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KNOWLEDGE TRANSFER AND INNOVATION INCUBATORS: THE CONTEXT OF THE EUROPEAN UNION

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Abstract. Since Lithuania became a member of the European Union in 2004, the main course of the country's economic development has changed. Lithuanian government was forced to search for new ways to ensure the wealth and prosperity of local society. One of the chosen methods for supporting economic growth was related to knowledge transfer and the incubation of innovations in Lithuania. The article aims to formulate theoretical and practical assumptions for knowledge transfer and incubation of innovations. Based on data from the State Data Agency and the European Statistics Bureau Eurostat research results, the situation in Lithuania is evaluated in the context of the European Union. Finally, juxtaposing theoretical background and research results helps establish main guidelines for further innovation development.

Keywords: knowledge; innovation; incubation; incubators; open innovation; sustainability; ecosystem; startups; research & development

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JEL Classifications: I23, M21, M53

1. Introduction

Processes of globalisation encouraging economic growth highlighted the importance of innovation sector development. Lithuania experienced a long period of economic transition from the planned model based on traditional industries of national production and export by using favourable geographical allocation and status of a transit country; the shift towards new ways to attract foreign investment into economic development became a reality. Such a decision was geared by the changed political situation and the most recent financial priorities to achieve a high quality of life and economic competitiveness by improving significantly low levels of technologies and insufficient labour force productivity. Therefore, the Lithuanian government took an interventionist approach toward the economy, strongly emphasising science and technology. The decision was supported by an argument that traditional industry needs more competitive incentive to introduce new technology and would recommend reliance on international market forces.

Since the political changes in 1990 and the economic crisis in 1998, there was increasing determination to revitalise the Lithuanian science and technology base, and legislation reflected the pressure. For example, the Governments Act of 2003 encouraged technology transfer to the country and established the concept of science and technology park development.

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The general concept's provisions are:
- The main development policy objective is to improve the competitiveness of the Lithuanian economy.
- Major economic changes are the main reason for the Lithuanian economy's orientation to knowledge, research and innovation-oriented industries.
- Some of the most important activities to promote competitiveness are creating the environment for entrepreneurship development, investments into personnel, research and increasing technological development, the business services sector and its infrastructure.

The government, municipal authorities, private entities and the community should support science and technology parks' activities, promote scientific and technological progress, innovate-oriented changes in the economy's structure, and increase competitiveness and social activity (Lithuanian Government's Act 2003).

Lithuanian innovations and technology development priorities were recognised as the areas in which Lithuanian companies can compete on world markets and require the contribution of science: biotechnology and pharmaceuticals, information, telecommunications and laser technology, electronics, and mechatronics. These areas were approved in the programs of technology development supporting Lithuania's Progress Strategy "Lithuania 2030". The strategy defines science and technology parks as organisations that support established companies operating in applied research and development and the results of research and economic relations between scientific and academic institutions in research commercialisation, knowledge transfer and incubation of innovations.

Therefore, the paper aims to formulate theoretical and practical assumptions for knowledge transfer and incubation of innovations in Lithuania. The objectives include theoretical background analysis, revealing main directions in knowledge transfer and incubation of innovations, and economic analysis of statistical data in the context of the European Union.

2. Theoretical background of innovation and knowledge transfer

2.1. Innovation concept

The General Lithuanian Encyclopedia (2023) states that innovation (lat. "innovatio"- renewal) is a process of change when new elements (models) of material and non-material culture are created, recognised, and implemented in a particular social system, new scientific knowledge is used, new legally legalised technologies of higher quality are introduced to produce products, to provide better services. Chen and Chen (2023) argue that innovation can indicate changes to an existing product, idea, or area. In other words, there is an innovation focused on thinking using available knowledge and materials to meet social needs for improvement or create new things, methods, items, paths, and environments and get some beneficial effect.

Although Ji et al. (2022) mentioned that economic globalisation and rapidly increasing technological complexity make innovation more critical than ever, Eppinger et al. (2021) consider potential benefits gaps and harmful effects of innovation; their study proposes six different attributes of innovation provide benefits to society:

(I) appropriate information and communication channels,
(II) affordable price,
(III) appropriateness and availability,
(IV) predictability in terms of relevant and reflective risk assessment,
(V) accountability concerning the proper allocation of the costs of harmful side effects and
(VI) creating a sustainable path for the transition to societal and environmental sustainability.

