

UNLEASHING THE PRODUCTIVE POTENTIAL OF DIGITALISATION IN LITHUANIA

ECONOMICS DEPARTMENT WORKING PAPERS No. 1753

By Vassiliki Koutsogeorgopoulou

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Authorised for publication by Isabell Koske, Acting Director, Country Studies Branch, Economics Department.

All Economics Department Working Papers are available at www.oecd.org/eco/workingpapers.

JT03519522

OECD Working Papers should not be reported as representing the official views of the OECD or of its member countries. The opinions expressed and arguments employed are those of the author(s).

Working Papers describe preliminary results or research in progress by the author(s) and are published to stimulate discussion on a broad range of issues on which the OECD works.

Comments on Working Papers are welcomed, and may be sent to the Economics Department, OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France, or by e-mail to PubRights@oecd.org.

All Economics Department Working Papers are available at www.oecd.org/eco/workingpapers.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

© OECD (2023)

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for commercial use and translation rights should be submitted to PubRights@oecd.org.

ABSTRACT/RÉSUMÉ

Unleashing the productive potential of digitalisation in Lithuania

Lithuania is digitalising its economy with visible success, but much scope remains for the integration of advanced technologies. The COVID-19 crisis confirmed the importance of digitalisation to sustain activity. Increased private investment in innovation is essential to speed up digitalisation. The take-up of R&D tax incentives is low, however, despite relatively generous provisions, and many smaller firms have not been inclined to innovate. More effective public support for business R&D and stronger research-business collaboration on innovation are important. There is also a need to promote digital uptake, especially among smaller firms that lag behind. Improving access to equity finance for young innovative firms, reducing remaining gaps in digital infrastructure, along with better information on digital tools and how to use them, can help smaller firms digitalise. The public sector too has to become more digitalised. Addressing weaknesses in foundational skills through education reforms and responding more effectively to labour market needs for digital skills would enable a wider adoption of advanced technologies and higher productivity growth, while ensuring that the digitalisation dividends are distributed fairly. Increased participation in adult learning, especially among the less educated, is the way forward to adapt to increased job automation in the digital era.

This Working Paper relates to the 2022 OECD Economic Survey of Lithuania

<https://www.oecd.org/economy/lithuania-economic-snapshot/>

JEL codes: J24, O3, O32, I23.

Key words: Collaboration, connectivity, digital, innovation, productivity, R&D, skills, technologies

* * * * *

Libérer le potentiel productif de la transformation numérique en Lituanie

La transformation numérique de l'économie lituanienne est en cours et connaît une réussite manifeste, mais il reste encore beaucoup à faire pour intégrer les technologies de pointe. La crise liée au COVID-19 a confirmé l'importance de la transformation numérique pour soutenir l'activité. Il est primordial d'accroître l'investissement privé dans l'innovation pour accélérer la transformation numérique. Or, les incitations fiscales en faveur de la R&D sont peu utilisées, malgré des dispositions relativement généreuses, et beaucoup de petites entreprises sont peu disposées à innover. Il importe d'apporter un soutien public plus efficace à la R-D des entreprises et de renforcer la collaboration entre les établissements de recherche et les entreprises dans le domaine de l'innovation. Il est également nécessaire de promouvoir l'adoption du numérique, en particulier par les petites entreprises à la traîne en la matière. Améliorer l'accès des jeunes entreprises innovantes à des financements par fonds propres, réduire les lacunes qui subsistent dans les infrastructures et améliorer parallèlement l'information sur les outils numériques et sur leur utilisation sont autant de mesures qui peuvent aider les petites entreprises à passer au numérique. Le secteur public doit lui aussi se convertir au numérique. Remédier aux lacunes relevées dans les compétences de base grâce à des réformes de l'éducation et répondre plus efficacement aux besoins en compétences numériques du marché du travail permettraient une adoption plus large des technologies avancées et des gains de productivité plus importants, tout en garantissant que les fruits de la transformation numérique soient équitablement répartis dans la société. Une augmentation de la participation à la formation des adultes est particulièrement importante à cet égard.

Ce Document de travail a trait à l'Étude économique de l'OCDE de la Lituanie, 2022

<https://www.oecd.org/fr/economie/lituanie-en-un-coup-d-oeil/>

JEL Classification : J24, O3, O32, I23.

Mots clés : Collaboration, connectivité, numérique, innovation, R-D, compétences, les technologies

Table of contents

Unleashing the productive potential of digitalisation in Lithuania	6
1. Lithuania has scope for further digitalisation and productivity gains	6
2. Promoting investment in innovation to speed up the digital transition	10
3. Fostering the digital transformation of firms, especially smaller ones	20
4. A well-developed digital government is key to successful digital transition	33
5. Harnessing skills for a digital economy	39
References	52

FIGURES

Figure 1. Digital transformation has accelerated, but more can be done	7
Figure 2. There is scope to boost productivity	8
Figure 3. Innovation performance improved, but some critical indicators lag behind	8
Figure 4. Lithuania has scope to increase investment in R&D	11
Figure 5. R&D tax incentives are generous but business investment in R&D lags behind	12
Figure 6. Overall support to R&D is comparatively low, despite generous tax incentives	13
Figure 7. Smaller firms have scope to improve innovation outcomes	14
Figure 8. Business-research collaboration can be strengthened	16
Figure 9. International research linkages remain weak	19
Figure 10. There is scope for greater uptake of digital technologies, especially by smaller firms	20
Figure 11. Smaller firms lag behind in productivity	21
Figure 12. The pandemic-related crisis has accelerated the use of digital tools	22
Figure 13. A range of policies can support productivity through digital adoption in Lithuania	23
Figure 14. The Lithuanian manufacturing sector lags behind in terms of digitalisation	24
Figure 15. Digital connectivity increased, but high-speed broadband could be used more by firms	25
Figure 16. Broadband coverage is lower in rural areas	26
Figure 17. The regulatory framework is business-friendly but could improve further	27
Figure 18. SMEs in Lithuania rely more on bank lending than equity financing	28
Figure 19. The debt-bias in the Lithuanian corporate tax system could be reduced	29
Figure 20. Reliance on venture capital could increase	30
Figure 21. Managerial skills can be improved	33
Figure 22. E-government indicators compare well internationally	34
Figure 23. There is scope to move to higher levels of digital government maturity	35
Figure 24. Cybersecurity incidences for businesses are relatively high	37
Figure 25. Awareness about cybercrime and risk assessment by firms need to be strengthened	38
Figure 26. Lithuania faces high risks of job automation in international comparison	39
Figure 27. There is scope to strengthen digital and foundational skills	40
Figure 28. Lithuanian schools can further increase ICT capacity	42
Figure 29. Lithuania faces large and rising shortages in ICT skills	43
Figure 30. Relatively few STEM graduates have an ICT specialisation	44
Figure 31. Other important skills for the digital era also need to be developed further	45
Figure 32. Participation in adult learning remains low especially among the vulnerable groups	47
Figure 33. There are multiple barriers to participation in adult training	48

Figure 34. There is scope to foster online learning

50

BOXES

Box 1. Lithuania's Digitalisation Strategy: main features	10
Box 2. Tax incentives to support business R&D and innovation in Lithuania: main features	13
Box 3. Enhancing business-research collaboration: some international practices	17
Box 4. Fostering technology-based innovation in the financial sector	21
Box 5. Crowdfunding: an alternative source for financing SMEs with high-innovative potential	31
Box 6. Supporting the digital advancement of SMEs: international experience	32
Box 7. Digitising government services: the case of Estonia	35
Box 8. Modernising Lithuania's public sector through digitalisation	36
Box 9. Financial incentives to encourage participation in adult learning: international trends	49

Unleashing the productive potential of digitalisation in Lithuania

By Vassiliki Koutsogeorgopoulou¹

1. Lithuania has scope for further digitalisation and productivity gains

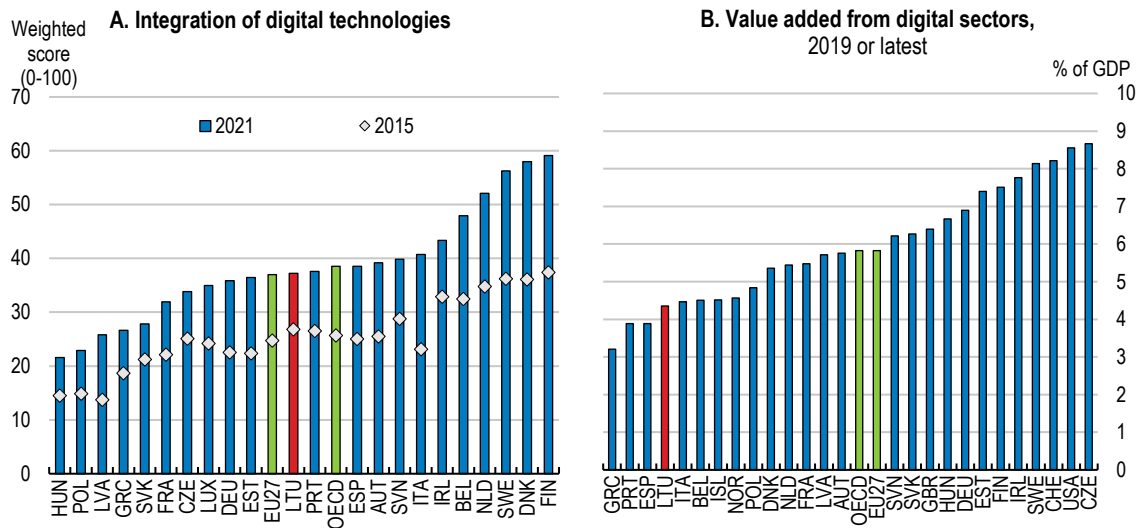
Lithuania has made visible progress in digitalising its economy. A growing share of households have broadband connection and use the Internet, and businesses increasingly rely on digital technologies to respond to changing patterns of consumption and production (Figure 1, Panel A). The advantage of digital innovation is evident in certain areas, notably fintech, life sciences and laser technology, where Lithuania is becoming a fast-growing hub. As in other countries, digitalisation has accelerated since the outbreak of the pandemic.

Yet, Lithuania has still much scope for further digitalisation. Despite progress, adoption of digital technologies by firms continues to lag behind the levels of leading European countries, such as Finland and Sweden (Figure 1, Panel A). Only 4% of growth firms (i.e. those that have experienced growth in the past three years) in Lithuania have a digitalisation strategy compared to an EU average of 22% (European Commission, 2021^[1]). The digitalisation gap may be partly explained by the structure of the economy, and in particular, the prevalence of SMEs, which are less likely to implement digital technologies than larger firms. The prevalence of low added-value outsourced production in Lithuanian industry (“contract manufacturing business”) and the small size of the economy may be additional factors (Lithuanian Innovation Center, 2020^[2]). The digital sectors are small in terms of value added as a share of GDP by international comparison (Figure 1, Panel B). Lithuania is middle-ranking in terms of digital progress, according to the composite Digital Economy and Society Index of the European Commission (European Commission, 2021^[3]).

Digitalisation can help boost innovation and productivity. Such potential lies, for example, in business processes innovation, automation of routine tasks and more efficient interactions between firms and customers. OECD estimates suggest, for instance, that increasing high-speed Internet connections by 10% would boost productivity by over 2% in Lithuania over a three-year horizon, while the indirect effect from increased adoption of advanced technologies, such as cloud computing, would add another 1.6% to productivity (Sorbe et al., 2019^[4]).

¹ Vassiliki Koutsogeorgopoulou is from the OECD Economics Department. The author would like to thank Hansjoerg Blöchliger, Vincent Koen, Isabell Koske, Alvaro Pereira, Douglas Sutherland (OECD Economics Department), Silvia Appelt (OECD Directorate for Science, Technology and Innovation), Bert Brys (OECD Centre for Tax Policy and Administration), James Mancini (OECD SGE), Ana Sasi-Brodesky, John-David Tochon (OECD Directorate for Financial and Enterprise Affairs), Stefano Piano (OECD Directorate for Employment, Labour and Social Affairs) and Lithuanian officials for their valuable comments and feedback on earlier drafts. Special thanks go to Natia Mosiashvili for research assistance and Michelle Ortiz for editorial assistance.

