LITHUANIA'S PATENT PARADOX: A COMPARATIVE ANALYSIS OF INNOVATION POTENTIAL AND PATENT PERFORMANCE

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ABSTRACT
Lithuania combines strong human-capital and selected innovation indicators with comparatively weak patent performance. According to the European Innovation Scoreboard 2026, Lithuania reaches 86.6% of the EU average in overall innovation performance, while PCT patent applications amount to only 40.4%. This article examines the factors associated with this apparent patent paradox, using Estonia, Latvia and Poland as comparative cases. Drawing on European Innovation Scoreboard data, supplemented by European Commission, EPO, WIPO and Eurostat evidence and recent scholarly literature, the study applies a research-to-patent conversion framework linking innovation inputs, business R&D, science-business interaction, and intellectual-property outputs. The findings indicate that Lithuania's patent gap is associated with low business R&D intensity, relatively weak science-business linkages, fragmentation of the public research base, technology-transfer capacity, sectoral structure and commercialisation constraints. Comparative evidence suggests that stronger R&D inputs alone are insufficient without effective knowledge-transfer mechanisms.
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Introduction

Intellectual property rights, and patents in particular, occupy an important place in knowledge-based economies. Patents provide legal protection for technological inventions, and can facilitate licensing, investment and the commercialisation of technological knowledge. At the same time, patenting behaviour differs substantially across industries and types of innovation, and patent counts should therefore not be treated as a comprehensive measure of innovation performance (Arundel, Kabla, 1998).

For small and catching-up economies, the capacity to generate internationally protectable technological inventions is nevertheless an important indication of the extent to which research and innovation capabilities are transformed into proprietary knowledge. Against this background, Lithuania presents an analytically interesting case.

According to the European Innovation Scoreboard 2026 (EIS 2026), Lithuania achieves a Summary Innovation Index (SII) equivalent to 86.6% of the EU average, and ranks 18th among EU member states, placing it in the Moderate Innovator group (European Commission, 2026a). Several indicators point to substantial innovation potential. The population with tertiary education reaches 187.0% of the EU average, and ranks third in the EU, while job-to-job mobility of human resources in science and technology (HRST) reaches 183.3%, and ranks first. Venture-capital expenditure stands at 114.7% of the EU average. Trademark applications reach 156.9%, placing Lithuania fifth among EU member states.

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At the same time, indicators more closely associated with internally generated technological knowledge remain considerably weaker. Business enterprise R&D expenditure (BERD) stands at only 26.9% of the EU average, and ranks 23rd. Direct and indirect government support for business R&D reaches 29.9%, while PCT patent applications reach only 40.4%, ranking Lithuania 25th among EU member states. Public-private co-publications, used as one proxy for formal interaction between science and industry, stand at 87.3% of the EU average.

This contrast forms the central empirical problem of the article. Lithuania performs relatively strongly in several dimensions associated with human capital, entrepreneurship, innovation activity and market-oriented intellectual property, but substantially less strongly in internationally oriented patenting. The term patent paradox is used here to describe this divergence, rather than to imply that Lithuania should necessarily generate patents at the same rate as economies with different industrial structures.

The temporal evidence adds another dimension to this problem. EIS 2026 reports that Lithuania's overall innovation performance improved by 19.7 percentage points relative to the 2019 benchmark, exceeding the improvement in the EU as a whole. Over the same period, however, the performance-change indicator for PCT patent applications was -7.8 percentage points. Thus, broader innovation performance has improved, without a corresponding improvement in relative patent performance (European Commission, 2026a).

A comparison with neighbouring economies further motivates the analysis. Estonia records an SII of 108.6% of the EU average, and a PCT patent score of 66.7%. Latvia and Poland both perform below Lithuania on the overall SII, at 61.0% and 65.2% respectively, yet their PCT patent scores, at 48.7% and 44.2%, are somewhat above Lithuania's. The patent gap can therefore not be explained simply by Lithuania's general level of innovation development.

The research problem is the apparent discrepancy between Lithuania's broader innovation potential and its comparatively weak patent performance.

The object of the research is the conversion of innovation and research capabilities into patentable technological outputs in Lithuania.

The aim of the article is to identify the structural, institutional and policy-related factors associated with Lithuania's patent gap, and, through a comparison with Estonia, Latvia and Poland, to assess which aspects of neighbouring innovation systems may provide relevant lessons for Lithuania.

The article addresses four research questions. RQ1: How does Lithuania's patent performance compare with Estonia, Latvia and Poland in the context of broader innovation-system indicators? RQ2: What structural, institutional and policy-related factors are associated with Lithuania's relatively weak research-to-patent conversion? RQ3: What relevant lessons can be drawn from Estonia, Latvia and Poland? RQ4: What policy and management measures could strengthen Lithuania's capacity to transform research and innovation capabilities into patentable and commercially exploitable technological knowledge?

1. The theoretical framework

1.1. National Innovation Systems and small open economies

The National Innovation System (NIS) approach emphasises that innovation depends not only on individual firms or research organisations, but also on interactions between firms, universities, public research institutions, government bodies, and other actors in an institutional environment (Lundvall, 1992).