Sánchez Ramírez et al. (2022) considered that ***making technological decisions*** for the development of new products and processes promotes the innovative capacity of companies, allowing them to satisfy the needs of a constantly changing market. Conversely, internally developed innovations or absorbed by companies provide an opportunity to shape or react actively to technological transitions. López and Oliver (2023) argue that the

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culture and innovation of each company experience different expectations, and technical capabilities can change the perception of product innovation. Some examples of the different ways that innovation can occur are:

(1) Product innovation when the Apple iPhone revolutionised the mobile phone industry.
(2) Process innovation, where the assembly line has changed the production process and enabled the mass production of goods.
(3) Business model innovation where Netflix disrupted traditional movie rental industry subscription streaming service.
(4) Organisational innovation where Google encourages creativity and collaboration among employees.
(5) Open innovation, where LEGO allows customers to submit ideas for new products; or
(6) Marketing innovation when Red Bull sent a man to the edge of space on a helium balloon.

Dziura and Rojek (2021) mentioned that the ***concept of novelty*** in the global sense needs to be emphasised in these models, and thus, the interpretation has weakened the meaning of innovations. Innovation in a company can be defined as an economic decision made to perform tasks related to the use of market opportunities or prevent the occurrence of threats. Such choices are often strategic. They can affect the competitive position of the company's activities and all aspects of its operation; in short, they can make a profit. Fernández-Portillo et al. (2023) stated that innovation is very important for companies. To ensure their survival, companies must constantly update their practices to keep up with market trends and evolving consumer needs. In this way, they also contribute to economic growth, employment, and the development of their respective countries. However, Maier et al. (2020) analyse that innovation has always been critical to long-term business success. Organisations that have successfully innovated have typically been rewarded with growth, profit, and access to new markets. According to Maier et al. (2020), continuous innovation has become vital to achieving competitive advantages. Innovation has been widely recognised as a critical mechanism for solving the problems of sustainable development.

Tirmizi Malik and Hussain (2020) stated that ***breakthrough innovations*** are necessary to gain and maintain a competitive advantage in the market. Similarly, Breakthrough Innovation (BI) capabilities have three fundamental building blocks: discovery, incubation, and acceleration. This means that inventions are the initial contribution to innovation, making them a viable proposition and further long-term investment in research and development organisations to ensure sustainable success and growth.

Kiseleva et al. (2022) mentioned that ***open innovation*** has proven its effectiveness and efficiency in many countries and is based on an ecosystem approach at the regional level. It provides a promising positive effect as it rapidly transfers innovations and their implementation due to the increased interest of all actors involved. Thus, it promotes high productivity of innovative activities in subjects, regions, and countries. Brodny and Tutak (2022) stated that open innovation is an excellent opportunity to develop a creative knowledge-based economy. Its practical application requires openness, willingness to share knowledge, and close stakeholder cooperation. Ryszko and Szafraniec (2022) stated that open innovation is a concept that essentially resides at the organisational level. Therefore, combining an open innovation process with the organisation's business model is necessary and perceived as an essential type of organisational change. Collaboration and co-creation in business model development are vital to sustaining open innovation. Therefore, openness is perceived as a critical factor affecting business model development. Proper business pattern matching enables co-developmental connections and increases the likelihood that external partnerships can be sustained over time.

Cao, Zhang and Qian (2019) stated that an innovation-based strategy that addresses the challenges of environmental pollution and pursues green development had gained an essential role in the economic literature in recent years. Gharbi et al. (2022) mentioned that organisations are increasingly supporting green innovation in their employee practices to promote sustainable development of the environment. Becker (2023) stated that ***green innovation*** refers to the innovation of products, processes, or organisations with a lower environmental impact. According to Becker (2023), the essential contribution of green innovation to green growth and the realisation of a sustainable economy is now well accepted. However, while the innovation economics and environmental economics literature will note that regulation, technology push, and market pull drive green innovation, its impact on firm performance is still debated. This lack of consensus in the literature is a significant

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knowledge gap: the greater complexity, uncertainty, and cost of green innovation compared to other innovations that require changes in organisational goals, practices, and routines may discourage investment in green innovation if it does not increase and possibly weaken the company's performance in terms of growth, employment, and productivity.