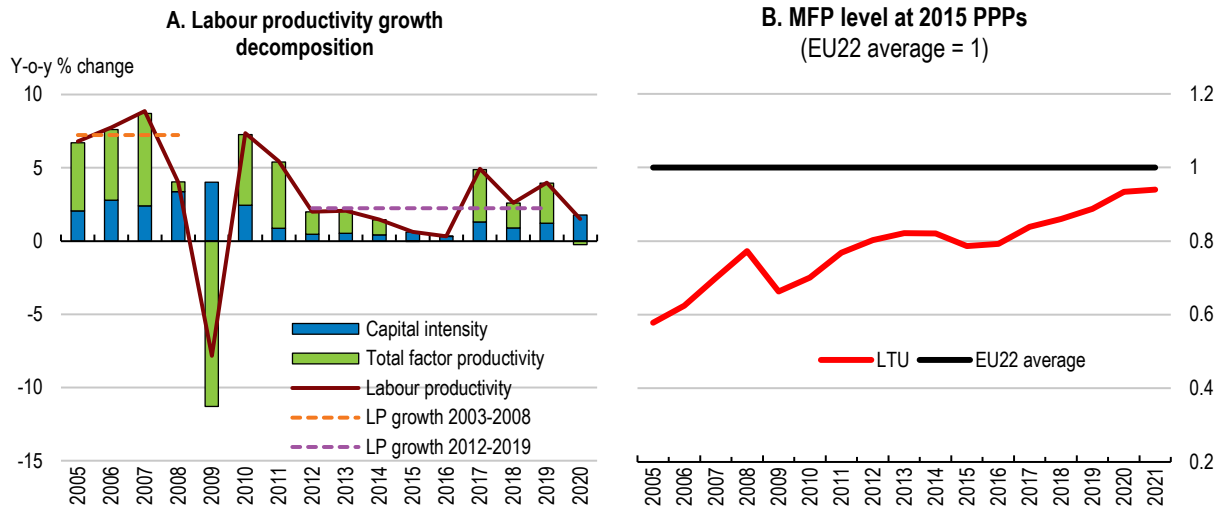
Figure 1. Digital transformation has accelerated, but more can be done



Note: In Panel A, OECD refers to the average of 22 OECD countries that are members of EU. In Panel B, digital sectors refer to Manufacture of computer, electronic and optical products (Nace Rev.2 code: V26), Manufacture of electrical equipment (V27), Publishing activities (V58), Audio visual and broadcasting activities (V59_60); Telecommunications (V61), and IT and other information services (V62_63). Digital sectors are defined according to the taxonomy described in: OECD (2018), A taxonomy of digital intensive sectors <https://doi.org/10.1787/f404736a-en>. Source: European Commission, Digital Scoreboard; and OECD, National Accounts database.

Labour productivity grew faster in Lithuania than the OECD average since the global financial crisis, but its level remains below average (Figure 1.2 in (OECD, 2022^[5])). There is considerable scope for stronger innovation as multi-factor productivity falls below the average of the EU OECD members and growth has yet to return to its pre-crisis highs (Figure 2). Despite a large improvement in recent years, overall innovation performance remains subpar, according to the 2021 European Innovation Scoreboard ranking (Figure 3). Some critical innovation outcomes for the digital era, including medium- and high-tech exports and ICT patenting are well below the OECD average. Many domestic companies remain poorly integrated in global value chains, limiting the potential to attract foreign investment and scale up innovation (Ministry of Economy and Innovation, 2021^[6]). Higher adoption of digital technologies by firms could boost innovative capacity, deepening integration in global value chains and boosting productivity (OECD, 2020^[7]).

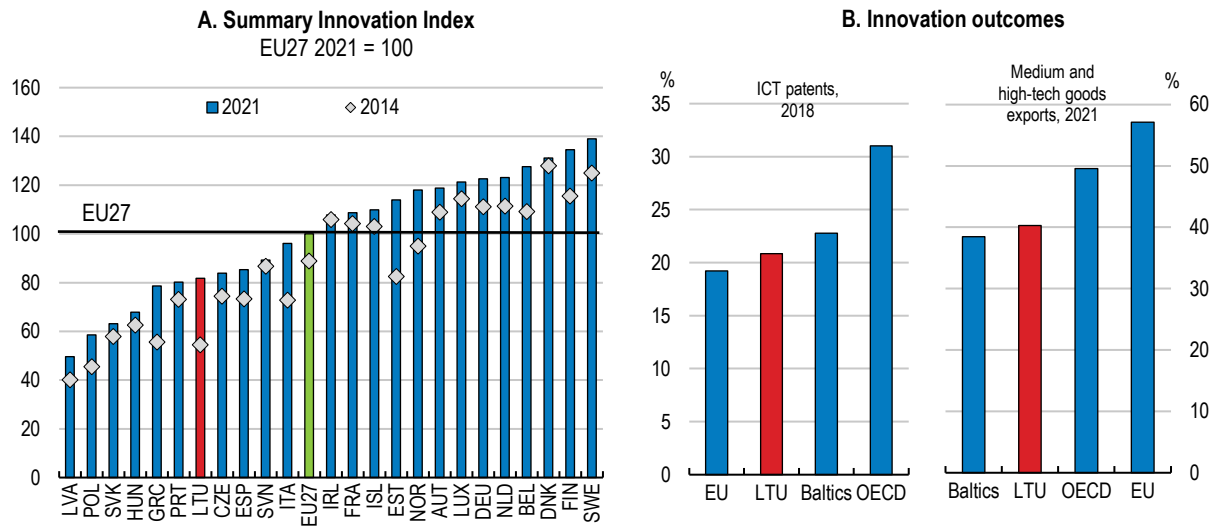
Figure 2. There is scope to boost productivity



Note: In Panel A, labour productivity is measured as GDP per person employed (National Accounts definition).
 Source: OECD Economic Outlook, No. 111 database.

StatLink 2 <https://stat.link/8z5m4t>

Figure 3. Innovation performance improved, but some critical indicators lag behind



Note: In Panel A, EU refers to weighted average of its 27 member countries. In Panel B, ICT patents refer to the share of ICT patents in overall patents (IP5 patent families). Data refer to the average of 2016 and 2018. Country aggregates are computed by first summing the ICT patents and total patents respectively, and then obtaining ratios for desired country groups. Data for medium and high tech goods exports refer to 2020.
 Source: European Commission, European Innovation Scoreboard 2021.

StatLink 2 <https://stat.link/rz15as>

The pandemic has further highlighted the importance of digital technologies. During the pandemic increased uptake of digital technologies, mainly in the form of e-commerce and teleworking (see below), helped many firms to stay in business. The enhanced use of digital technologies also became evident in other areas, including education where distance learning has increased. Going forward, it is essential that Lithuania strengthens the enablers of digitalisation to accelerate the transition and achieves higher productivity growth. A greater take-up of digital technologies is particularly important for smaller firms that lag behind in terms of innovation and productivity. Seizing the opportunities of new technologies would pave the way for more solid, greener and inclusive growth in the post-COVID 19 era.

Against this background, the paper examines broad-based policies to help Lithuania make the most of the fast-moving digital landscape. The paper first discusses current policies to support business R&D and research-business collaboration to boost business investment in innovation, and the ongoing reforms to enhance the effectiveness of the innovation system. Stronger international cooperation in research would bring additional gains in terms of technology transfer. It will then look at policies that reduce barriers to firms' digital transition, notably reforms to strengthen digital infrastructure and reduce regional gaps, as well as measures to improve framework conditions and ensure access to finance for young innovative firms. It will also address size-related barriers smaller firms face. This is followed by a discussion of potential areas of reform to accelerate progress towards digital government. The paper then assesses education and training policies from the perspective of building strong digital skills but also for limiting the rise in inequalities associated with the increased automation of jobs and labour market transformation, ensuring a fair distribution of the digitalisation dividend. The main findings and recommendations are summarised at the end of the paper. The government digitalisation strategy addresses many of these challenges (Box 1), but reform efforts and implementation need to continue.

Box 1. Lithuania's Digitalisation Strategy: main features

The National Digitisation Development Programme 2021-2030 sets out the priorities and guidelines for digitalising the economy, with specific plans translating the strategy into concrete actions (Ministry of Economy and Innovation, 2021^[6]). The priorities are funded from the Recovery and Resilience Plan (RRP), providing EU Structural Funds for the period 2021-27, the state budget and other available sources. Measures aiming to promote digitalisation account for 20% of the total funds (EUR 2.2 billion) allocated under the plan, with reforms to digitise the public sector making up the largest part of reform measures (European Commission, 2021^[8]). Other priority areas include the digitalisation of businesses, digital infrastructure and digital skills.

In brief, the government's main priorities for Lithuania's digital transformation include:

- Consolidating state information resources, IT infrastructure and services.
- Ensuring reliable public-sector data and the possibility to share them across sectors.
- Developing advanced tools and technological solutions and integrating them into electronic services to ensure interoperability, security and accessibility of these services, especially for people with disabilities. This hinges upon creating the necessary conditions for science and businesses to develop and deploy advanced digital technologies. Advanced solutions based on artificial intelligence, data analytics and natural language processing and comprehension machine learning are among the main priorities.
- Improving digital connectivity and addressing rural-urban gaps. The aim is to ensure universal access to high-speed broadband by 2027.
- Promoting digital competencies and skills at all levels of society.

The 2020-30 Industry Digitisation Roadmap provides guidelines for the integration of digital technologies, the adoption of digital technologies by the public and private sectors, strengthening business-research collaboration on innovation and boosting the participation of manufacturing firms in international value chains (European Commission, 2021^[3]). The technologies the roadmap focuses upon, including information and communication technologies (ICT) and automation and robotics are correlated with future investment on R&D in line with the Lithuania's Smart Specialisation Strategy (S3) (Lithuanian Innovation Center, 2020^[2]).

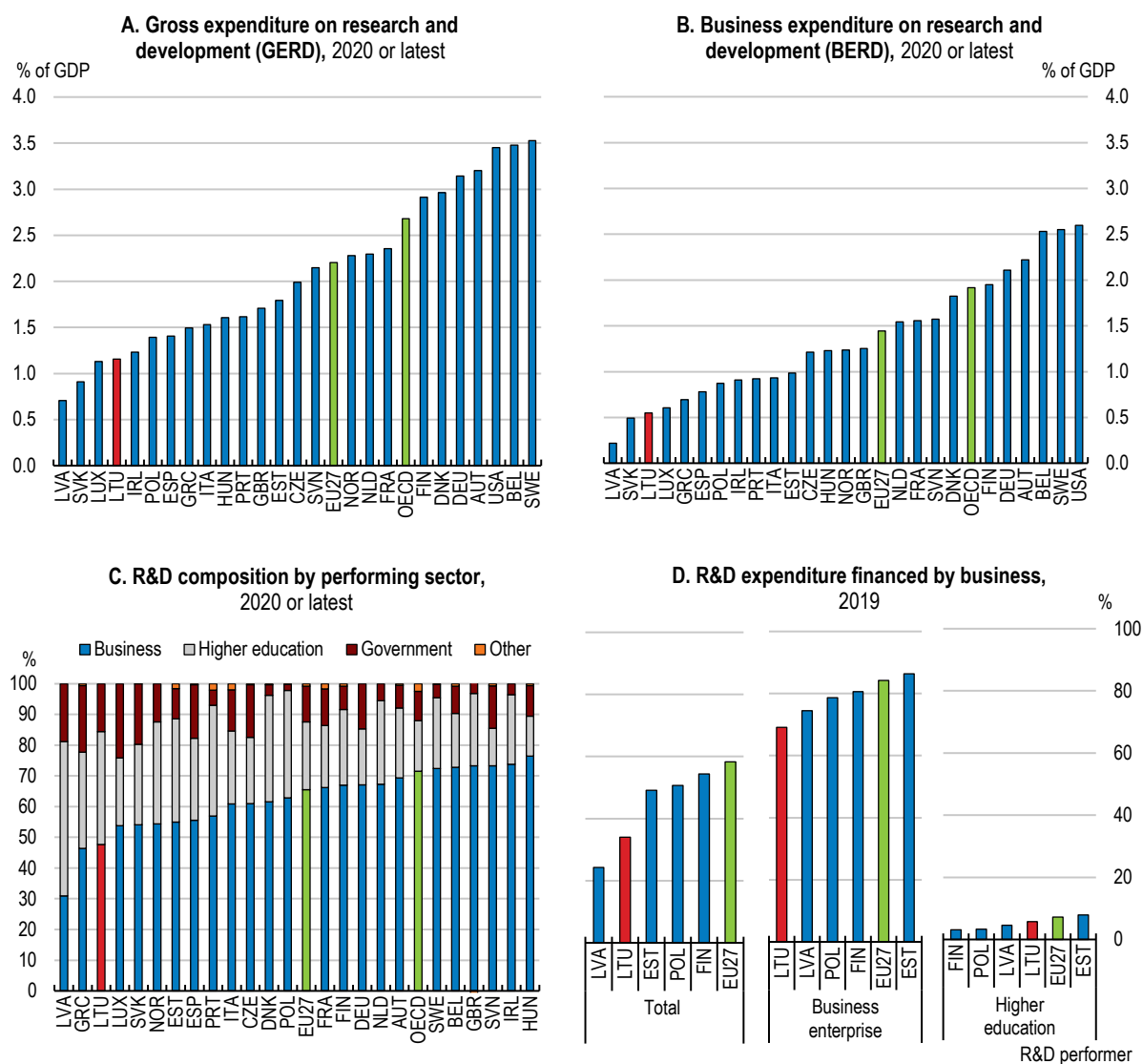
Lithuania's Smart Specialisation Strategy (S3), setting the priority areas for R&D and innovation, has digital technologies at its centre, together with new materials and related new processes with far-reaching economic and societal implications. The labour market effects of disruptive technologies are anticipated and aligned with national and regional innovation policies in order to create jobs in new sectors. A new S3 strategy, under preparation, will streamline the priority fields identified as main R&D and innovation areas from seven under the previous strategy to three with the highest potential: health technology/biotechnology; new production processes, materials and energy efficiency; and ICT technologies.

