Table 2. The relationship between the assessment of "successful investor engagement" and the organization's RDI experience (years)

Statement	RDI experience (years)	Average	Standard	Std. Error	95% Confidence Interval for Mean Lower Bound	Upper Bound	Minimum	Maximum
Successful investor engagement, rapid scaling of results.	1-3	3,836	1,607	0.21675	3.4018	4.2709	1.00	6.00
	4-5	3.048	1.738	0.26824	2.5059	3.5893	1.00	6.00
	6-10	3.093	1.875	0.28591	2.5160	3.6700	1.00	6.00
	11-15	3.405	1.913	0.29526	2.8085	4.0010	1.00	6.00
	16-20	2.647	1.579	0.38292	1.8353	3.4588	1.00	5.00
	20	2.988	1.728	0.19204	2.6055	3.3698	1.00	6.00
	I don't know / I won't answer	4.429	2.070	0.78246	2.5140	6.3432	1.00	6.00
	Total	3.251	1.784	0.10529	3.0436	3.4581	1.00	6.00

Source: own research, N = 287 (descriptive statistics)

According to the results, organizations that have only been involved in R&D&I activities for 1-3 years scored an average of 3.84 on a six-point scale, which is not only above average but also significantly exceeds the performance of organizations with medium experience (4-20 years). It is particularly noteworthy that the average score for organizations with 16-20 years of experience is only 2.65, which is almost one and a half points lower than that of beginners. This pattern cannot be considered a random statistical fluctuation. This phenomenon is even more strongly supported by the analysis of cooperation with innovation agencies, which produced the strongest statistical result of the study ($F(6, 280) = 3.141$, $p = 0.005$, $\eta^2 = 0.063$). Here, the average success of start-up organizations (1-3 years) is 4.09, while those with 16-20 years of experience again have the lowest score, 2.76. This second result, which reaches an even stricter significance level of , confirms that this is not an isolated phenomenon, but a systematic pattern

Project Portfolio Size and the Performance Gap

Analysis by number of R&D&I projects yielded further important insights. Significant differences were found between organizations with different numbers of projects in terms of successful sales of new product developments ($F(6, 280) = 2.505$, $p = 0.031$, $\eta^2 = 0.051$).

Table 3. The relationship between the assessment of "product development" and the number of RDI projects in the organization

Statement		Sum of squares	df	Mean square	F	p
Successful sales of new product developments.	Between groups	21,745	5	4,349	2,505	0.031
	Within groups	487,858	281	1,736		

Source: own research, N = 287 (One-way ANOVA)

Table 4. The relationship between the assessment of "product development" and the number of RDI projects in the organization

Statement	Number of RDI projects	Average	Standard	95% Confidence Interval for Mean		Minimum	Maximum
			Std. Error	Lower Bound	Upper Bound		
Successful sales of new product developments.	1	3,517	1,271	0.10415	3.3110	3.7226	1.00	6.00
	6-10	2.946	1.026	0.16866	2.6039	3.2880	1.00	6.00
	11-15	3.421	1.170	0.26837	2.8572	3.9849	1.00	5.00
	16-20	4,571	1.272	0.48093	3.3946	5.7482	3.00	6.00
	20	3.535	1.510	0.17923	3.1777	3.8927	1.00	6.00
	I don't know / I won't answer	4.25	2.363	1.18145	0.4901	8.0099	1.00	6.00
	Total	3.477	1.335	0.07879	3.3223	3.6324	1.00	6.00

Source: own research, N = 287 (descriptive statistics)

The most fundamental observation is that the simple linear logic of "the more, the better" does not apply. In fact, the results reveal an interesting and, from a practical point of view, extremely important "gap" in organizations with a medium-sized portfolio (6-10 projects). The average success of organizations working with 6-10 projects (M = 2.95) is significantly lower than that of organizations with fewer (1-5 projects: M = 3.52) or significantly more projects (20+ projects: M = 3.54).

Institutional Embeddedness and External Relations: The Openness of Beginners

The strong significance observed in the case of cooperation with the innovation agency (p = 0.005) deserves special attention, as it was the strongest statistical result in the entire analysis.