In a well-functioning innovation system, scientific and technological knowledge generated within universities and research organisations can move through collaborative research, technology transfer, researcher mobility and other mechanisms, into the business sector. Firms, in turn, require sufficient technological and organisational capabilities to absorb this knowledge, develop commercially relevant innovations, and use appropriate mechanisms to protect and exploit them.

The Triple Helix framework similarly emphasises relationships between universities, industry and government in knowledge-based innovation systems (Etzkowitz, Leydesdorff, 2000). The value of research therefore depends not only on scientific production, but also on the mechanisms connecting research organisations with potential users of knowledge.

This issue is particularly relevant to smaller and catching-up economies. Compared with large innovation-intensive economies, smaller countries often have fewer large firms with extensive internal R&D programmes, and a narrower technological specialisation base. Effective connections between public research, business R&D and technology transfer therefore become especially important.

Kleszcz and Rusek (2022) demonstrate considerable heterogeneity in patent performance among the EU-13 countries. Their analysis indicates that common institutional developments, including EU accession, have not produced uniform patenting outcomes. The result reinforces the importance of country-specific capabilities and innovation-system structures.

1.2. Absorptive capacity

The concept of absorptive capacity provides an important theoretical link between research inputs and technological outputs. Cohen and Levinthal (1990) define absorptive capacity as the ability of an organisation to recognise the value of external knowledge, assimilate it, and apply it commercially.

Internal R&D has a dual role in this process. It can directly generate technological inventions, but it also develops the organisational knowledge required to understand and exploit knowledge produced elsewhere. Consequently, firms with little internal R&D may have difficulty commercialising even high-quality research produced by universities or public research institutions.

Paliokaitė (2019) shows that this issue is particularly relevant in catching-up economies. Firms operate at different technological capability levels, and therefore require differentiated innovation-policy instruments. Policies that assume that all enterprises can immediately transform public support or scientific knowledge into R&D-intensive innovation may have limited effectiveness.

Research on Nordic-Baltic knowledge transfer likewise demonstrates that absorptive capacity is multidimensional, and affects the ability to benefit from external knowledge flows (Šimelytė, Tvaronavičienė, 2022). This distinction is relevant to Lithuania, where high educational attainment and substantial labour mobility coexist with comparatively weak business R&D.

1.3. University-industry technology transfer and knowledge valorisation

The transition from research to patentable and commercially exploitable technology requires a number of intermediary processes. Potential inventions must be identified, assessed, protected when appropriate, and linked to firms, investors or entrepreneurial teams capable of developing them further.

Technology transfer offices (TTOs), innovation centres, incubators and other intermediary organisations can facilitate this process. Micozzi et al. (2021) provide evidence that strengthening human resources in technology transfer offices can positively affect technology-transfer and intellectual-property valorisation outcomes. Their findings emphasise that formal organisational structures alone are insufficient without specialised professional capabilities.

Ravi and Janodia (2022) similarly identify organisational support, incentives, university-industry relationships and institutional capabilities among factors affecting university technology transfer and commercialisation.

Regional technological specialisation must also be taken into account. Caviggioli et al. (2023) demonstrate substantial heterogeneity in the co-evolution of university and industrial technological specialisation across European regions. Scientific knowledge is more likely to generate local technological applications when research capabilities and industrial technological demand can interact effectively.

Innovation incubators and related intermediaries may also contribute to knowledge-transfer ecosystems, although their effects depend on the wider institutional environment (Išoraitė et al., 2024). Studies of intellectual-property commercialisation further show that legislation, university support and links between academia and industry influence the capacity to derive economic value from protected knowledge (Tkeshelashvili et al., 2024).

1.4. Research-to-patent conversion chain

On the basis of these theoretical perspectives, the article uses a research-to-patent conversion chain as an analytical framework.

Stage 1: Innovation inputs. Human capital, research resources, business R&D investment, venture capital and public support provide the resources from which technological innovation can emerge.

Stage 2: Intermediary linkages. Collaboration between firms and research organisations, researcher mobility and technology-transfer mechanisms influence whether knowledge moves between actors and is developed further.

Stage 3: Intellectual-property outputs. Patent applications represent one potential outcome of technological invention, while trademarks and designs represent other forms of intellectual-property activity.

The framework does not imply that all innovation should lead to patents. Rather, it provides a structure for examining whether a relatively low level of patenting reflects weaknesses in R&D inputs, knowledge-transfer mechanisms, sectoral characteristics, intellectual-property strategies or commercialisation conditions.

2. Data sources and methodology

2.1. Data sources

The principal quantitative source is the European Innovation Scoreboard 2026 (Gotti et al., 2026). EIS 2026 provides a harmonised comparative assessment of national innovation systems using 32 innovation indicators. Indicator values are normalised to enable comparisons between countries.

Country profiles for Lithuania, Estonia, Latvia and Poland are used to examine national strengths, weaknesses and policy context (European Commission, 2026a-d). Additional evidence is drawn from the 2026 European Semester Country Report for Lithuania, Eurostat, the European Patent Office (EPO), the World Intellectual Property Organization (WIPO), and relevant national and institutional sources.

A methodological distinction is important. Values reported in EIS 2026 are current benchmarking scores indexed to the EU average in 2026, but the underlying statistical observations do not all originate from the 2026 calendar year. The EIS uses the latest available data for each indicator. Therefore, the term ‘EIS 2026 score’ is used, rather than assuming that each underlying observation refers to 2026.