2. Promoting investment in innovation to speed up the digital transition

Lithuania invests comparatively little in research and development (R&D), a key driver of advancements in digital technologies, and R&D spending remains largely reliant on European funds (European Commission, 2021^[8]). At 1.2% of GDP, overall R&D spending in 2020 was around half the EU average (Figure 4). EU funds accounted for approximately a quarter of total R&D spending in 2020. The business sector plays a relatively small role, investing around 0.5% of GDP in R&D in 2020, among the lowest shares in OECD countries. The government's strategy envisages an increase in overall R&D investment to 1.5% of GDP in

2024, bringing Lithuania closer to the EU average level, although not eliminating the gap. The Innovation Promotion Fund, in operation since 2021, is expected to contribute to this end, but effective government support for business R&D to mobilise private investment is vital, as is stronger business-university collaboration and solid framework conditions (discussed further below).

Figure 4. Lithuania has scope to increase investment in R&D



Note: In all panels, OECD and EU27 refer to weighted averages of the member countries.

Source: OECD, Main Science and Technology Indicators database; Ministry of the Economy and Innovation; and OECD, Research and Development Statistics database.

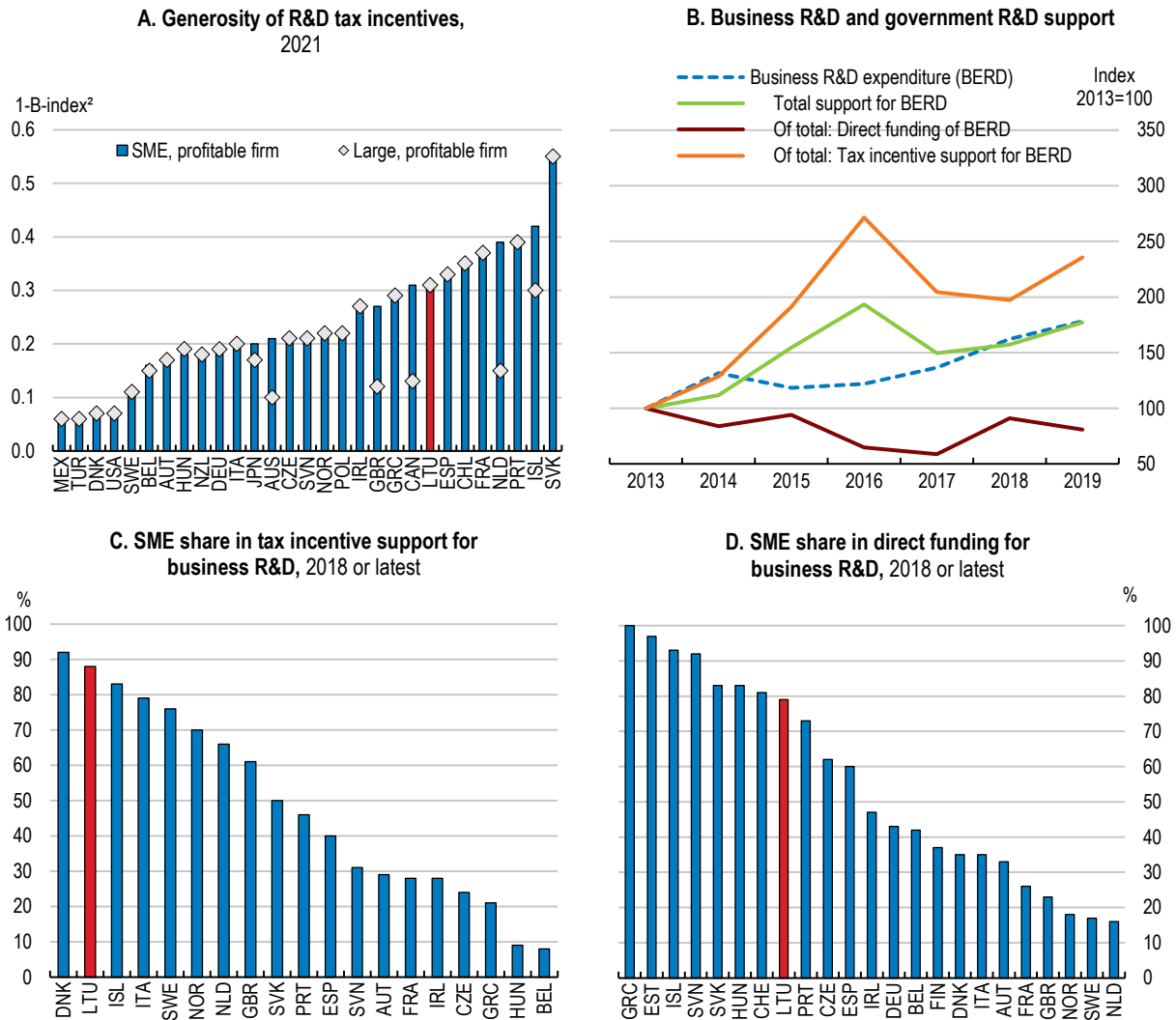
StatLink 2 <https://stat.link/szk9r8>

2.1. Support for business R&D could do more to encourage private investment

Lithuania's tax incentives for business R&D are generous and have increased as a share of GDP in recent years, growing faster than direct support (Figure 5). In particular, regulations allow for an enhanced deduction of eligible R&D expenditures from taxable income and accelerated depreciation of R&D capital assets over two years (OECD, 2021^[9]) (Box 2). There is no threshold or ceiling on qualifying R&D

expenditure. Nonetheless, the take-up of tax incentives is modest (OECD, 2021^[10]), and overall government support for business R&D is low compared to most OECD countries, at around 0.03% of GDP against 0.2% across OECD (Figure 6). In addition to tax relief for R&D tax expenditure, a “patent box” regime was introduced in 2018, allowing for a reduced corporate income tax rate (5% from 15%) on profits from intellectual property assets (Box 2).

Figure 5. R&D tax incentives are generous but business investment in R&D lags behind



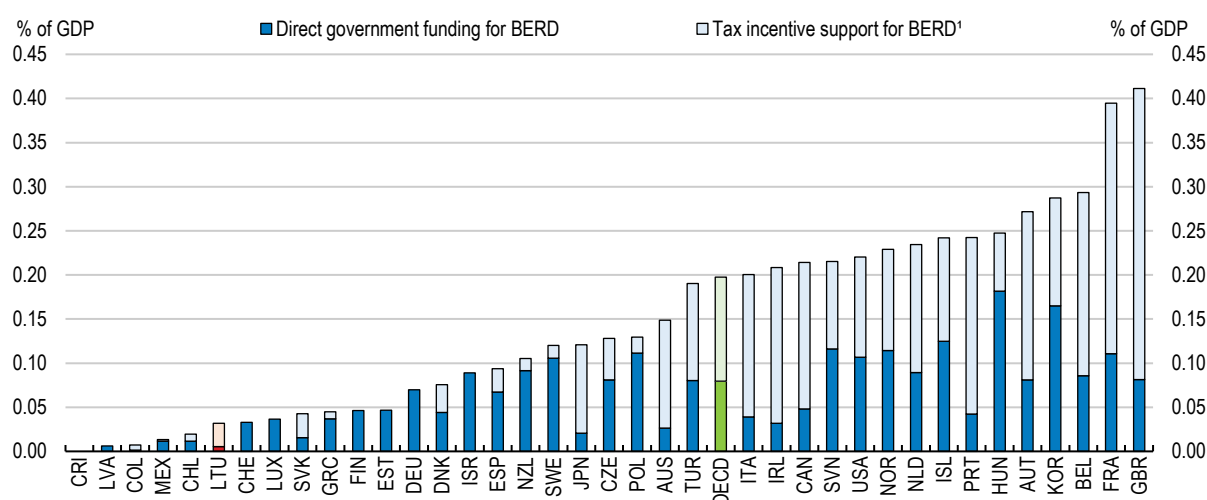
Note: In Panel A, The B-index specifies the pre-tax income needed for a “representative” firm (typically defined for convenience as one with sufficiently large profits to be able to fully make use of earned tax credits in the reporting period) to break even on a marginal, monetary unit of R&D outlay (OECD, 2020). It is customary to present this indicator in the form of an implied subsidy rate, namely one minus the B index. In Panels C and D, further information on the yearly coverage and R&D tax incentive schemes, refer to the figure 12 in [R&D tax incentives database report, 2021 edition](#).

Source: OECD R&D Tax Incentives database, <http://oe.cd/rdtax>, March 2021.

StatLink 2 <https://stat.link/kjz94f>

Figure 6. Overall support to R&D is comparatively low, despite generous tax incentives

Government support for business R&D, as share of GDP, 2019 or latest year



1. In the case of Canada, Japan and Hungary subnational tax support for BERD is included in tax support for BERD.

Source: OECD R&D Tax Incentives database. <http://oe.cd/rdtax>.

StatLink 2 <https://stat.link/mv72b1>

Box 2. Tax incentives to support business R&D and innovation in Lithuania: main features

- Expenditure-based tax incentives for R&D, introduced in 2008, include: i) an R&D tax allowance that provides for an enhanced deduction at a rate of 200% of expenses incurred for R&D purposes such as wages of employees who are directly involved in scientific research and experimental development works, as well as for acquiring R&D related services; and ii) an accelerated depreciation provision for fixed assets (machinery and intangibles) used in the context of R&D projects. Under the latter scheme, a business entity is allowed to write off the acquisition cost of assets used in R&D activities within two years. There is no threshold, or ceiling, on the amount of eligible R&D expenditures or value of R&D tax relief. In the case of insufficient tax liability, unused claims can be carried-forward indefinitely.
- A “patent box” regime was introduced in 2018 allowing for a reduced corporate income tax rate (5% from 15%) on profits from intellectual property assets. The scheme is not limited to specific industries or entity types.
- A reduction of taxable profit for enterprises investing in substantial technological renewal (reduction of profits due to an ongoing investment project) was introduced in 2009 with the relevant threshold doubling in 2018. Under existing arrangements, eligible enterprises may reduce the taxable profit for the tax period up to 100% when investing, for instance, in projects for the introduction of new processes or a substantial change in an existing process.

Source: Ministry of Economy and Innovation; (OECD, 2021^[9]; OECD, 2020^[11]).

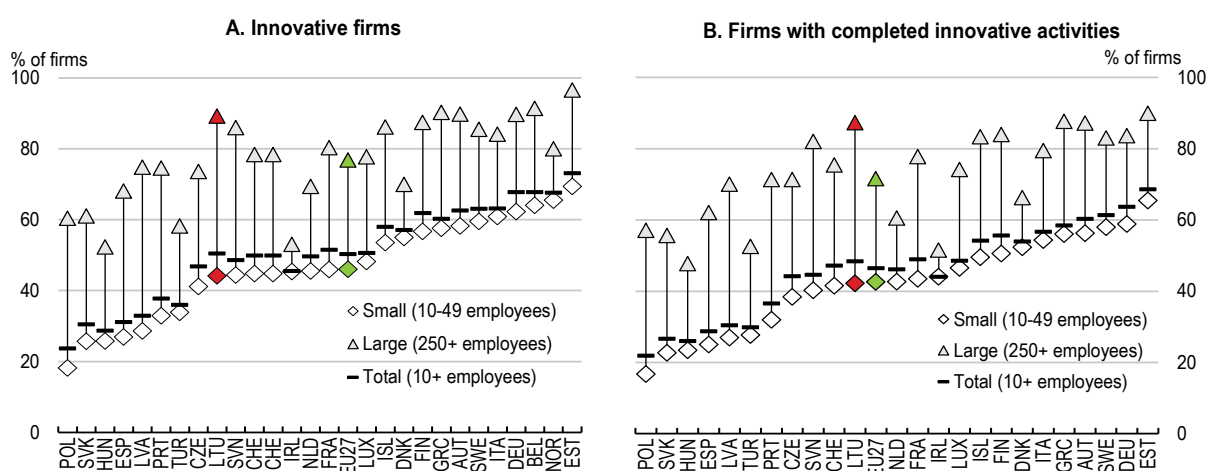
Tax incentives could become more effective. Business investment in R&D has not caught up with the rapid rise in tax incentives in recent years (Figure 5). Despite generous provisions, only 260 firms – out of 166 228 operating in Lithuania – received tax relief for R&D in 2019 through the R&D tax allowance (OECD, 2021^[9]; OECD, 2021^[10]). Uncertainty regarding the definition of eligible R&D expenditure, complex and lengthy application procedures and associated high compliance and administrative costs are among the

likely culprits (European Commission, 2019^[12]; OECD, 2018^[13]). Limited awareness of the scheme among firms may be another factor.