Kurniawati et al. (2022) analyse that ***sustainability-oriented open innovation*** is an open innovation designed to meet organisational needs from an economic, environmental and social perspective. Case studies by Behnam, Cagliano and Grijalvo (2018) and Lopes et al. (2023) show the successful implementation of sustainability-oriented open innovation in large organisations. According to Kurniawati et al. (2022), sustainability is essential for large organisations and SMEs. Therefore, it is necessary to implement sustainability-oriented open innovations in SMEs. To achieve sustainability, SMEs must innovate in their activities, primarily related to the environment, employees, society, and ethics. Meglio and Di Paola (2021) considered that innovative solutions are needed to improve well-being or address sustainability challenges, including in the fashion and clothing, chemical, pharmaceutical or logistics, and transport industries, which usually create tension between increasing economic/financial value and preserving the natural environment. According to Meglio and Di Paola (2021), they need customised solutions to achieve this balance. The solution to these significant challenges is not a one-sided effort but a collective, open, and multi-stakeholder effort that requires collaboration across disciplines and institutional boundaries. Companies can actively find and develop sustainable innovations and provide viable solutions to global problems such as climate change, food security, and population ageing. Harsanto et al. (2022) stated that innovation for sustainability goes beyond profit but also for social, environmental, or both advantages. This term is a blend of two well-known words: innovation and sustainability. Innovation has been around for over five centuries, and sustainability has been around for over a century. Both share that the term is now interdisciplinary and examined from various perspectives. Combining these two concepts, innovation and sustainability, ultimately creates a new paradigm where this combination creates several concepts that are used interchangeably, e.g. sustainable innovation, sustainability-oriented innovation (SOI), environmental protection-friendly innovation, or sustainability-based innovation. Martínez-Alonso et al. (2019) mentioned that innovation has been identified as one of the most valuable sources of sustainable competitive advantages, allowing companies to grow and develop even faster, survive and endure over time in a rapidly changing environment, manage company resources more efficiently and ultimately achieve better results.

Latifah et al. (2022) considered that ***human capital*** is a set of knowledge, skills, and abilities integrated into company employees. Organisations can only create knowledge with individuals. Latifah et al. (2022) argue that knowledge creation and innovation are processes in which tacit knowledge is internalised as part of organisational knowledge. Employees with higher education will find it easier to adapt to new tasks and technologies. In addition, companies with a high level of human capital will facilitate the creation of knowledge and innovation. The literature also shows that innovative activities increase through exchanging and combining available knowledge. Thoumrungroje and Racela (2022) argue that innovation capability refers to the firm's ability to continuously ***convert knowledge resources*** and ideas into new products/services and organisational processes. According to Thoumrungroje and Racela (2022), such innovations are considered the most crucial element for companies seeking to provide the highest value proposition to the markets; therefore, these companies try to understand customers by acquiring market information so that they can anticipate changes in customer needs and behaviour.

As a result, it can be agreed with the summary provided by Visser (2020), who stated that embedded innovation is my term for scalable, breakthrough design and implementation solutions in the areas of systemic failure, so multi-level, multi-functional are improved through our interconnected economic, social, ecological, technological, and human systems. More simply put, integrated innovation means finding market-based solutions to problems for sustainable development.

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2.2. Incubation of innovations

Al Sharif et al. (2022) provide insights into an incubation program organised by one of the prominent centres in Qatar to incubate interested potential entrepreneurs who want to use ***open innovation in digital startups***. The article uses a qualitative method of data analysis obtained during interviews with the centre's instructors (employees) and entrepreneurs who have gone through the incubation process. Four hypotheses were developed to understand various aspects of open innovation, collaboration, the number of startups, and the role of the incubation centre. The results show that incubation and open innovation can contribute to digital startups. Habiburrahman et al. (2022) mentioned that factors influencing digital success from an incubator perspective, startups have eleven success factors with three different priorities. The priority levels consist of the following factors:
(1) synergy and product;
(2) process, innovation management, information technology, innovation skills, and functional skills;
(3) communication, culture, experience, and implementation skills.

Vaz et al. (2022) study extends previous research in the understudied field of ***incubation experiences*** of 16 entrepreneurs who are tenants of four technology business incubators located in the metropolitan area of Porto, Portugal. First, it illuminates several aspects these founders of technology-based startups perceive as contributing to and hindering their incubation experience. The incubation experience reported by the entrepreneur was generally positive and mainly motivated by the intangible resources provided during the incubation and the social and relational aspects experienced during the incubation process. However, it also revealed negative aspects of the incubation experience, mainly related to the irregular periodicity of mentoring sessions or shifts of mentors, training events provided by external entities, and several problems with using services provided by external incubator partners. Lin-Lian, De-Pablos-Heredero and Montes-Botella (2022) consider that the results confirm that business incubators create value in society, regardless of why entrepreneurs start their businesses. This job provides an opinion and a direct vision of how different profiles of entrepreneurs value contribution in the first stage of sustainability of business incubators. Pattanasak et al. (2022) recommend that academic researchers and BI prioritise the intangible factors that constitute the hidden value of an organisation. Thus, the review provides new findings by identifying common critical factors for BI performance and provides performance evaluation guidelines that consider BI intangible assets and trends for future studies.