Table 1. Indicators used in the research-to-patent framework

Stage	Indicator	EIS code	Principal source	Definition
Human capital	Population with tertiary education	1.1.2	Eurostat	Population aged 25–34 with tertiary education
Finance	Venture-capital expenditure	2.1.2	Invest Europe / EIS	Venture-capital expenditure relative to GDP
Finance	Direct and indirect government support of business R&D	2.1.3	Eurostat/OECD	Public support for business R&D relative to GDP
Firm capability	R&D expenditure in the business sector	2.2.1	Eurostat	BERD relative to GDP
Linkages	Innovative SMEs collaborating with others	3.2.1	Eurostat/CIS	Innovative SMEs engaged in innovation cooperation
Linkages	Public-private co-publications	3.2.2	Clarivate/WoS	Public-private scientific co-publications per million population

Stage	Indicator	EIS code	Principal source	Definition
Linkages	Job-to-job mobility of HRST	3.2.3	Eurostat/LFS	Mobility of human resources in science and technology
IP output	PCT patent applications	3.3.1	EPO/WIPO	PCT patent applications relative to GDP in PPP
IP output	Trademark applications	3.3.2	EUIPO	Trademark applications relative to GDP in PPP
IP output	Design applications	3.3.3	EUIPO	Design applications relative to GDP in PPP

Source: Compiled by the author, based on European Innovation Scoreboard 2026 methodology.

2.2. Methodology

The article applies a comparative secondary-data design combining quantitative benchmarking and qualitative institutional analysis.

Lithuania is treated as the principal case. Estonia, Latvia and Poland are used as comparators, because they represent geographically and institutionally relevant but different innovation-system configurations.

The comparison does not assume that any of the three countries represents a universally superior model. Estonia performs substantially above Lithuania on the overall innovation index and several linkage indicators. Latvia performs below Lithuania overall, but somewhat above it on the PCT patent indicator. Poland combines considerably stronger business R&D and government R&D support, with patent performance only modestly above Lithuania.

Quantitative analysis is based primarily on the current EIS 2026 benchmarking scores, and on the internally recalculated EIS 2026 performance trends. Values from separate historical EIS editions are not mechanically combined, because methodological and normalisation revisions can alter historical scores.

No regression analysis is conducted. A four-country sample is insufficient for robust econometric inference, and the study does not claim to establish causal relationships. Rather, the comparison is used to identify patterns and plausible structural or institutional constraints.

The study is also subject to measurement limitations. PCT patent applications measure filing activity rather than patent grants, technological quality or commercial value. Patenting propensity varies significantly between sectors and firm types. Furthermore, national-level indicators can conceal substantial regional, sectoral and firm-level variation. These limitations are taken into account in interpreting the results.

3. Lithuania's innovation and patenting profile

3.1. Overall innovation performance

Lithuania's EIS 2026 Summary Innovation Index is 86.6% of the EU average, placing the country 18th among EU member states.

The national profile is heterogeneous, rather than uniformly weak or strong. Lithuania performs particularly well in job-to-job mobility of HRST, population with tertiary education, trademark applications, non-R&D innovation expenditure, employed ICT specialists, and selected other indicators.

At the same time, business R&D, government support for business R&D, knowledge-intensive services exports and PCT patent applications remain among the country's relative weaknesses.

Table 2. Selected innovation and patent indicators, EIS 2026

Indicator (% of EU average)	Lithuania	Estonia	Latvia	Poland
Summary Innovation Index	86.6	108.6	61.0	65.2
Intellectual Assets	87.5	131.4	75.9	85.9
PCT patent applications	40.4	66.7	48.7	44.2
Trademark applications	156.9	214.4	133.4	103.6
Design applications	84.0	138.4	57.0	124.9
Business R&D expenditure	26.9	79.3	20.0	58.6
Government support for business R&D	29.9	42.1	4.4	76.4
Venture-capital expenditure	114.7	227.4	41.8	27.1
Public-private co-publications	87.3	242.9	101.8	66.1
Innovative SMEs collaborating	91.8	174.1	61.0	50.1
HRST job-to-job mobility	183.3	156.2	87.5	100.0

Source: European Commission (2026a-d). Scores are indexed to the EU average in 2026.

3.2. Strengths of Lithuania's innovation potential

Human capital is one of Lithuania's clearest strengths. The population with tertiary education reaches 187.0% of the EU average, while HRST job-to-job mobility reaches 183.3%.

High mobility can potentially facilitate the circulation of knowledge across organisations, although the indicator does not demonstrate that mobility occurs specifically between universities and technology-intensive businesses.

Venture-capital expenditure also remains above the EU benchmark, at 114.7%. However, venture-capital data are volatile in small economies, and a high aggregate score does not necessarily mean that financing is equally accessible across all sectors and stages of technological development.

Trademark applications represent another clear strength, at 156.9% of the EU benchmark. This suggests substantial activity in market-oriented intellectual property, although trademark applications and patents represent different forms of protection, and should not be treated as interchangeable innovation outputs.

Together, these indicators provide the basis for the 'innovation potential' component of the patent paradox examined in this article.

3.3. The patent gap

Lithuania's PCT patent performance remains substantially below both its overall innovation performance and the EU average.