Challenges related to the complexity of R&D tax incentives scheme need to be addressed. Smaller firms lag behind their larger counterparts in terms of innovation outcomes (Figure 7). Whereas other factors can also influence such outcomes, ensuring effective tax support for business R&D is very important. A more balanced combination of tax incentives and direct support for R&D for small innovative firms is also essential (Figure 6). Compared to R&D tax incentives, direct public funding might be better suited for young firms in that they often lack the upfront funds required to start an innovative project (Appelt et al., 2016^[14]). As discussed below, there is room for increasing further direct government funding for business R&D in Lithuania.

Figure 7. Smaller firms have scope to improve innovation outcomes

2018



Note: Panel A: an enterprise is considered as innovative if during the reference period it introduced successfully a product or process innovation, had ongoing innovation activities, abandoned innovation activities, completed but yet introduced the innovation or was engaged in in-house R&D or R&D contracted out. Panel B: firms with completed “innovation activities” are those which implement product and/or process innovation and at least one innovation activity, such as R&D and acquisition of equipment or software, during 2016-18.

Source: Eurostat, the Community Innovation Survey 2018.

StatLink 2 <https://stat.link/sh8dfm>

Regular evaluations of the effectiveness of R&D tax incentives are essential to inform policy choices and further reforms. Lithuania has made no changes in the design of the R&D tax scheme since its introduction in 2008, nor has it modified the relevant administrative and compliance procedures (OECD, 2021^[9]) (Box 2). The government is currently reviewing the tax incentive scheme. The aim is to increase the flexibility of the R&D and innovation support measures and reduce bureaucracy at all stages of innovation, while also improving the communication of R&D tax incentives to firms. The ongoing evaluation is important and needs to be completed as scheduled. Developing a comprehensive R&D database, including matched R&D activity and tax relief data, in line with initiatives in some OECD countries, is vital for assessing input additionality (i.e., the extent to which public support prompts R&D over and above the amount that would be undertaken without it), as well as output additionality (i.e., the outputs from R&D activities which would have been achieved without public support) and wider economic and social impacts (Appelt et al., 2016^[14]; OECD, 2021^[15]).

In addition, the key parameters of the R&D tax incentive scheme need to reflect evolving conditions. A recent reform in the United Kingdom, for instance, has broadened the scope of qualifying costs incurred in the context of R&D projects to include data and cloud computing (OECD, 2020^[16]). Other countries further provide explicit tax incentives to promote business-research collaboration. For example, Japan

offers a dedicated R&D tax credit for collaborative/subcontracted R&D (Open innovation activity-based R&D tax credit) where firms benefit from an enhanced credit-tax rate of 30% for joint or contracted R&D with universities and national research institutes, 25% in the case of joint or contracted R&D with R&D venture corporations, and 20% in the case of joint or contracted R&D with other entities including large corporations (OECD, 2021^[17]; OECD, 2021^[18]).

It is also important to monitor on a regular basis the effectiveness of tax incentives for the commercialisation of patented inventions, as patent boxes (also referred as intellectual property regimes) may not be the most effective tool to stimulate innovation, especially among innovative start-ups and SMEs. Many OECD countries have introduced intellectual property regimes to complement tax incentives for R&D, but these schemes favour patent holders and may reduce incentives to innovate through risky experimentation, which is key to digital innovation (OECD, 2015^[16]; Appelt et al., 2016^[13]). Moreover, large, often multinational, corporations tend to be the main beneficiaries of these schemes, rather than young firms. A careful assessment of the benefits and costs of this type of tax incentive is therefore required.

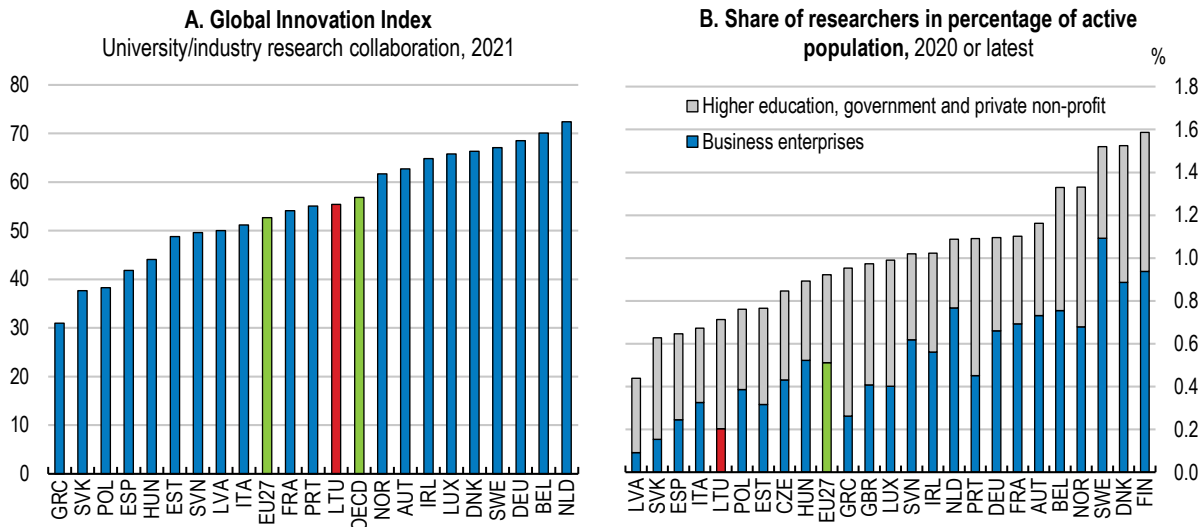
Lithuania has scope to increase direct funding for business R&D further, which is in principle particularly suited for young financially constrained firms (see above), as this support accounted for less than 20% of total in 2019, well below the corresponding EU share (Figure 6). Also, a large share of such support is earmarked for foreign investors. Going forward, it will be important to continue to boost direct funding for business R&D and ensure a balanced mix between tax incentives and direct funding. Cross-country evidence suggests that a combination of support is more successful in incentivising R&D investment by business, underlying their complementary (OECD, 2020^[19]). As a positive step, the Innovation Promotion Fund, in operation since January 2021, supports investment in basic and applied research, as well experimental development and innovation. The new Fund is composed of allocations from the government budget, EU funds and other sources. Greater reliance on budgetary sources is welcome, given the relatively high reliance on EU funds. Support should also focus on business innovation with disruptive potential. Comprehensive evaluations of the funded projects based on rigorous cost-benefit analysis and systematic impact assessments are essential in this regard.

Moreover, it is important to set up a coherent system of support that would cover an innovation project as a whole, rather than particular steps in isolation, as is often the case under the current system, while also reducing fragmentation in the provision of support (IMF, 2017^[20]; OECD, 2016^[21]). The ongoing reform of the innovation system (discussed below) could help in this respect. Financial support needs to be accompanied by measures to raise awareness of the importance of R&D and innovation among firms and enhance their absorptive capacity, including through stronger business-research collaboration and improved digital skills. Initiatives, such as the Inospurtas project that provides innovation consultancy and support services through the involvement of public institutions, including the Lithuanian Innovation Centre and Science and Technology Parks, are welcome steps (OECD, 2021^[22]).

2.2. Enhancing technology transfer through stronger collaborative research

Strengthening research-business collaboration remains an important challenge. Such partnerships facilitate knowledge exchange and the transmission of knowledge on advanced technologies, with high innovation and productivity potential for firms (Andrews, Criscuolo and Gal, 2015^[23]; Guellec and Paunov, 2018^[24]). There are many examples of well-established alliances between universities and business partners in Lithuania, even though they are limited to certain industries, especially biotechnology and laser industries (European Future Innovation Centre, 2020^[25]). The level of collaboration falls below the OECD average and Nordic countries, although Lithuania fares well compared to other countries in Central and Eastern Europe (Figure 8). The mobility between the two sectors is also low, as indicated by the relatively low share of researchers in the business sector.

Figure 8. Business-research collaboration can be strengthened



Note: Panel A: country aggregates represent the unweighted averages of member countries. Panel B: EU27 stands for a weighted average of 27 EU members. Researchers are in full-time equivalent units.
 Source: Global Innovation Index, 2021; and Eurostat.

StatLink 2 <https://stat.link/j8t0dp>

The benefits from collaboration are particularly large for small businesses, which often lack the necessary equipment and skilled personnel needed to innovate (Hewitt-Dundas, Gkypali and Roper, 2017^[26]). The universities also stand to benefit through “valorisation” activities, including the commercialisation of research outcomes. However, academics consider a lack of private and public funding for collaborative research, including from universities themselves, and the focus on producing practical results by businesses as barriers to collaboration, according to opinion surveys (University-Business Cooperation in Europe, 2018^[27]). The workload and bureaucracy related to collaborative research explains in part a comparatively low absorption capacity among SMEs. Firms also see the lack of researchers with business knowledge within universities and insufficient government funding for collaborative research as impediments to business-research collaboration (University-Business Cooperation in Europe, 2018^[28]).

A range of measures have been introduced to improve research-business collaboration, including innovation vouchers for technical feasibility studies and for early stages of R&D projects, support for SMEs for the recruitment of researchers, and the establishment of science and technology parks for start-ups attached to a university. Knowledge transfer has also become more important with the establishment of technology transfer offices (TTO’s) in universities that act as intermediaries between academia and the business sector. Moreover, a new funding formula for universities and research institutions, introduced in 2019, takes into account science-business collaboration, as well as activities related to international R&D programmes. These initiatives, along with Lithuania’s Smart Specialisation strategy that sets priority areas for R&D and innovation, including promoting research-business collaboration (Box 1), have paved the way for a more targeted approach to collaboration (Angelis et al., 2020^[29]).

Boosting collaboration requires stimulating both interested parties. To incentivise businesses, the authorities should consider introducing specific programmes that connect SMEs with researchers, while strengthening incentives for engagement, based on the experience of other OECD countries. Australia, Canada and Korea, for instance, have developed such programmes (Box 3). To stimulate researchers to seek partnerships with industry, the government could introduce “engagement” criteria in the appointment and promotion arrangements for academics. Greater recognition of industry experience would also promote mobility between the research and industry sectors with large potential for facilitating knowledge flow. Industry-oriented doctoral studies currently cover only specific topics, mainly in the fields of life

science and laser, and are supported by a small number of companies in Lithuania. Further developing industry-oriented doctoral studies would be a move in the right direction. Such programmes broaden the opportunities of new research, while strengthening the innovation capacity of the firms. To enhance mobility between the business and research sectors some countries, such as Canada and the United Kingdom, provide financial support to firms to strengthen their incentives to hire students (Box 3).

Box 3. Enhancing business-research collaboration: some international practices

Several OECD countries have implemented programmes to promote business research collaboration, with a large variation in design. Specific examples include:

Programmes that connect SMEs and researchers

- Australia's Innovation Connections programme involves a network of dedicated facilitators that provides practical advice and mentorship to eligible SMEs, directing them to research expertise. It also provides financial support for collaborative projects through grants and incentives (CSIRO, 2022^[30]).
- The Canadian Technology Access Centres grant programme aims to boost the innovative capacity of SMEs by helping them access specialised talent, expertise, equipment and technology in Canadian colleges (OECD, 2019^[31]). It provides financial support to a network of 30 technology access centres throughout the country, which are small specialised, applied R&D centres affiliated with publicly-funded colleges located across the country.
- The Patent Commercialisation Platform in Korea employs experts that provide advice to SMEs and promotes technology transfer by matching SMEs with university technologies. It also provides follow-up financing for the commercialisation of these technologies by SMEs. The programme connects more than 8 000 SMEs with researchers from 24 universities (OECD, 2019^[31]).