Rodrigues et al. (2022) stated that ***the intellectual capital*** of the incubator company has a direct and positive relationship with innovation, satisfaction, and sustainability incubating companies. In turn, the innovative capacity of the incubated company has a direct and positive impact on sustainability. In addition, the sustainability of the incubating company and her satisfaction with the set company positively affect her competitive success. Management implications include realising that the more effort possible to improve incubated companies' human, structural, and communication capital, the better the results will be in supporting companies and helping startups develop sustainably and competitively in the market.

Bajwa et al. (2021) investigate thematic incubation for disaster risk reduction, climate change, and sustainable development with a possible approach to ***corporate sustainability***, culture innovation, entrepreneurship, science utilisation, and sustainability at the local level. Cirule and Uvarova (2022) explore the theoretical points and fundamentals of business incubation perspectives that facilitate the creation of ***sustainable value*** open innovation methods and test research tools for investigating technology-based factors in creating sustainable value in startups incubated in Latvia. Cirule et al.'s (2022) results show that climate change as a planetary boundary positively encourages the development of startup technology-based sustainable value creation. The incubator's location influences the pursuit of sustainability, affecting technology-based sustainable value creation. These results contribute to the business incubation of startups on the sustainability scale for new theoretical concepts related to integrating sustainability issues and open innovation practices in business incubation.

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3. Innovation and knowledge transfer in Lithuania: data analysis

3.1. Innovation ecosystem as knowledge transfer means in Lithuania

According to Su, Kajikawa, Tsujimoto & Chen (2018), innovation ecosystems are composed of interrelated organisations, including firms, government, intermediary agents, research institutes and universities, that are connected through a leading organisation or a technology platform to produce innovative goods or services.

De Andrade et al. (2023) considered that the knowledge-sharing process in digital startups is under development in the current debate, although its importance for sustainable economic growth is recognised. Piccinetti, Santoro and Rezk (2023) emphasised the importance of an innovation ecosystem for startups and other companies. Knowledge transfer is a way to share information, skills, and ideas across different areas of your business. This service is designed to provide the most efficient way for the knowledge transfer process. Transferred knowledge can be theoretical, practical, complex, or specific (specific procedures or processes).

Zhang, Wang and Chun (2022) found that knowledge sharing had a significant positive effect on all three elements of intellectual capital, while human capital and structural capital had a positive impact on innovations. Relational capital positively affected exploitable innovation but did not significantly impact research innovation. Zhang, Wang and Chun (2022) stated that, unexpectedly, there was no direct effect of knowledge sharing on ambiguous innovation, while the elements of intellectual capital are fully mediated. Companies should pay more attention to the role of relational capital when they embrace exploitative innovation. At the same time, we remind managers that innovation can be promoted only when knowledge sharing increases intellectual capital. Therefore, abuse management measures should be avoided, and ineffective management practices should be reduced. Furthermore, Zhang, Wang and Chun (2022) investigated the relationship between knowledge sharing and the open innovation paradigm and provided several suggestions for future research.

Wang et al. (2021) consider that knowledge is there an essential and unique resource for construction companies. According to Wang et al. (2021), an effective knowledge transfer process can enrich and update the company's knowledge base to improve the ability to solve problems and overcome challenges. Knowledge transfer can facilitate the company's innovation process. Pinto et al. (2019) analyse that usually requires the creation of networks related to sharing information and knowledge between producers, suppliers, and customers. Pinto et al. (2019) study that interactive information networks based on inter-organisational trust reflect the strength of knowledge transfer, and its potential benefits would reduce the risk of information asymmetry between partners.

Lithuania has been actively fostering innovation and technological development in recent years, aiming to strengthen its position in the global market. Here are some critical aspects of innovation development in Lithuania:

1) Government Support: The Lithuanian government has implemented several initiatives and support programs to encourage innovation. From 2014 to 2020, Lithuania has a National Innovation Strategy that outlines the country's vision, goals, and measures to enhance innovation and competitiveness (European Commission, 2023). The strategy aims to stimulate R&D activities, improve the innovation ecosystem, and increase cooperation between research institutions, businesses, and government bodies. As included in the reports from agencies like Invest Lithuania and government press releases, this includes tax incentives, grants, and funding opportunities for startups and innovative projects. Lithuania introduced a startup visa program to attract foreign startups and talents. This initiative simplifies the process for non-EU entrepreneurs to establish and develop their innovative businesses in Lithuania. The government-backed initiative *Startup Lithuania* supports startups through networking events, mentoring, access to funding, and international visibility. They organise events like *LOGIN*, *Startup Fair*, and *Startup Lithuania Roadshow* to showcase startups and connect them with investors and partners. Lithuania has established special economic zones and technological parks, such as Vilnius Tech Park and Kaunas Science and Technology Park, providing infrastructure and support services for technology-driven companies and startups. The Lithuanian government has introduced regulatory frameworks that foster innovation, particularly in the financial technology sector. The country’s progressive regulatory environment has attracted many fintech companies, leading to the issuance of specialised licenses for payment and electronic money institutions.