The EIS 2026 current benchmarking score for PCT patent applications is 40.4%, compared with the SII of 86.6%. Patent applications are therefore among Lithuania's weakest relative indicators.

The trend data reinforce this difference, but they need to be interpreted using the EIS methodology, rather than by directly comparing scores reported in separate annual editions.

According to the recalculated EIS 2026 time series, Lithuania's overall innovation performance improved by 19.7 percentage points between the 2019 benchmark and 2026. Over the same comparison, the PCT patent performance indicator changed by -7.8 percentage points. Business R&D expenditure improved by 7.2 percentage points, while public-private co-publications improved by 29.1 percentage points.

This evidence supports the argument that relative patent performance has not improved in parallel with Lithuania's broader innovation performance.

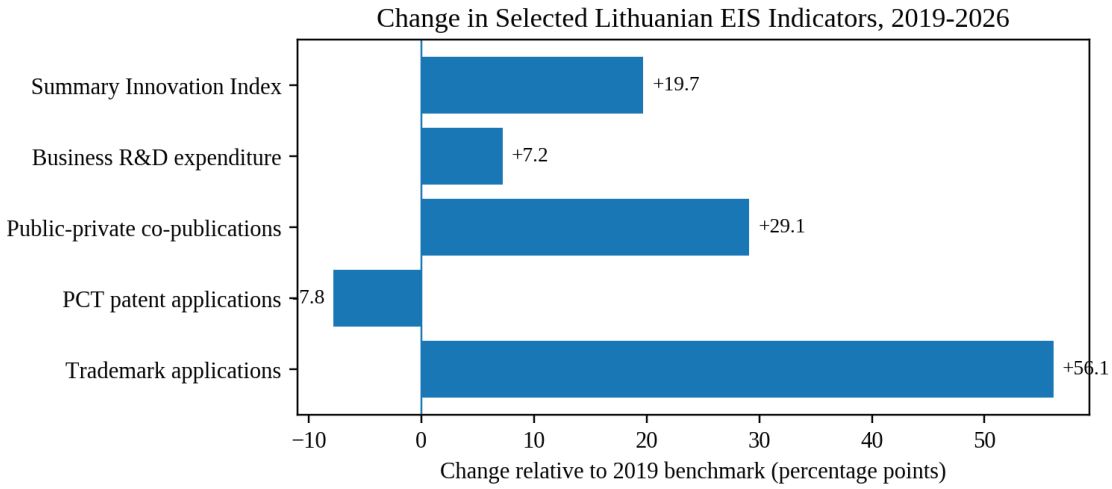


Fig 1. Change in selected Lithuanian EIS indicators, 2019–2026

Source: European Commission, 2026a.

3.4. Internal asymmetry in intellectual-property performance

Lithuania's overall Intellectual Assets score is 87.5% of the EU average. However, this aggregate combines substantially different results across PCT patents, trademarks and designs.

PCT patent applications stand at 40.4%, trademark applications at 156.9%, and design applications at 84.0%.

The high trademark score therefore coexists with weak patent performance. This should not be interpreted simply as evidence that firms choose trademarks instead of patents. Patent and trademark protection serve different purposes, and are strongly influenced by sectoral structure.

Nevertheless, the divergence is analytically useful. Lithuania appears more successful in generating some types of market-oriented intellectual-property activity than in producing internationally oriented patent applications arising from technological invention.

4. Comparative analysis

4.1. Estonia: stronger R&D and innovation linkages

Estonia represents the strongest innovation system among the four countries examined. Its EIS 2026 Summary Innovation Index reaches 108.6% of the EU average, classifying it as a Strong Innovator.

Its PCT patent score of 66.7% remains below the EU average, but is considerably above Lithuania's 40.4%.

The differences are even more pronounced in some intermediate stages of the proposed conversion chain. Estonia's business R&D expenditure reaches 79.3% of the EU average, compared with Lithuania's 26.9%. Public-private co-publications reach 242.9%, while innovative SME collaboration reaches 174.1%.

Estonia also records venture-capital expenditure of 227.4% of the EU benchmark.

These results do not establish that any one indicator causes Estonia's higher patent performance. They do, however, show that stronger patent performance coexists with considerably stronger firm-level R&D and measured science-business linkages.

The institutional context reinforces this interpretation. Estonia operates the SekMo intersectoral-mobility measure, which supports the movement of researchers, highly qualified specialists and knowledge-transfer doctoral candidates between research organisations and other sectors. The country also supports applied research and knowledge valorisation through several institutional mechanisms.

Estonia's deep-tech ecosystem provides further evidence of a comparatively research-intensive entrepreneurial pipeline. The Baltic Deep Tech Report 2025 reports that Estonia accounted for 56% of Baltic deep-tech funding (Startup Estonia, 2026).

The main comparative lesson for Lithuania is not that Estonia's institutional architecture can be copied directly. Rather, the Estonian case suggests that stronger business R&D, knowledge-transfer mechanisms and access to risk capital can operate as complementary parts of an innovation system.

4.2. Latvia: a useful country example

Latvia has the weakest overall innovation performance among the four countries examined. Its EIS 2026 SII reaches 61.0% of the EU average.