Policy initiatives to promote business-academia mobility of researchers

- Canada's Mitacs-Elevate programme consists of a one- to two-year research management training scheme for postdoctoral students. The programme deploys leading talent to the private sector, where they have the opportunity to lead industry research projects and gain business experience. The programme subsidises more than 80% of the salary (OECD, 2019^[31]).
- The United Kingdom's Knowledge Transfer Partnerships (KTP) programme is a three-way partnership between a company, an academic or research organisation, and a suitably-qualified graduate (OECD, 2021^[32]). The recruited graduate (Associate) works at the company for 12 to 36 months, depending on the project. A KTP is part-funded by a grant, while the company contributes to the salary of the Associate and the cost of the supervisor. The amount to be provided by the company depends on the scale and length of the project.

Innovation voucher programmes

- Several countries, including Lithuania (see text), offer innovation vouchers to support the purchase of services by firms from research institutions. The design of vouchers differs across countries. In terms of eligibility criteria, for instance, in countries such as Estonia, the Netherlands and Portugal the innovation voucher programmes focus on SMEs or start-ups, while in others, including Lithuania, the provision of innovation vouchers is not subject to firm size (OECD, 2019^[31]). Knowledge providers need to be certified in the majority of the countries offering innovation vouchers.

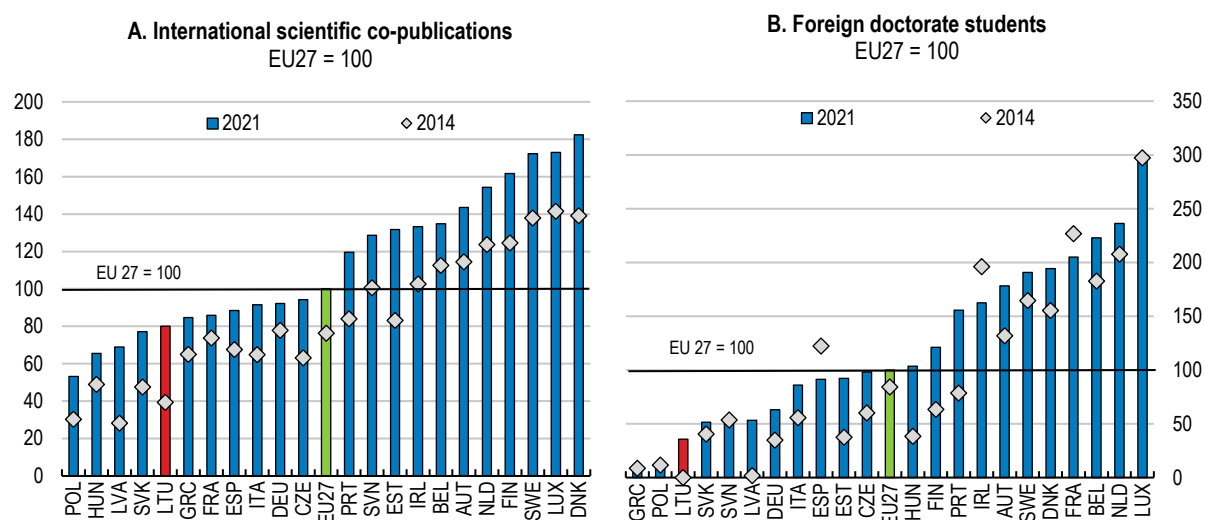
Well-functioning technological transfer offices (TTOs) can play an important role. TTOs are relatively young institutions (up to 10 years) in Lithuania, growing slowly. Therefore, it is still early to evaluate their impact on collaborative research. The digital era reinforces the need for effective intellectual property management, given the importance of data as inputs and outputs of digital innovation (Guellec and Paunov, 2018^[24]). It is important, in this context, that TTOs are well resourced, and their staff has strong skills and expertise in the management of intellectual property. In view of the small size of the Lithuanian innovation system and relatively large number of universities, consideration could be given to pool the TTO expertise and resources in the country, focusing on the two or three best-positioned universities and research organisations, as recommended by the 2016 OECD *Innovation Review for Lithuania* (OECD, 2016^[21]). At the same time, universities need to develop technology transfer strategies that include clear and sufficiently ambitious objectives, accompanied by a comprehensive set of indicators to monitor relevance and impact.

In this regard, there is clearly merit in the foreseen establishment of an ICT competence centre to strengthen links between business, academia and public authorities on the development of technologies, products and services and the commercialisation of outcomes. Involving researchers and businesses, as well as other system players, in the development process of science, technology and innovation (STI) policy would also have beneficial outcomes in terms of collaboration (Angelis et al., 2020^[29]). As a positive step, the national Recovery and Resilience Plan envisages support for mission-based science-business cooperation (Government of the Republic of Lithuania, 2021^[33]). The missions will include funding for both R&D activities and necessary infrastructure and will be implemented in the course of 2022, with the participation of business and research consortia. The topics to be covered by the missions have been identified through public consultation and submitted for approval to the Science and Innovation Council. An increasing number of countries have implemented mission-oriented innovation policies in order to address intensifying societal challenges, such as climate change (Larrue, 2021^[34]). In essence, these are co-ordinated packages of policy and regulatory measures tailored specifically to mobilise science, technology and innovation in order to address these challenges, in a defined timeframe.

International collaboration in research is another important channel of knowledge flow and technology transfer. This is even so for small countries like Lithuania that need to tap into global science and innovation networks to enhance their own capacities and achieve critical mass (OECD, 2016^[21]). Lithuania participates in several European cooperation programmes, such as Horizon 2020 and Erasmus+. There is still scope, however, to increase the scale of international cooperation in research. Indicators such as international co-publications and the share of foreign doctoral students are below the EU average, despite increases in recent years (Figure 9). Enhancing the performance of tertiary education that lags behind in international comparison (OECD, 2022^[5]) is important, but stronger international linkages in research also require making internationalisation a core element in the research strategies of universities and research institutions, as recommended by the OECD *Review of Innovation Policy for Lithuania* (OECD, 2016^[21]). Improving the funding conditions for joint projects between Lithuanian institutions and international research groups and reducing red tape for such projects is vital in this regard.

Figure 9. International research linkages remain weak

2020



Note: In Panel A, International scientific co-publications refer to the number of scientific publications with at least one co-author based abroad (where abroad is non-EU for the EU27) per million population. In Panel B, the data refer to the share of foreign doctoral students in overall doctoral students.

Source: European Commission, European Innovation Scoreboard 2021.

StatLink 2 <https://stat.link/thncfg>

2.3. The ongoing reform of the innovation system is a step in the right direction

More generally, Lithuania's innovation system suffers from a number of long-standing weaknesses that need to be addressed. They include a lack of co-ordination among government institutions, fragmentation of programmes and implementation of policies, and overall complexity. The *OECD Review of Innovation Policy for Lithuania* (OECD, 2016_[21]) has called for an integral improvement of the overall governance of the innovation system, and a consolidation of agencies and support programmes, to be accompanied by a comprehensive review of innovation-related programmes. Reforms in 2018 have changed the governance of the innovation system in important ways, including defining the role of the Science, Technology and Innovation Council, but fragmentation remained high (OECD, 2021_[22]).

The National Progress Plan (NPP) for 2021-30 sets the improvement of the science, technology and innovation (STI) system as a key strategic goal. The reform seeks to address unclear institutional responsibilities and the duplication and overlapping of functions, as well as providing innovation promotion instruments that cover all stages of the implementation of innovative activities (both R&D and innovation), rather than particular steps in the process, while also increasing the flexibility and effectiveness of such instruments. A core element of the reform is the establishment of a single Innovation Agency, scheduled to be in full operation in the course of 2022, that will consolidate the innovation promotion functions currently spread across various agencies. Moreover, the Innovation Promotion Fund (see above) is set to be expanded to ensure an effective financing of R&D and innovation activities and contribute to their development. Plans also include the establishment of a network of science offices to strengthen relevant expertise in the ministries (OECD, 2021_[22]). In addition, the number of Smart Specialisation priority areas will be reduced in an attempt to make the innovation policy more focused (European Commission, 2021_[8]) (Box 1).

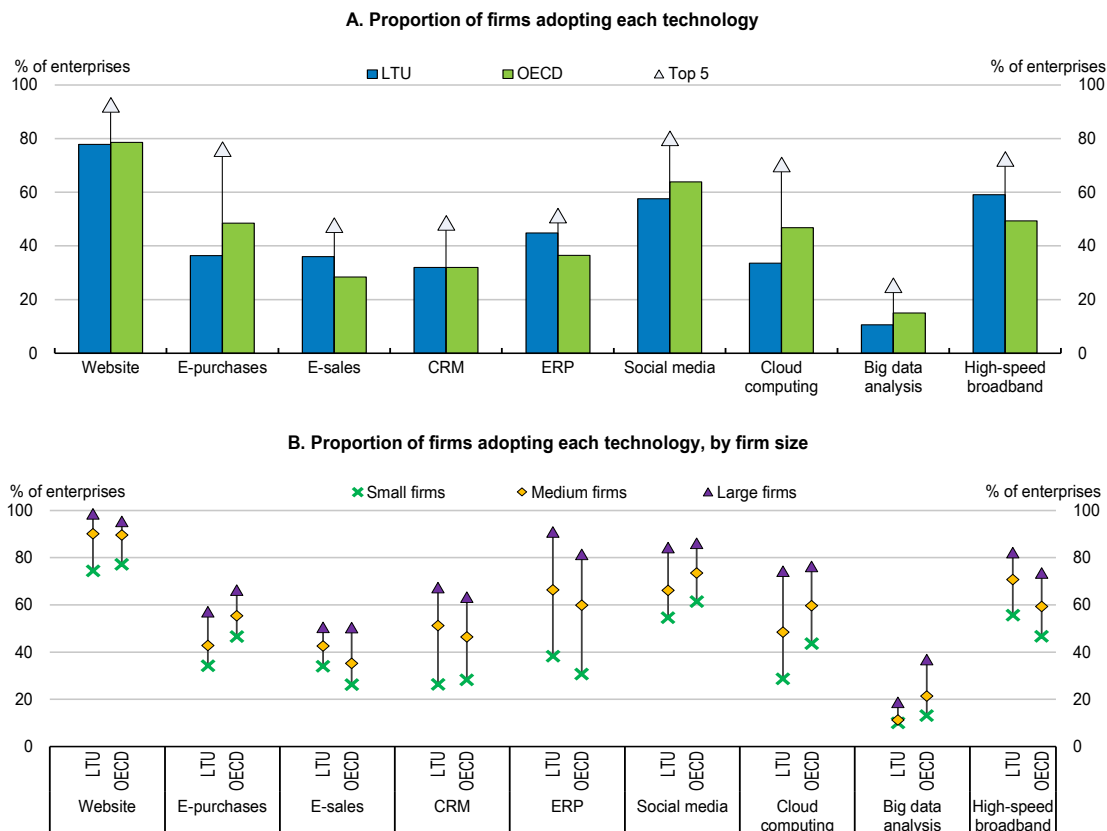
The announced reforms go in the right direction and should be implemented swiftly. Yet, reform could go further to encompass more agencies based on a careful assessment. Streamlining the numerous strategic documents on innovation would help clarify the overall direction of policies and reinforce strategic orientation by reducing the risk of overlapping and, possibly, competing policy priorities. Regular monitoring

of the effectiveness of innovation-related programmes would ensure a balanced provision of such programmes and make it easier to adjust the portfolio of relevant policy instruments if outcomes are not in line with intentions. At the same time, it is essential to ensure sufficient domestic funding to safeguard the continuity of innovation reforms and support of R&D and innovation activities beyond the end of the period covered by the EU Recovery and Resilience Plan.

3. Fostering the digital transformation of firms, especially smaller ones

There is scope to boost the digitalisation of firms, especially the smaller ones, and make the use of advanced technologies more effective. The uptake of some digital technologies, such as e-sales and enterprise resource planning software, exceeds the OECD average, but Lithuania underperforms in terms of the adoption of digital tools such as big data analysis and cloud computing, which are important for more comprehensive digital transformation and data-driven innovation (Figure 10). Smaller firms, accounting for the bulk of total businesses in Lithuania, lag behind in all technologies. Translating innovations, such as big data and cloud computing, into productivity gains nevertheless requires effective use of these technologies to improve or produce new business processes and products. Many small firms in Lithuania lag behind in this regard (Figure 7). Disparities in the take-up and effective use of digital technologies may explain to an extent the productivity dispersion across firm size and the relatively long tail of low-productivity firms in the country (Figure 11). Fast progress in digitalisation can help Lithuania explore and make the most of innovation niches, while yielding productivity gains. The fintech sector is a successful example in this respect (Box 4).