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2) Startup Ecosystem: A sufficiently effective startup ecosystem has been created in Lithuania. As stated in *The Lithuanian Startup Ecosystem 2022 Review*, Lithuania "is one of the fastest-growing startup ecosystems in Central and Eastern Europe since 2017. The combined enterprise value of startups HQd & founded in Lithuania has grown 16.8x between 2017 and 2022, against a CEE growth average of 4.2x." The country has actively nurtured a conducive environment for startups, fostering innovation and supporting entrepreneurship. According to *Startup Lithuania*, in June 2023, there are over 850 startups active in the country. Lithuania offers a supportive infrastructure for startups, including coworking spaces, incubators, and accelerators. Organisations like Vilnius Tech Park, Startup Highway, and Startup Wise Guys provide resources, mentorship, and networking opportunities for early-stage companies. Lithuania has emerged as a leading fintech hub in the European Union. The country's proactive approach to issuing specialised licenses for payment and electronic money institutions has attracted numerous fintech startups and companies. The startup ecosystem in Lithuania benefits from investment and funding opportunities. Angel investors, venture capital firms, and government grants support the growth of startups across various industries, including technology, biotech, and green energy.

3) *Research and Development (R&D):* The universities, scientific institutes, and colleges contribute to research in various fields, driving innovation in technology, life sciences, and more. Different clusters and innovation hubs that combine companies, research institutions, and government bodies seek to foster innovation and R&D collaborations. For instance, Sunrise Valley Science and Technology Park in Vilnius encourages innovation and collaboration among tech companies. Science and Technology Park of the Institute of Physics collaborates with business companies in laser technologies. Altogether, seven science and technological parks operate in Lithuania. Numerous private companies across sectors like biotechnology, information technology, engineering, pharmaceuticals, and more invest in R&D activities. Companies like *Thermo Fisher Scientific* and *Teva Pharmaceuticals* have R&D operations in Lithuania. Lithuania has been steadily increasing its investment in R&D. According to Hollanders (2023), in 2020, Lithuania's expenditure on R&D (GERD - Gross Domestic Expenditure on Research and Development) amounted to around 1.07% of GDP. This reflects a positive trend in R&D investment, though it is still below the EU's average. Lithuanian organisations actively participate in international collaborations and EU-funded research programs. Horizon Europe, the EU's flagship R&D program, allows Lithuanian researchers and organisations to participate in collaborative research projects. Joint research projects with partners from other countries contribute to knowledge exchange and technology transfer.

4) *Funding:* In Lithuania, various sources often fund innovations. Apart from government funding through multiple channels, such as the Research Council of Lithuania and the Ministry of Education, Science, and Sport, private investments, EU structural funds and programmes, and innovation grants exist. These funds support academic research, innovation initiatives, and technology development. Venture capital, angel investors, private equity firms, and corporate investments play a significant role in funding innovations in Lithuania. These investors often invest in startups, tech companies, and innovative businesses, supporting their growth and development. Programs like Horizon Europe, the European Regional Development Fund (ERDF), and the Cohesion Fund provide grants and support for innovative projects and businesses. Various grants, awards, and competitions exist from public and private entities in Lithuania. Crowdfunding platforms and alternative financing methods, such as peer-to-peer lending, are also utilised by innovators and entrepreneurs to raise funds for their projects or products.

3.2. Lithuanian research & development data analysis in the context of the European Union

The research method is based on a comparative statistical analysis of data available from credible sources of relevant data (Eurostat, OECD). The research aims to investigate impact factors and establish trends explaining changes significant for knowledge transfer and incubation in Lithuania in the context of the European Union.

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Research and development (R&D) is often considered a driving force behind economic growth, job creation, innovation, and increasing product quality. The European Commission evaluates the expenditure on research and technological development as a primary instrument for funding European research (European Commission, 2010). R&D lies at the heart of the EU's strategy to become the most competitive and dynamic knowledge-based economy; moreover, it became one of the Lisbon strategy's goals to increase R&D expenditure to at least 3% of the European Union's Gross Domestic Product (GDP). It is believed it would help create a unified and attractive research area of the business, the scientific society, and ordinary citizens' needs to transform Europe into a vibrant knowledge economy, boost economic growth, create more and better jobs and ensure lasting prosperity in Europe (European Commission, 2010). However, progress has remained too slow since the 3% goal was set in 2002.