Business R&D expenditure stands at 20.0%, while direct and indirect government support for business R&D is only 4.4%. Venture-capital expenditure is also significantly below the EU benchmark.

Despite these weaknesses, Latvia's PCT patent score reaches 48.7%, somewhat above Lithuania's 40.4%.

The Latvian case is therefore particularly important for interpretation. It shows that patent performance is not a simple linear function of the overall innovation index, public R&D support, or business R&D expenditure.

Sectoral composition, the concentration of patenting among particular firms or technological fields, differences in applicant structure, and other factors, may influence the result. Testing these explanations would require patent-level and sector-level data beyond the scope of this article.

Latvia is also preparing reforms aimed at facilitating research commercialisation and reducing administrative barriers to technology transfer. These reforms are relevant as comparative policy developments, but because they are recent, their impact on patenting should not yet be assumed.

4.3. Poland: stronger financial inputs, modest patent difference

Poland provides a different configuration.

Its direct and indirect government support for business R&D reaches 76.4% of the EU average, compared with Lithuania's 29.9%. Business R&D expenditure reaches 58.6%, more than twice Lithuania's relative score.

Despite these considerably stronger R&D inputs, Poland's PCT patent score is 44.2%, only modestly above Lithuania's 40.4%.

Poland's innovation linkage indicators are also comparatively weak. Public-private co-publications stand at 66.1%, while innovative SME collaboration reaches 50.1%, both below Lithuania's.

This result is consistent with the proposition that greater R&D financing alone does not automatically translate into proportionately higher international patenting.

Karpińska and Protasiewicz (2021) similarly identify organisational, financial and legal conditions affecting patent activity in Poland.

The Polish experience therefore provides an important qualification for Lithuanian policy: stronger business R&D and public support may be necessary components of technological upgrading, but they need to operate alongside effective knowledge-transfer, institutional and commercialisation mechanisms.

4.4. Comparative conversion profiles

The three comparator countries display different configurations.

Estonia combines relatively strong business R&D, venture capital, collaboration indicators, and higher PCT patent performance.

Latvia combines relatively weak innovation inputs with patent performance somewhat above Lithuania.

Poland combines stronger business R&D and substantially stronger public R&D support with patent performance only slightly higher than Lithuania, and weaker measured science-business linkages.

Lithuania, by comparison, combines strong human capital, HRST mobility and trademark activity with comparatively weak business R&D and PCT patenting.

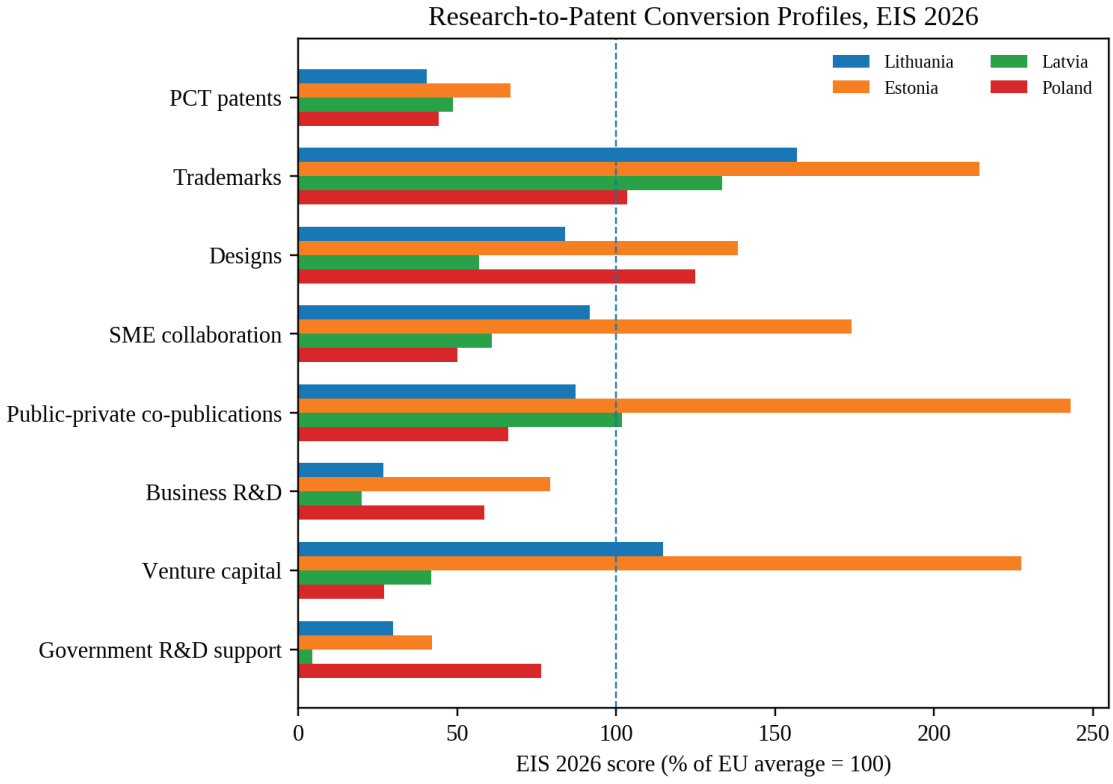


Fig 2. Research-to-Patent Conversion Profiles, EIS 2026

Source: European Commission (2026a-d). All values are indexed to the EU average = 100.