Figure 10. There is scope for greater uptake of digital technologies, especially by smaller firms 2021 or latest

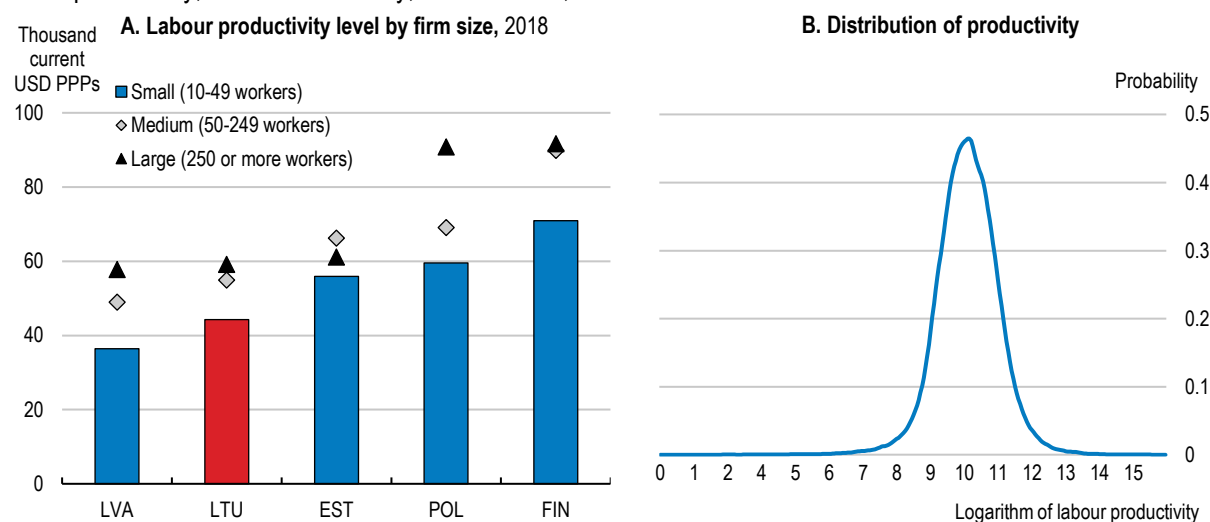


Note: For Lithuania, data for E-purchases refer to 2018, data for Big data analysis to 2019, and data for E-sales to 2020. "Top 5" refer to the average of the five best performers. "Small" stands for enterprises with 10-49 employees, "Medium" for enterprises with 50-249 employees and "Large" for enterprises with 250 employees and over. Total refers to the enterprises with at least 10 employees. Source: OECD, ICT Access and Usage by Businesses database.

StatLink 2 <https://stat.link/jl4sd4c>

Figure 11. Smaller firms lag behind in productivity

Labour productivity, business economy, current PPPs, 2018



Note: In Panel A, labour productivity is measured as value added per person employed. Business economy comprises the ISIC Rev. 4 industry codes B to N, excluding financial and insurance activities. In Panel B, labour productivity is computed as the ratio of real value added and the number of employees. Agriculture, finance and insurance activities are not included. The sample includes enterprises with 10 or more employees. The estimates cover the period 2010 and 2020. The labour productivity distribution function depicts the probability for a firm to have the level of productivity (in log) shown on the horizontal axis.

Source: OECD Compendium of Productivity Indicators; and OECD estimates based on Structural Business Statistics firm-level data provided by Statistics Lithuania.

StatLink 2 <https://stat.link/6xe1p>

Box 4. Fostering technology-based innovation in the financial sector

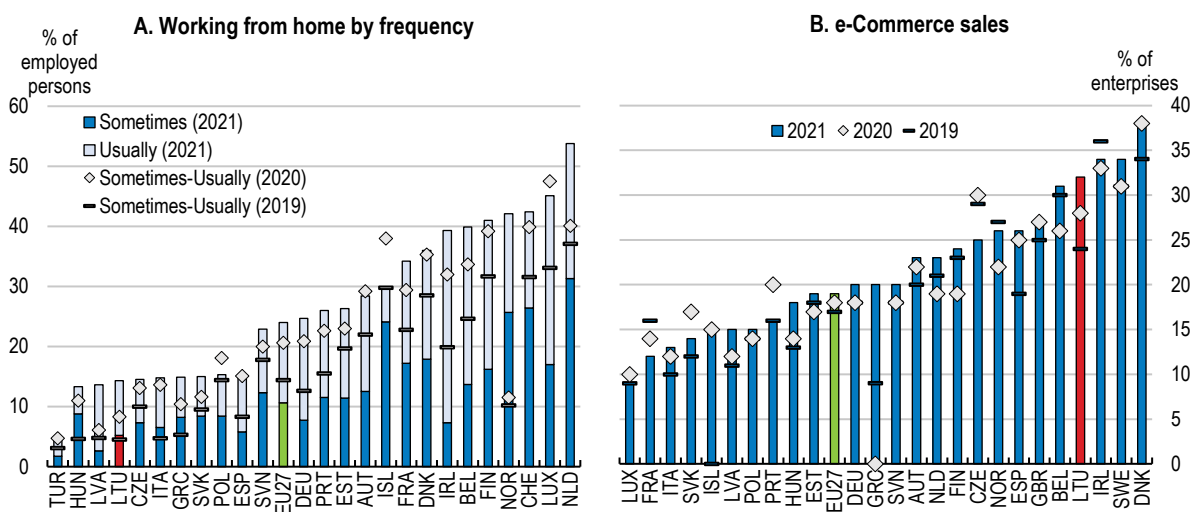
Lithuania has made notable progress in recent years in the field of financial technology (fintech). This allowed the country to develop and adopt innovative technology-based solutions for financial services. The fintech sector, encompassing currently 265 firms (both domestic and foreign), provides a wide array of services, products, and business models including payment and electronic money institutions, specialised banks, peer-to-peer lending and crowdfunding platforms, security brokers and investment management and insurance companies (ECOVIS, 2020_[35]) (Figure 1.14 in (OECD, 2022_[5])).

The development of fintech owes much to a supportive regulatory environment and payments infrastructure, and a sandbox that allows participants to test their financial innovations in a live environment under the supervision of the central bank. The sandbox has also been used in cross-border testing of climate change-related data analysis. Moreover, a blockchain-based sandbox (LBChain) combines technology and regulatory infrastructures to enable financial and fintech companies, including start-ups, to carry out blockchain-oriented research, test and adapt blockchain-based services and provide innovations to their customers (ECOVIS, 2020_[35]). Non-regulatory tools include initiatives, such as the Newcomer programme, which is focused on pre-licensing support. Since 2016, more than 650 participants have entered the Newcomer programme from more than 70 countries. Innovations explored or implemented through these tools include the development of peer-to-peer insurance platforms and other financial services. The Financial Market Development Center, established in the central bank in early 2022, is dedicated to attract new market entrants and financial services in Lithuania (see below).

Lithuania is introducing new national guidelines for developing the fintech sector, with the participation of public and private stakeholders (Invest Lithuania, 2021_[36]). Emphasis remains on promoting the use of digital financial services, fostering the creation of technological innovations, ensuring the future growth and maturity of the fintech sector and strengthening risk management.

As in other countries, the uptake of digital tools, such as teleworking and e-commerce, has increased since the onset of the pandemic, helping businesses to maintain and/or expand economic activity (Figure 12). Barriers to digitalisation, especially for small firms, nevertheless remain. Increasing the take-up of high-speed broadband, upgrading skills and a higher use of e-government (discussed further below) could boost the digital uptake, with associated productivity dividends (Sorbe et al., 2019^[4])(Figure 13). Reducing regulatory barriers to competition and easing financing conditions of young and innovative firms are also associated with a higher use of digital technologies and productivity gains. To enhance the impact, pro-competitive regulations need to be combined with insolvency regimes that do not over-penalise entrepreneurial failure and sufficiently flexible labour market regulations, with particularly large benefits for smaller firms (OECD, 2019^[37]; Sorbe et al., 2019^[4]). For smaller firms going digital, however, it is also vital to address several additional size-related barriers in terms of awareness, knowledge on what digital tools they need and how to integrate and use them effectively, as well as managerial competence.

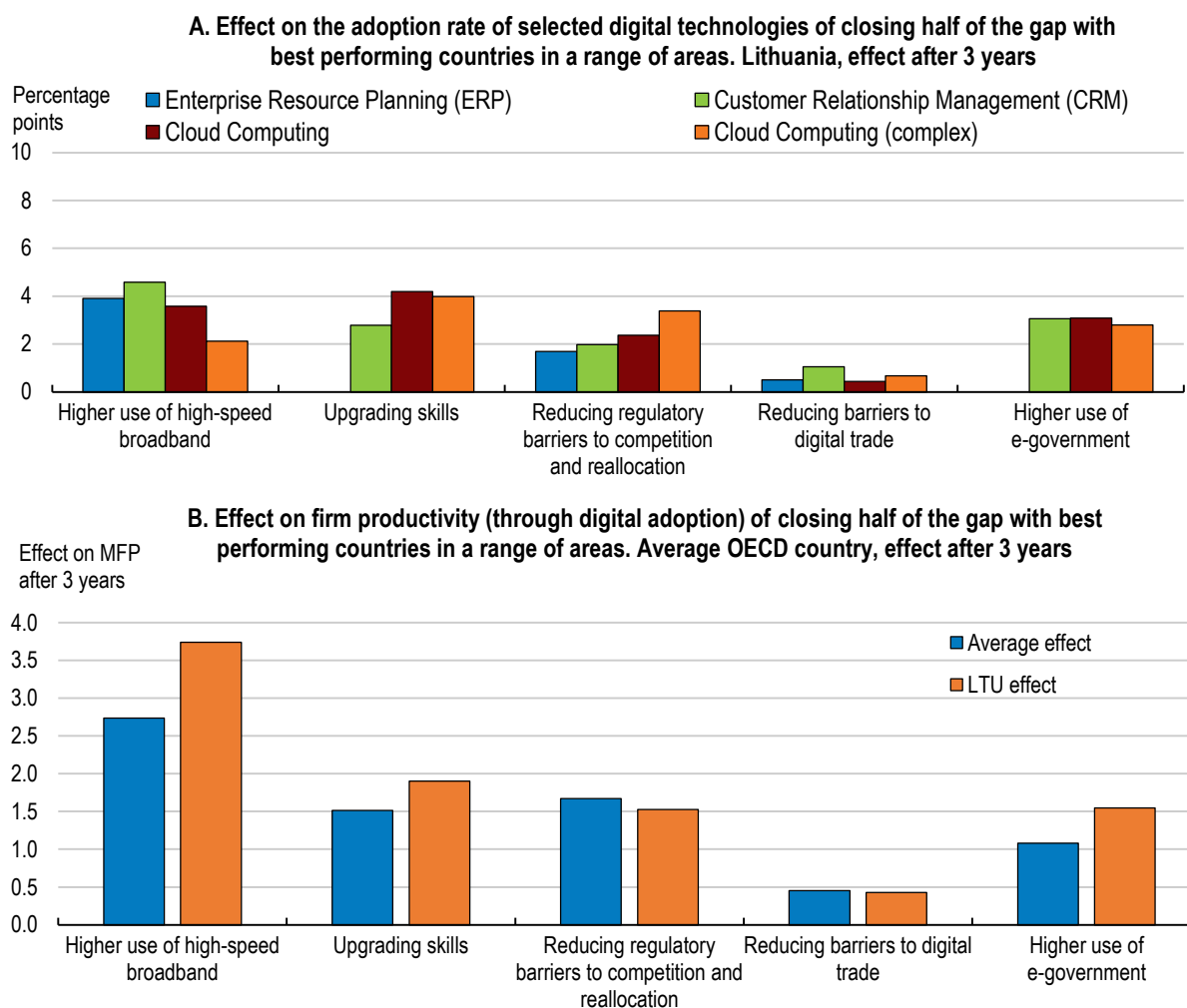
Figure 12. The pandemic-related crisis has accelerated the use of digital tools



Source: European Labour Force Survey data following Ker, D., P. Montagnier and V. Spiezia (2021), "Measuring telework in the COVID-19 pandemic", OECD Digital Economy Papers, No. 314, OECD Publishing, Paris, <https://doi.org/10.1787/0a76109f-en>; and Eurostat.

StatLink 2 <https://stat.link/yxdips>

Figure 13. A range of policies can support productivity through digital adoption in Lithuania



Note: Estimated effect on the average digital adoption rate (Panel A) and the multi-factor productivity (MFP) of the average firm (Panel B) of a range of policy and structural factors. The effect of “Higher use of high-speed broadband” on productivity combines the direct and indirect effects. “Upgrading skills” covers quality of management schools. “Reducing regulatory barriers to competition and reallocation” includes lowering administrative barriers to start-ups and relaxing labour protection on regular contracts. For each of the underlying indicators, it is assumed that half of the gap to the best performing country in the sample is closed. It is also assumed that policy factors in each group are largely independent from each other. Results are presented for the average OECD country.