Table 1. Comparison of expenditure on R&D in the European Union in 2011 and 2021 (as % of GDP)

	European Union	Ireland	Austria	Belgium	Bulgaria	Czechia	Denmark	Estonia	Greece	Spain	Italy	Cyprus	Croatia	Latvia
2011	2.02	1.55	2.67	2.17	0.53	1.55	2.95	2.31	0.68	1.33	1.20	0.45	0.74	0.72
2021	2.27	1.11	3.26	3.43	0.77	2.00	2.76	1.75	1.46	1.43	1.45	0.83	1.24	0.74
Change	*0.25*	*-0.44*	*0.59*	*1.26*	*0.24*	*0.45*	*-0.19*	*-0.56*	*0.78*	*0.10*	*0.25*	*0.38*	*0.40*	*0.02*
	Lithuania	Luxembourg	Poland	Malta	Netherlands	Portugal	France	Romania	Slovakia	Slovenia	Finland	Sweden	Hungary	Germany
2011	0.90	1.43	0.75	0.67	1.88	1.46	2.19	0.48	0.65	2.41	3.62	3.19	1.18	2.81
2021	1.11	1.04	1.43	0.65	2.27	1.68	2.22	0.47	0.92	2.13	2.99	3.40	1.64	3.13
Change	*0.21*	*-0.39*	*0.68*	*-0.02*	*0.39*	*0.22*	*0.03*	*0.01*	*0.26*	*-0.28*	*-0.63*	*0.21*	*0.46*	*0.32*

Source: based on Eurostat, OECD

GDP expenditure on research and technological development in the European Union's 27 countries has risen by 0.25% on average. Seven countries experienced a negative trend (Ireland, Denmark, Estonia, Luxembourg, Malta, Slovenia, and Finland), while others showed growth in expenditure on R&D. The highest growth could be observed in Greece (0.78%), Poland (0.68%), and Austria (0.59%).

In 2021, expenditure on research and technological development in the European Union's 27 countries represented an average of 2.27% of GDP. However, the required level of 3% of expenditure of GDP on R&D is achieved in Belgium (3.43%), Sweden (3.40%), Austria (3.26%), and Germany (3.13%).

Expenditure on research and development is divided into four main areas: business enterprises, government, higher education sector and private non-profit organisations. Costs are calculated regardless of funding source and are expressed as a ratio to GDP, known as R&D intensity.

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Table 2. Gross domestic expenditure on R&D in the European Union in 2011 and 2021 (as %)

	Business enterprise sector		Government sector		Higher education sector		Private non-profit enterprises	
	2011	2021	2011	2021	2011	2021	2011	2021
EU-27	56.258	58.069	33.644	30.292	0.916	1.186	1.165	1.174
Belgium	60.151	64.418	23.417	17.264	2.870	2.558	0.601	0.524
Bulgaria	16.925	32.930	38.763	26.068	0.199	0.658	0.183	0.216
Croatia	38.186	38.438	48.210	35.939	1.707	4.758	0.249	0.086
Czech Republic	37.683	36.054	41.717	32.319	0.935	0.992	0.007	0.090
Denmark	61.164	59.564*	48.152	28.696*	-	-	3.579	6.280*
Germany	65.585	62.779	29.887	29.964	-	-	0.349	0.321
Estonia	55.006	50.946	32.751	36.982	0.286	1.369	0.098	0.193
Ireland	48.877	55.525	29.444	16.764	0.746	0.560	0.587	0.897
Greece	32.739	38.296	49.238	44.455	2.269	2.548	1.001	0.316
Spain	44.312	50.240	44.476	37.458	3.981	3.981	0.551	0.867
France	55.044	55.428	35.149	32.457	1.262	2.93	0.797	1.491
Italy	45.088	53.912	41.905	35.148	0.886	0.681	3.063	1.455
Cyprus	11.994	35.663	69.809	36.740	3.832	3.426	0.449	1.953
Latvia	24.849	33.468	22.535	33.894	1.610	2.219	-	-
Lithuania	28.235	36.055	42.219	29.761	0.994	2.592	0.154	0.264
Luxembourg	45.304	44.181	33.543	46.989	0.524	1.273	1.167	0.445
Hungary	47.462	50.574	38.098	35.079	-	0.216	0.990	0.336
Malta	50.047	61.301	29.099	31.065	2.129	0.770	0.300	0.732
Netherlands	51.117	56.524	33.940	30.765	0.315	0.108	3.305	2.326
Austria	46.167	52.960	35.757	28.464	0.666	1.043	0.474	0.305
Poland	28.116	50.971	55.803	37.394	2.440	3.054	0.250	0.408
Portugal	44.716	53.658	41.770	35.584	5.358	3.256	2.124	1.182
Romania	37.406	55.172	49.130	31.646	1.172	0.475	0.227	0.143
Slovenia	61.228	48.728	31.510	24.306	0.231	0.519	0.011	0.041
Slovakia	33.853	45.704	49.753	37.919	1.848	1.966	0.388	0.535
Finland	67.012	58.084	25.033	25.576	0.149	0.588	1.263	1.736
Sweden	57.640	60.653	27.464	23.255	0.930	0.854	2.968	3.283