5. Factors associated with Lithuania's patent gap

5.1. Low business R&D expenditure

Lithuania's low business R&D intensity is the most direct constraint identified by the comparative analysis.

Business R&D expenditure reaches only 26.9% of the EU average, compared with 79.3% in Estonia and 58.6% in Poland.

Patentable technological inventions generally require sustained investment in research, experimentation and technological development. Internal R&D also contributes to the absorptive capacity required to understand and exploit external knowledge (Cohen, Levinthal, 1990).

The European Commission's analysis characterises Lithuania as comparatively reliant on technology absorption and adaptation, rather than internal R&D. This does not mean that technology adoption is economically undesirable. Adoption and adaptation can generate significant productivity and innovation benefits.

However, an innovation model strongly oriented towards the acquisition and adaptation of existing technologies is less likely to produce a large flow of proprietary patentable inventions.

The relevant policy challenge is therefore not simply to replace technology adoption with R&D, but to increase the number of firms capable of moving towards proprietary technological development, where such a strategy is commercially appropriate.

5.2. Public support and R&D incentives

Direct and indirect government support for business R&D in Lithuania reaches only 29.9% of the EU average.

The 2026 European Semester assessment notes that Lithuania already provides relatively generous R&D tax incentives, but that their uptake remains limited, particularly among smaller enterprises.

At the time of the European Semester assessment, the Ministry of the Economy and Innovation had proposed simplifying the process and introducing *ex ante* assessment of activities qualifying as R&D, but the reform had not yet passed the government vote.

The significance of this reform lies less in increasing the nominal generosity of R&D incentives than in improving their predictability and accessibility.

However, Poland demonstrates that high public support does not automatically produce strong patent outcomes. The design of support instruments, firm capabilities and the wider technology-transfer system are also relevant.

5.3. Fragmentation and critical mass in the public research system

The 2026 European Semester Country Report describes Lithuania's public science base as fragmented, comprising seven colleges, 11 universities, and 11 research institutes.

The Commission argues that this fragmentation can limit critical mass, and hinder the production and commercialisation of high-quality research.

The significance of fragmentation should nevertheless be interpreted carefully. The number of institutions alone does not determine research or patent performance. Relevant issues include the scale and quality of research groups, technological specialisation, access to research infrastructure, and the availability of specialised technology-transfer capabilities.

Caviggioli et al. (2023) demonstrate that regional technology transfer also depends on the alignment between university technological specialisation and industrial capabilities.

For Lithuania, the practical question is therefore not only whether the public research network should become more concentrated, but how research capabilities can achieve sufficient scale and connect more effectively with technological demand.

5.4. Science-business linkages and technology transfer

Lithuania's public-private co-publication score of 87.3% is below the EU average, and substantially lower than Estonia's 242.9%.

Public-private co-publications capture only one form of interaction, and should not be treated as a complete measure of university-industry cooperation. Nevertheless, the difference is consistent with the broader European Commission assessment that science-business linkages in Lithuania remain limited.

Interestingly, Lithuania performs strongly on general human-capital indicators. The population with tertiary education reaches 187.0% of the EU average, while HRST job-to-job mobility reaches 183.3%.

Thus, a highly educated and mobile workforce does not automatically guarantee extensive research cooperation between businesses and scientific institutions.

The professional capacity of technology-transfer intermediaries is important in this context. Micozzi et al. (2021) show that strengthening TTO human resources can improve technology-transfer outcomes. Lithuania has already introduced initiatives to strengthen Innovation and Technology Transfer Centres, including proof-of-concept activities, commercial-potential assessment, IP protection and international technology-transfer networking.

The key issue is therefore not simply to create additional organisations, but to ensure that existing transfer mechanisms have sufficient expertise, scale and incentives to move promising research towards market application.

5.5. Sectoral structure and intellectual-property strategy

Part of Lithuania's patent gap is likely to reflect sectoral structure, rather than an institutional failure.

Arundel and Kabla (1998) demonstrate substantial differences in firms' propensity to patent innovations across industries. Patents are particularly important in some technology-intensive industries, while service firms and businesses relying on complex know-how may prefer secrecy, lead time, copyright, trademarks, or other appropriation mechanisms.

EIS structural indicators show that employment in high and medium-high-technology activities is substantially lower in Lithuania than the EU average.

Lithuania's high trademark score and low patent score should therefore not be interpreted as evidence that firms are making an incorrect intellectual-property choice. For many firms, trademark or other protection may be commercially more appropriate than patenting.

This distinction has an important policy consequence. A simple national target to increase the number of patent applications could encourage low-value patenting without strengthening innovation.

The more relevant objective is to ensure that genuinely patentable and commercially promising inventions are identified and appropriately protected.

5.6. Financing and commercialisation

Lithuania's venture-capital indicator is above the EU average, but this does not imply that all stages of technology commercialisation are adequately financed.

Research-intensive technologies frequently require long development periods and significant investment in proof of concept, prototyping, testing, certification, manufacturing or market validation, before commercial revenues appear.

The 2026 European Semester Country Report also identifies broader limitations in Lithuania's financing system, including shallow capital markets, and substantial reliance on internal financing.

This may be particularly significant for technology-intensive SMEs and academic spin-offs.