Table 5. The relationship between the assessment of "cooperation with innovation agencies" and the organization's RDI experience (years)

Statement		Sum of squares	df	Mean square	F	Sig
Cooperation with the Innovation Agency for the utilization of the developed product/service.	Between groups	60.904	6	10,151	3,141	0.005
	Within groups	904,935	280	3,232		

Source: own research, N = 287 (One-way ANOVA)

Table 6. The relationship between the assessment of "cooperation with innovation agencies" and the organization's RDI experience (years)

Statement	Size (persons)	Average	Standard	95% Confidence Interval for Mean		Minimum	Maximum
				Std. Error	Lower Bound	Upper Bound		
Cooperation with the Innovation Agency for the utilization of the developed product/service.	1	4,091	1,602	0.21598	3.6579	4.5239	1.00	6.00
	4-5	2.976	1.828	0.28204	2.4066	3.5458	1.00	6.00
	6-10	3.047	1.812	0.27633	2.4888	3.6042	1.00	6.00
	11-15	3,524	2,015	0.31093	2.8959	4.1517	1.00	6.00
	16	2.765	1.678	0.40701	1.9019	3.6275	1.00	5.00
	20	3.235	1.791	0.19897	2.8386	3.6305	1.00	6.00
	I don't know / I won't answer	4.714	1.976	0.74688	2.8867	6.5418	1.00	6.00
	Total	3.383	1.838	0.10847	3.1698	3.5968	1.00	6.00

Source: own research, N = 287 (descriptive statistics)

Start-up organizations (1-3 years) are particularly successful in this dimension (M = 4.09), which significantly exceeds the average for the entire sample and is particularly far from the performance of organizations with medium experience.

Conclusion

This study provides empirical evidence regarding the effectiveness of different innovation support mechanisms in facilitating RDI result utilization in the Hungarian innovation ecosystem. The findings reveal that the relationship between organizational experience and innovation success follows a non-linear, U-shaped pattern, challenging conventional assumptions about cumulative learning advantages. Beginning organizations demonstrate remarkable success in certain dimensions, while those in the middle experience range face significant challenges. This pattern suggests that innovation policy interventions should be tailored to organizations' developmental stages rather than applying uniform support mechanisms.

The research confirms that collaborative approaches, particularly consortium-based and industry-partnered models, yield superior market-oriented utilization outcomes compared to independent commercialization efforts. This finding underscores the importance of fostering structured partnerships between academic institutions, industry actors, and innovation support organizations. The institutional presence of dedicated innovation management functions emerges as a crucial enabler of utilization success, highlighting the need for capacity building in this area.

The identification of a performance gap in the medium project portfolio range (6-10 projects) suggests that organizational innovation management involves complex dynamics that cannot be captured by simple linear models. This finding has important implications for both organizational strategy and policy design, indicating that support mechanisms should account for varying organizational capacities and developmental trajectories.

Recommendations

Based on these findings, several recommendations can be formulated for innovation policy design. First, support mechanisms should be differentiated according to organizational experience levels, recognizing that beginning, intermediate, and experienced organizations face distinct challenges and opportunities. Second, policy instruments should prioritize the development of structured collaboration frameworks that facilitate industry-academia partnerships, as these demonstrably enhance market-oriented utilization outcomes.

Third, investment in organizational innovation management capacity represents a critical policy priority. Supporting the establishment and professionalization of technology transfer offices and innovation management units can serve as a force multiplier for RDI result utilization. Fourth, attention should be given to organizations in the medium project portfolio range, as they appear to face particular challenges that may benefit from targeted support interventions.

Future research should investigate the causal mechanisms underlying the observed non-linear relationships and explore how different contextual factors moderate the effectiveness of various support mechanisms. Longitudinal studies tracking organizations over time would provide valuable insights into the dynamics of innovation capacity development and utilization success.

Scientific Ethics Declaration

* The author declares that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the author.

Conflict of Interest

* The author declares that there is no conflict of interest.

Funding

* This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Science and Education (www.iconse.net) held in Antalya/Türkiye on November 12-15, 2025.

* The author would like to thank the conference committee and the referees for reviewing the article and providing feedback.

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To cite this article:

Dobos, O. (2025). Exploring the impact of innovation support mechanisms on RDI result utilization: Survey evidence from Hungary. *The Eurasia Proceedings of Educational and Social Sciences (EPESS), 47,* 261-268