* - data of 2019

Source: Eurostat, OECD

According to the data of the European Statistics Office Eurostat, the largest share of funds for scientific research and technological development in the European Union is in use in the business sector (58.069%), followed by the government sector (30.292%), the higher education sector (1.186%) and private non-profit sector (1.174%).

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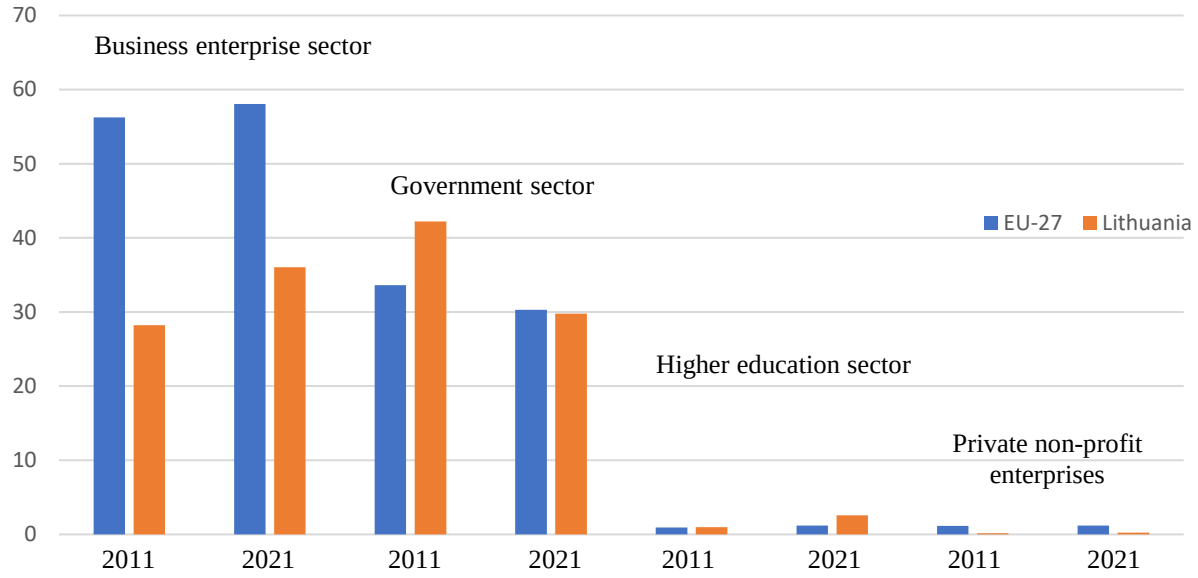

Figure 1. Comparison of gross domestic expenditure on R&D in the European Union and Lithuania in 2011 and 2021 (as %)

Source: based on Eurostat, OECD

The comparison of gross domestic expenditure on R&D has revealed the growing trend of spending on the business enterprise sector in the European Union. Interestingly, it affected Lithuanian performance, as, in the last decade, the leading position of the government sector was overtaken by the business enterprise sector, as well. The expenditure on R&D in the higher education sector has also risen in the country. However, the total amount of funding remains relatively low.

Regarding the European innovation scoreboard (2023), all European countries may be identified as a part of different innovation growth groups.