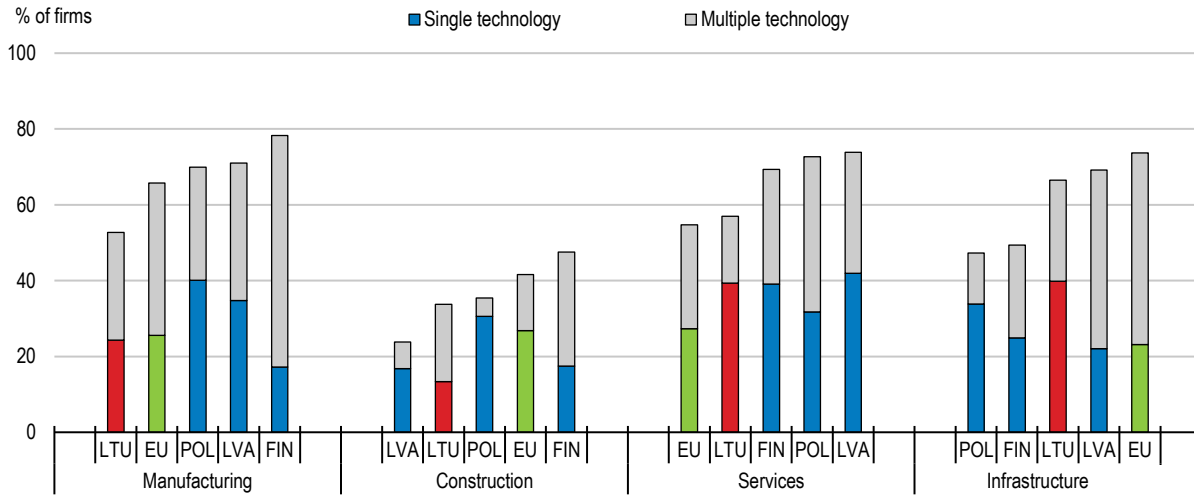
Source: Sorbe et al., 2019.

StatLink 2 <https://stat.link/bsz6vf>

The prevalence of SMEs in Lithuania makes it very important that this segment of the economy is encouraged to switch to digital technologies to reduce the productivity gap between small and large firms and address structural challenges after the pandemic. This would also help with the digitalisation of manufacturing, which is the largest sector of the Lithuanian economy, and it still lags behind the EU average in terms of digitalisation and productivity (Figure 14) (Lithuanian Innovation Center, 2020_[2]). Smaller enterprises account for the bulk of total enterprises in manufacturing, but only a quarter of such firms reported plans to digitise within the next two to three years, according to 2020-2030 Industry Digitisation Plan, raising important concerns (Lithuanian Innovation Center, 2020_[2]). The sections below discuss policy enablers for the successful digital transition of firms.

Figure 14. The Lithuanian manufacturing sector lags behind in terms of digitalisation

Adoption of digital technologies by sector, 2021



Note: A firm is identified as “digital, single technology” if one digital technology is implemented in parts of the business and/or if the entire business is organised around one digital technology. A firm is identified as “digital, multiple technologies” if at least two digital technologies are implemented in parts of the business and/or if the entire business is organised around at least two digital technologies. Different digital technologies are chosen depending on the sector. In manufacturing sector, firms are surveyed about the use of (a) 3D printing; (b) robotics; (c) the internet of things; and (d) big data/artificial intelligence. Firms in construction sector are surveyed about the use of (a) 3D printing; (b) drones; (c) the internet of things; and (d) virtual reality. Firms in services sector are surveyed about the use of (a) virtual reality; (b) platforms; (c) the internet of things; and (d) big data/artificial intelligence. Firms in infrastructure sector are surveyed about the use of (a) 3D printing; (b) platforms; (c) the internet of things; and (d) big data/artificial intelligence.

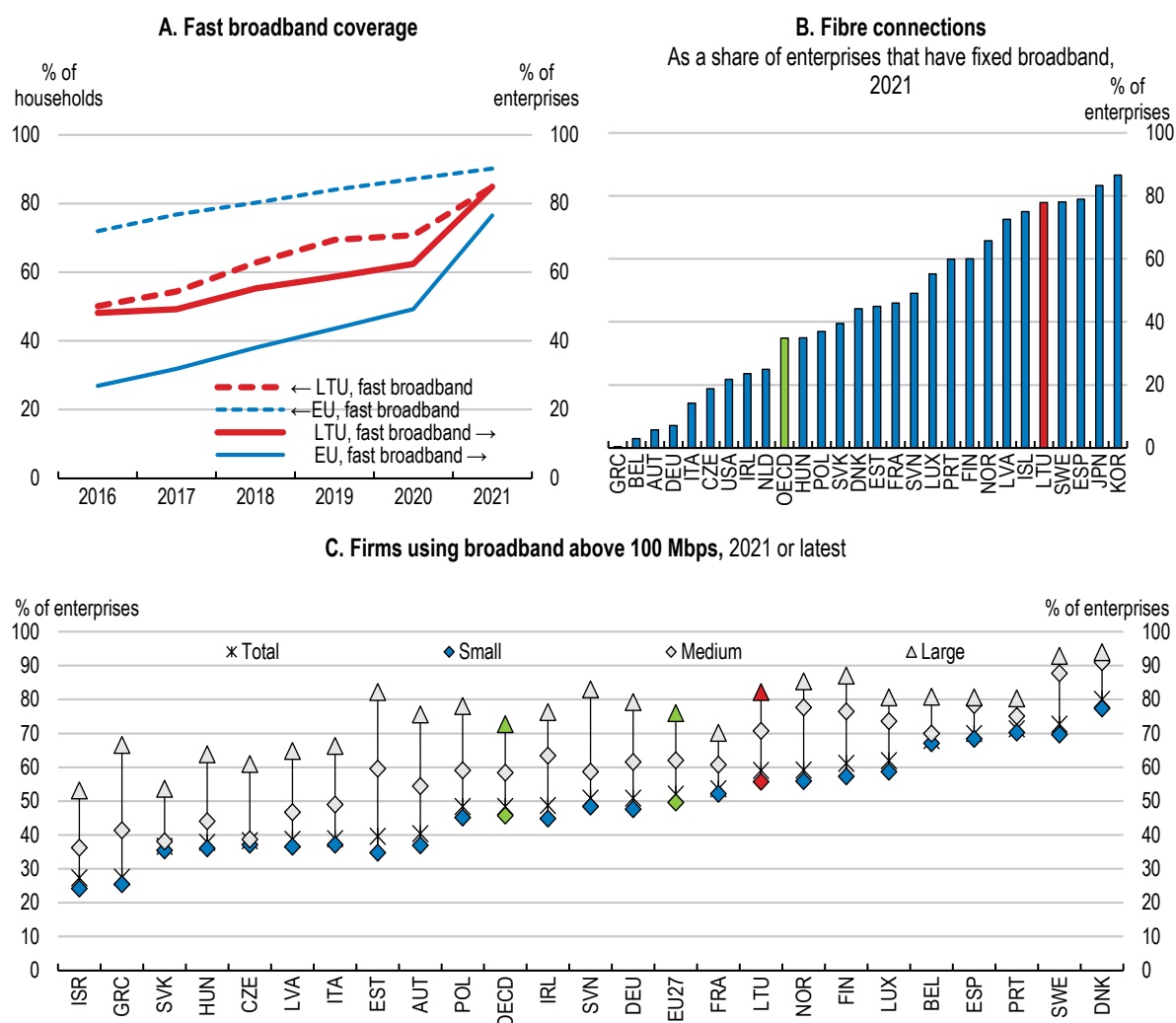
Source: European Investment Bank, Investment Survey data.

StatLink 2 <https://stat.link/i91uhj>

3.1. Digital connectivity needs to improve

Lithuania has made progress towards improving digital connectivity. Around 85% of households were covered by fast broadband in 2021, up from 50% in 2016, and most firms have broadband connection (Figure 15). The share of fibre connections in total fixed broadband is close to the levels of top performing countries, supporting fast data transmission required for the adoption of advanced technologies. 4G coverage is almost universal. There is scope, however, to increase further the share of firms with high-speed broadband connections (at least 100 Mbps), especially among smaller firms. Recent OECD estimates reveal productivity gains from higher take-up of high-speed broadband (Sorbe et al., 2019^[41]) (Figure 13).

Figure 15. Digital connectivity increased, but high-speed broadband could be used more by firms



Note: Panel A: there has been a methodological change in the definition of the share of enterprises that have a fast broadband (at least 30 Mbps) in 2021, Nace Rev.2 sector 75 (research and development activities) have been included.

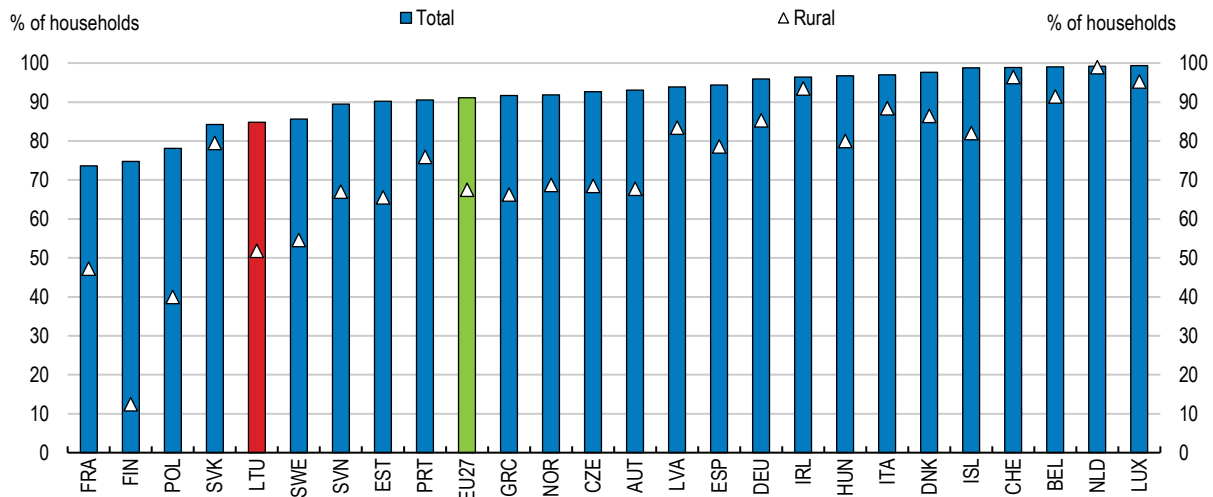
Source: European Commission, Digital Economy and Society Index Report 2022, [DESI | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/digital-single-market/en/desi-shaping-europe-digital-future); OECD, ICT Access and Use by Businesses database; and OECD, Broadband Portal, <http://www.oecd.org/sti/broadband/broadband-statistics/> retrieved 24 February 2022.

StatLink 2 <https://stat.link/yb2k11>

Despite progress, gaps in digital connectivity remain. The share of households with access to fast broadband lags behind the EU average, especially in rural areas (Figure 15, Panel A and Figure 16). As in other countries, rural and remote areas tend to be less attractive for private investment in ICT infrastructure in view of the higher deployment costs, thereby requiring additional public investment (OECD, 2021^[38]). Ongoing efforts focus on further improving digital connectivity and addressing the urban-rural digital divide, including through the renewed National Broadband Plan 2021-2027 (Box 1). It is essential to continue applying cost-benefit analyses to identify, at a minimum, priorities regarding the expansion of the network over time. Further use of high-speed broadband and the deployment and a take-up of 5G will allow businesses to face increasing data demand in the near future (OECD, 2019^[39]).

Figure 16. Broadband coverage is lower in rural areas

Households in areas where fixed broadband with a speed of 30 Mbps or more is available, as a percentage of households in the total and rural categories, June 2021



Note: Following the methodology of OECD (2019), Measuring the Digital Transformation <https://doi.org/10.1787/9789264311992-en>, coverage of NGA technologies (VDSL, FTTP, DOCSIS 3.0) capable of delivering at least 30 Mbps download was used to estimate the coverage. Source: European Commission, Broadband Coverage in Europe in 2021.