Marzougui et al. (2024) show in the university context that patent creation alone does not ensure successful valorisation. Financing, industry links and commercial capabilities remain necessary after patent protection has been obtained.

Commercialisation finance should consequently be viewed as part of the broader patent ecosystem, rather than as an issue arising only after patenting.

6. Policy and management implications

6.1. Comparative policy lessons

The comparison with Estonia, Latvia and Poland suggests that the Lithuanian patent gap cannot be addressed through one policy instrument.

Table 3. Comparative lessons and possible relevance for Lithuania

Country	Mechanism	Relevance for Lithuania	Qualification
Estonia	SekMo intersectoral mobility and knowledge-transfer doctorates	Could strengthen direct researcher-business interaction	Requires evaluation of outcomes, not only mobility numbers
Estonia	Applied research and technology-transfer support	Relevant for strengthening intermediary capabilities	Institutional arrangements cannot be transferred mechanically
Estonia	Stronger deep-tech and venture-capital ecosystem	Demonstrates potential complementarity between research and risk capital	Small-economy VC data are volatile
Poland	Higher public support for business R&D	Shows the potential role of larger R&D support	Patent performance remains only modestly above Lithuania
Latvia	Research-commercialisation reform under preparation	Provides a neighbouring policy experiment addressing administrative barriers	Effects cannot yet be evaluated
Latvia	Higher-education and research restructuring	Relevant to Lithuania's critical-mass debate	Consolidation alone does not guarantee commercialisation

Source: Compiled by the author from European Commission, 2026a–d; European Semester reports and Startup Estonia, 2026.

6.2. Recommendations for Lithuania

First, the accessibility and predictability of business R&D incentives should be strengthened. The proposed simplification of R&D tax incentives and *ex-ante* clarification of eligible activities address a genuine barrier identified by the European Commission. Future evaluation should focus not only on the number of firms using incentives, but also on whether supported firms sustain R&D activity and generate commercially relevant technological outputs.

Second, technology-transfer capacity should be strengthened through professional specialisation. Existing Innovation and Technology Transfer Centres provide an institutional basis. Further development should focus on access to patent, licensing, market-validation and technology-commercialisation expertise. In a small research system, some specialist functions may be more efficiently organised as shared capacities across institutions.

Third, researcher-industry interaction could be expanded. Estonia's SekMo programme provides a relevant example of an instrument designed explicitly to increase cross-sector knowledge flows. Lithuanian initiatives could similarly support researchers, doctoral candidates and highly qualified specialists working on applied R&D projects across institutional boundaries.

Fourth, proof-of-concept and early commercialisation finance should complement patent support. Public assistance should not reward patent filing as an end in itself. Instead, support should help promising inventions reach technical and commercial validation stages where private investors can make more informed decisions.

Fifth, the issue of critical mass in the public research system should be addressed on the basis of evidence. The planned evaluation of Lithuania's public science base provides an opportunity to assess where consolidation, shared infrastructure or stronger institutional cooperation could improve research quality and commercialisation. The objective should be effective research scale, rather than consolidation for its own sake.

Sixth, Lithuania should systematically review legal and contractual barriers to research commercialisation. Latvia's developing commercialisation framework provides a neighbouring policy experiment worth monitoring. Clear rules regarding intellectual-property ownership, researcher incentives, licensing,

and university-business contracting, can reduce transaction costs, but reforms should be based on evidence from the Lithuanian institutional context.

These measures should be understood as complementary. Increasing R&D expenditure without effective transfer mechanisms may produce limited commercial impact, while strengthening TTOs without a sufficient pipeline of technological R&D may similarly generate limited results.

Conclusion

This article has examined Lithuania's patent paradox: the coexistence of comparatively strong human-capital and selected innovation indicators with weak PCT patent performance.

The findings addressing RQ1 show that Lithuania reaches 86.6% of the EU average in overall innovation performance, but only 40.4% in PCT patent applications. Estonia performs more strongly on both measures, while Latvia and Poland achieve lower overall innovation scores, but somewhat higher PCT patent scores. Patent performance therefore cannot be explained solely by the general level of national innovation development.

Regarding RQ2, Lithuania's weak patent performance is associated with several interrelated characteristics. Business R&D expenditure remains particularly low, limiting both proprietary technological development and firms' absorptive capacity. Public support for business R&D is also below the EU average, while science-business links and technology-transfer mechanisms remain areas for further development. Fragmentation of the public research base may limit critical mass, although this relationship requires institutional-level analysis. Sectoral structure and different firms' intellectual-property strategies also explain part of the observed gap. Finally, technology commercialisation requires financial and managerial capabilities beyond the patent application itself.

The comparison addressing RQ3 provides differentiated lessons. Estonia combines stronger business R&D, science-business linkages and risk-capital indicators with stronger patent performance. Poland demonstrates that larger public and private R&D inputs are not sufficient to guarantee proportionately higher patent activity. Latvia shows that patent performance can be somewhat stronger even within a substantially weaker overall innovation system. These comparisons underline the importance of analysing the whole research-to-patent conversion process.

In response to RQ4, the analysis suggests focusing on the capacity to convert technological knowledge into economically valuable outcomes, rather than targeting patent counts in isolation. Relevant measures include improving the accessibility of R&D incentives, strengthening professional technology-transfer capabilities, increasing researcher-industry interaction, supporting proof-of-concept and commercialisation activity, improving critical mass in the research system, and reducing avoidable institutional barriers to commercialisation.