Table 3. European Innovation Scoreboard data

Innovation leaders	Denmark (137.6%), Sweden (134.5%), Finland (134.3%), Netherlands (128.7%), Belgium (125.8%)
Strong innovators	Austria (119.9%), Germany (117.8%), Luxembourg (117.2%), Ireland (115.8%), Cyprus (105.4%), France (105.3%)
Moderate innovators	Estonia (98.6%), Slovenia (95.1%), Czechia (94.7%), Italy (90.3%), Spain (89.2%), Malta (85.8%), Portugal (85.6%), Lithuania (83.8%), Greece (79.5%), Hungary (70.4%)
Emerging innovators	Croatia (69.6%), Slovakia (64.2%), Poland (62.8%), Latvia (52.5%), Bulgaria (46.7%), Romania (33.1%)

Source: European Innovation Scoreboard, 2023

Denmark is the new top innovator with the best performance in the EU, overtaking Sweden after a few years in a leading position. Other Innovation Leaders are Sweden, Finland, the Netherlands, and Belgium. Austria, Germany, Luxembourg, Ireland, Cyprus, and France are Strong innovators, performing above the EU average. Croatia, Slovakia, Poland, Latvia, Bulgaria, and Romania are Emerging Innovators. Lithuania, Estonia, Slovenia, Czechia, Italy, Spain, Malta, Portugal, Greece and Hungary are Moderate innovators.

European Innovation Scoreboard (2023), evaluating Lithuania's performance, praises the level of population with tertiary education, non-R&D innovation expenditures, collaboration of innovative SMEs, trademark

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applications; however, it suggests increasing knowledge-intensive services exports, government support for business R&D, and, R&D expenditure in the business sector.

3.3. Research results' discussion and limitations

Based on the above considerations, the European Union still struggles to implement the Lisbon Strategy of supporting innovation development by investing in R & D at least 3% of the gross domestic product. As for 2021, the level of expenditure on R&D achieved an average level of 2,27% among all 27 European Union countries. Lithuania increased the level of spending by 0,21% in the last decade. However, the overall level of the country's funding is less than half of the EU's average (1,11%).

Despite the relatively low level of R&D expenditure, the growing trend of support for the business enterprise sector, common for the European Union, in Lithuania was also indicated. Moreover, in the last decade, the leading position of R&D expenditure in the government sector was overtaken by the country's business enterprise sector. Additionally, the rising trend of expenditure of R&D in the higher education sector in the country was indicated, as well. The overall results provided by the European Innovation Scoreboard include Lithuania among Moderate innovators and suggest increasing knowledge-intensive services exports, government support for business R&D, and R&D expenditure in the business sector.

Regardless of the limitations related to the specifics of the analysed period due to the pandemic, the established impact factors suggest keeping an eye on the expenditure level on R&D in various sectors contributing to the innovation development and knowledge transfer since a speedier transition toward a more sustainable future depends on the ability of market actors to create and adopt social and technological innovations.

Conclusions

The theoretical background of innovation and knowledge transfer can be characterised by a combination of various ideas and approaches, including sustainability-oriented open innovations and knowledge resources development by keeping the importance of concepts of novelty, breakthrough innovation and the need to make technological decisions. Therefore, the current trend in knowledge transfer is focused on developing open innovations in digital startups, emphasising the role of incubation experience, intellectual capital and sustainable value of corporate sustainability.

Analysis of the innovation ecosystem in Lithuania highlighted the importance of Government support, which is deeply involved in funding R&D processes important for creating a vital startup ecosystem. Technology parks and business incubators are some of the most common and suitable ways of high technology development in countries which orientate their economy into knowledge-based industrial sectors:

- Technology parks and business incubators are the leading high technology transfer and incubation forms, which ensure high technology sector development by meeting industrial, academic and government needs.
- Technology parks and business incubators allow the development of significant sectors of high-tech industries for small and medium-sized enterprises, which, according to many scientists' opinions, is a priority for such business sectors.

Despite similarities, there is a significant difference between both forms of technology transfer and incubation: while incubators focus on new enterprise development, science and technology parks aim to establish a concentration of firms or industries in a particular area and are associated with technology transfer objectives. In Lithuania, they specialise primarily in consulting and other services rather than in research programs and technology development. This may be explained by the growing percentage of employment in the knowledge-intensive service sector and the decreasing average employment in industry in Lithuania.

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Moreover, while Research and Development is often considered a driving force and the European Commission has established the limit on R&D at 3% of GDP, in Lithuania, this indicator achieves just 1,11%. Nevertheless, the growing trend in expenditure on the business enterprise sector in the European Union has accordingly affected the allocation of funding among different sectors in Lithuania. Therefore, regarding the European Innovation Scoreboard 2023, in terms of innovation growth, nowadays, the country is among a group of moderate innovator countries with a growing trend of gross domestic expenditure on R&D in the business sector. Based on the study results, it is essential to reconsider the economic policy of lagging behind countries by emphasising development factors impacting the faster development of innovations since a speedier transition toward a more sustainable future depends on the ability of market actors to create and adopt social and technological innovations.

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