The study has several limitations. It relies primarily on aggregated EIS indicators, which cannot establish causal mechanisms, and may conceal sectoral and regional variation. PCT applications measure filing activity rather than patent quality or commercial success. Industrial structure also strongly influences patent propensity.

Future research should therefore combine patent microdata from EPO and WIPO with enterprise-level R&D data, sectoral indicators and qualitative evidence from firms, researchers and technology-transfer organisations. Such research could identify more precisely where potentially valuable technological knowledge is lost between research, invention, intellectual-property protection, and market application.

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LIETUVOS PATENTŲ PARADOKSAS: INOVACINIO POTENCIALO IR PATENTAVIMO REZULTATŲ LYGINAMOJI ANALIZĖ

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Santrauka

Straipsnyje analizuojamas Lietuvos patentavimo paradoksas – situacija, kai santykinai stiprūs žmogiškojo kapitalo, inovacinės veiklos ir kai kurie finansavimo rodikliai nėra matomi šalies tarptautinio patentavimo rezultatuose. 2026 m. Europos inovacijų suvestinės duomenimis, bendras Lietuvos inovacijų indeksas siekia 86,6 proc. Europos Sąjungos vidurkio, o PCT patentų paraiškų rodiklis – tik 40,4 proc. ES vidurkio. Tuo tarpu aukštąjį išsilavinimą turinčių gyventojų rodiklis siekia 187,0 proc., mobilumas žmogiškųjų išteklių mokslo ir technologijų srityje – 183,3 proc., rizikos kapitalo išlaidos – 114,7 proc., o prekių ženklų paraiškos – 156,9 proc. ES vidurkio.

Tyrimo tikslas – identifikuoti struktūrinius, institucinius ir inovacijų politikos veiksnius, siejamus su gana silpnais Lietuvos patentavimo rezultatais, bei, lyginant Lietuvą su Estija, Latvija ir Lenkija, nustatyti aktualias kitų šalių inovacijų sistemų patirtis. Tyrimui taikoma lyginamoji antrinių statistinių duomenų ir dokumentų analizė. Pagrindinis empirinis šaltinis – 2026 m. Europos inovacijų suvestinė, papildomai naudojami Europos Komisijos, Europos patentų tarnybos, WIPO ir Eurostato duomenys bei remiamasi moksline literatūra. Tyrimu nesiekiama nustatyti priežastinių ryšių; identifikuojami rodiklių deriniai ir institucinės sąlygos, siejamos su silpnesne patentavimo veikla.

Straipsnyje taikoma mokslinių tyrimų ir patentų konversijos grandinė, apimanti inovacinius išteklius, mokslo ir verslo sąveikos grandis bei intelektinės nuosavybės rezultatus. Analizė atskleidė, kad Lietuvos patentavimo atotrūkio negalima paaiškinti vienu veiksniu. Viena svarbiausių silpnybių yra mažos verslo MTTP investicijos, siekiančios tik 26,9 proc. ES vidurkio. Tai riboja tiek patentabilių technologinių sprendimų kūrimą, tiek įmonių absorbcinį pajėgumą panaudoti išorines mokslo žinias. Reikšmingi ir mokslo bei verslo ryšiai, technologijų perdavimo pajėgumai, viešosios paramos verslo MTTP prieinamumas, mokslinių tyrimų sistemos kritinė masė bei komercializavimo finansavimas. Patentavimo intensyvumui įtaką daro ir ekonomikos sektorinė struktūra, todėl mažesnis patentų skaičius savaime nėra tapatus mažam inovatyvumui.

Lyginamoji analizė atskleidžia skirtingus taikomus modelius. Estijai būdingos daug didesnės verslo MTTP investicijos, intensyvesni mokslo ir verslo ryšiai bei aukštesnis PCT patentų rodiklis. Lenkija gerokai daugiau viešosios paramos skiria verslo MTTP ir pasižymi didesnėmis verslo investicijomis, tačiau jos patentavimo rezultatai tik šiek tiek viršija Lietuvos. Latvijos atvejis rodo, kad santykinai aukštesnis patentavimo rodiklis galimas ir esant silpnesniam bendram inovacijų sistemos rezultatui.

Daroma išvada, kad Lietuvos inovacijų politikos tikslas neturėtų būti vien patentų skaičiaus didinimas. Svarbiau stiprinti visą mokslinių ir technologinių žinių transformavimo grandinę: įmonių MTTP gebėjimus, profesionalų technologijų perdavimą, mokslo ir verslo bendradarbiavimą, ankstyvojo komercializavimo finansavimą ir tinkamos intelektinės nuosavybės strategijos pasirinkimą. Ateities tyrimuose tikslinga derinti EPO ir WIPO patentų mikrolygmens duomenis su įmonių MTTP rodikliais, sektorine analize ir interviu su įmonių, universitetų bei technologijų perdavimo padalinių atstovais.

RAKTINIAI ŽODŽIAI: *patentai, MTTP, technologijų perdavimas, inovacijų sistema, Lietuva.*

JEL KLASIFIKACIJA: O31, O32, O34, O38.

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