StatLink 2 <https://stat.link/gewr4z>

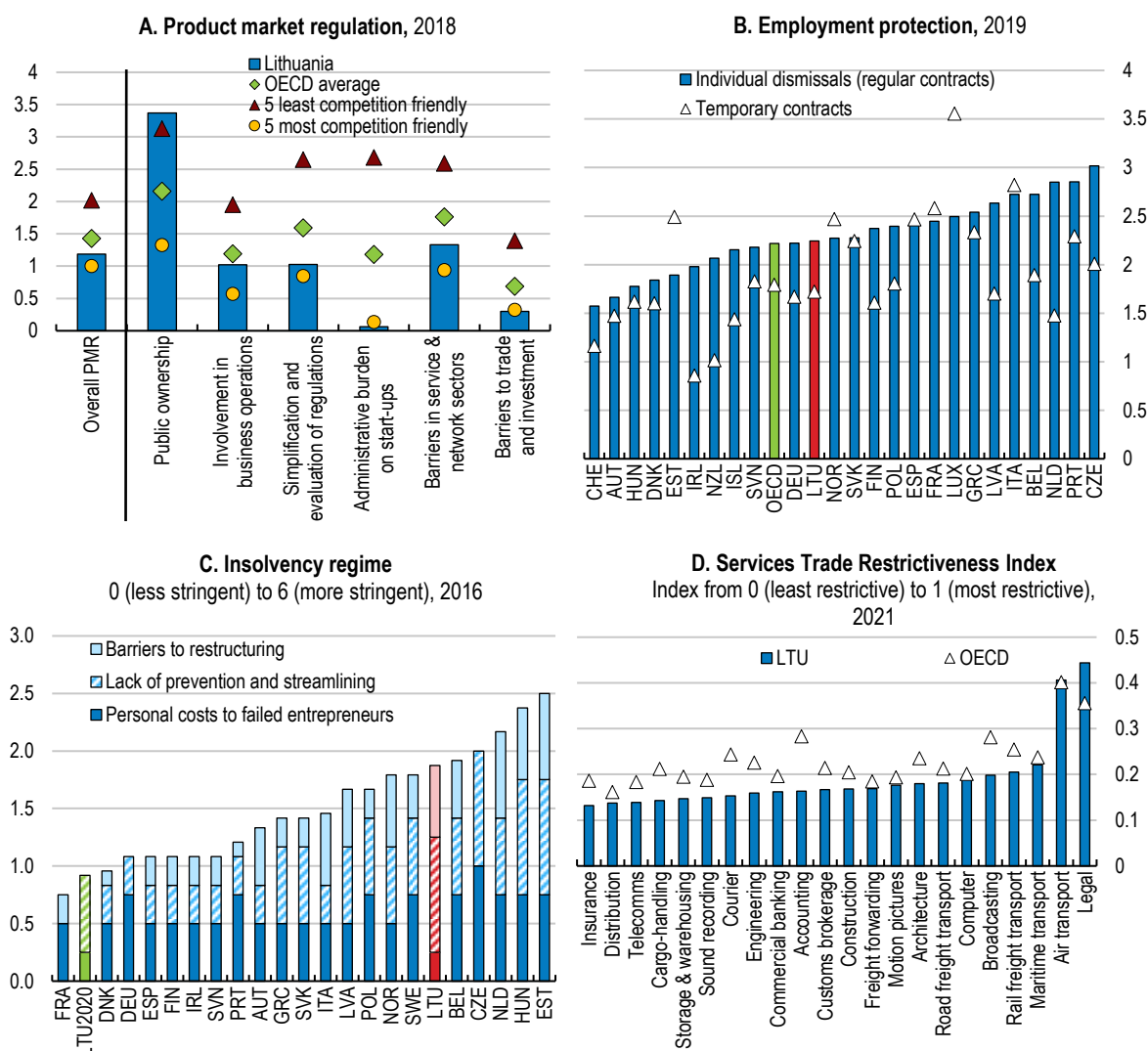
3.2. Framework conditions are business-friendly but can improve further

Lithuania's regulatory framework is business-friendly. Barriers to market entry are well below the OECD average, and the administrative burden for setting up a new business is among the lowest among OECD countries (Figure 17). Since 2014, Lithuania has been applying a "one-in, one-out" rule for the administrative burden faced by businesses with biannual plans for selected sectors. Lean regulations for product markets are combined with relatively flexible labour market regulations. Reforms in 2017, under the new Labour Code, relaxed stringent dismissal rules, while strengthening social protection (OECD, 2018^[13]).

Insolvency procedures were eased markedly in 2020 (Figure 17, Panel C). The new regime has accelerated timely initiation and resolution of personal and corporate insolvency proceedings, while providing business with more options for restructuring, rather than exit, and accelerates court procedures (OECD, 2020^[40]). A restructuring plan can be currently approved without the consent of the shareholders of the legal entity or the creditors, thereby increasing the opportunities for approval. By facilitating the restructuring of companies, the new insolvency regime has the potential to enhance incentives for disruptive innovation and increase the uptake of digital technologies.

As a further step towards improving the regulatory framework, the government plans to review overly complex licensing mechanisms in priority sectors, with the aim of replacing, where possible, licensing by business oversight or possibly move to a lighter declarative licensing model. A licensing review for the health care sector is under way. The reform is appropriate and needs to be implemented swiftly in all priority sectors. Simplifying the licence procedures for firms helps to make the regulatory environment even more business-friendly, thereby stimulating entry of young firms -- a vital part of the digital innovation landscape.

Figure 17. The regulatory framework is business-friendly but could improve further



Note: In Panel C, the figure shows values for 2016, except Lithuania for which the pre-reform 2016 and post-reform 2020 values are presented. Source: OECD, Product Market Regulations Statistics database; OECD, Strictness of Employment Protection database; "The design of insolvency regimes across countries", OECD Economics Department Working Paper, No. 1504, 2018; and OECD, Services Trade Restrictiveness Index database.

StatLink 2 <https://stat.link/y6k278>

Removing remaining regulatory barriers to foreign direct investment would accelerate digitalisation and boost productivity by bringing know-how to the country and enhancing innovation activity. New provisions enacted in 2021 simplified the conditions for investors from non-EU countries to transfer their employees to Lithuania. Notably, it is no longer required that the qualifications or work experience of such employees be assessed by the Public Employment Services, which represents an important easing of the regulation underlying the migration of firm-specific human capital from non-EU countries, encouraging the relocation of non-EU firms to Lithuania. In addition, the 2021 provisions eased the migration procedures for computer specialists from countries outside the European Union, helping businesses to expand given that such skills are in short-supply in Lithuania. Some barriers for foreigners to do business in Lithuania nevertheless remain in some important sectors, notably legal services, reflecting burdensome requirements of recognition of foreign qualifications (Figure 17, Panel D) (OECD, 2021^[41]). Moreover, stringent economy-

wide regulations impose limitations on the acquisition of real estate by foreigners, except nationals from European Economic Area and OECD countries, while a minimum amount of capital must be deposited for the registration of a limited liability company.

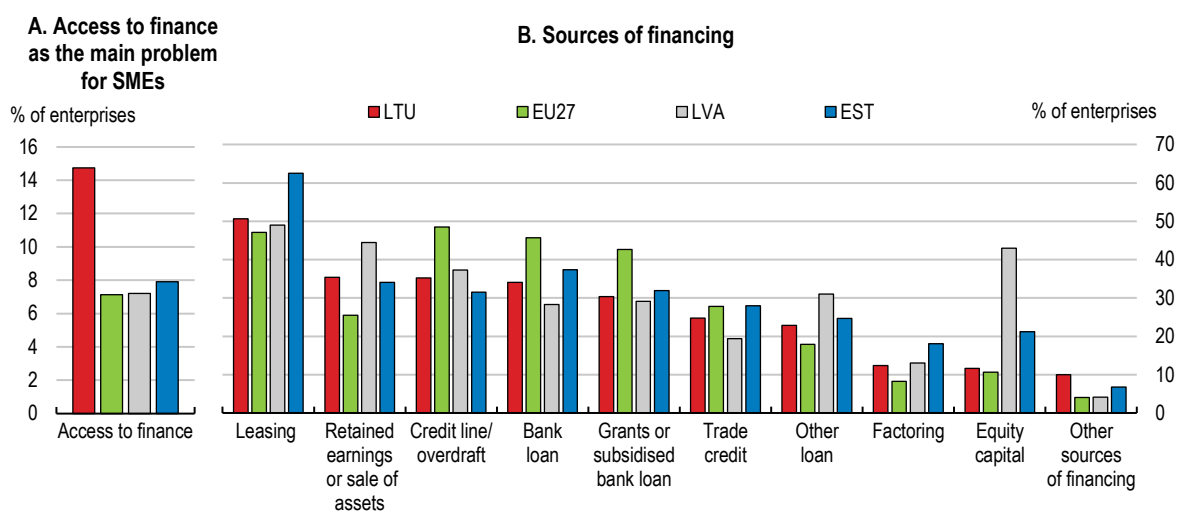
The digital transformation poses new challenges for regulatory frameworks and competition policy. Digitalisation promotes competition in many product and service markets through the increased use of data and cross-border mobility, with potential benefits for consumers in the form of lower prices and broader choice of products (OECD, 2020^[42]). However, digitalisation can also raise barriers to entry because of economies of scale and scope and network effects (i.e. gains enjoyed by consumers of a product when the number of users increases), which can strengthen the market position of dominant firms (“winner takes most dynamics”) (OECD, 2022^[43]). In particular, digital technologies can create barriers to entry, which provide a competitive edge to digital platform incumbents. As a result, new regulatory frameworks may be needed to address competition challenges arising from digitalisation (OECD, 2021^[44]). Existing sector regulatory frameworks may also need to be re-assessed. In the United Kingdom, for instance, a new council (the Regulatory Horizon Council) has been established to advise the government on regulations that may need to be reformed to keep pace with technological change. Moreover, an Innovation Test has been piloted to ensure that the impact of regulation on innovation is taken into consideration in the early stages of policy making (OECD, 2021^[45]).

3.3. Broadening the range of financing sources for firms

Broadening the range of financing sources is important to ease access for SMEs and support investment in digital assets. Around 15% of small and medium-sized (SMEs) firms in Lithuania report difficulties in accessing finance, almost twice the EU average (Figure 18, Panel A). According to recent research, the main factors limiting credit for SMEs include a lack of acceptable collateral, a lack of information on available financing options and poor financial literacy (Bank of Lithuania, 2021^[46]). Survey data suggest that 23% of Lithuanian SMEs identify the insufficient collateral or guarantee the most important obstacle to obtain external financing (European Commission, 2021^[47]). As in other countries, firms facing financial constraints are often young innovative SMEs, with high growth potential.

Figure 18. SMEs in Lithuania rely more on bank lending than equity financing

2021



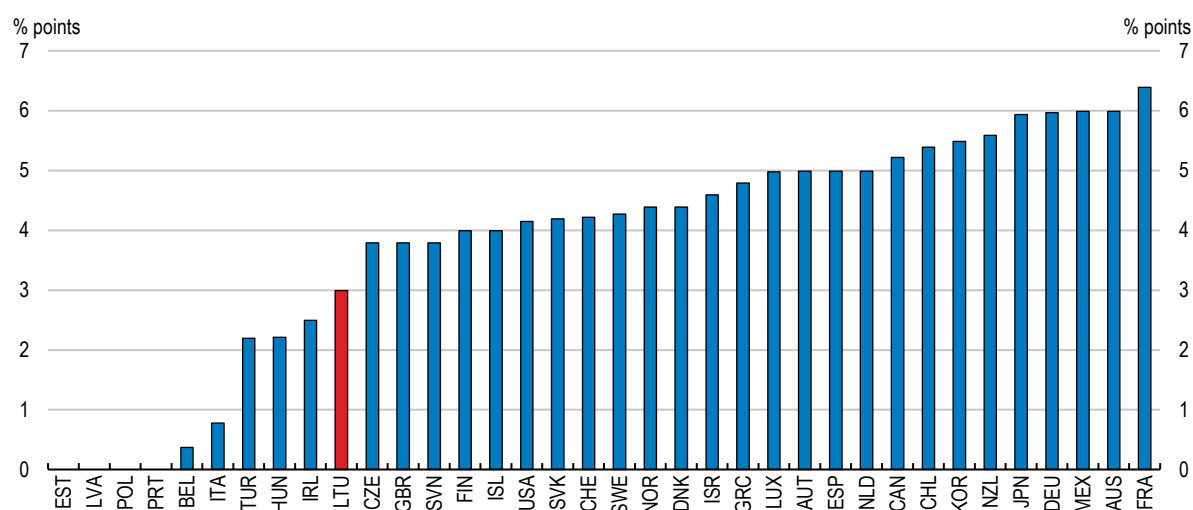
Source: European Commission, Survey on the Access to Finance of Enterprises (SAFE) wave 25.

StatLink 2 <https://stat.link/52fou4>

Equity financing needs to develop further. Enhancing access to equity for small and young firms can boost digitalisation by allowing more intangible investment (Demmou, Franco and Stefanescu, 2020^[48]). The share of SMEs in Lithuania making use of equity finance is on par with the EU average, but bank lending remains the main source of external finance (Figure 18, Panel B). As with other countries, this may reflect, to an extent, more favourable tax treatment for debt than for equity finance (Figure 19). While corporate income tax systems allow deductibility of interest expenses in general, equity finance is not deductible, making it relatively costly compared to debt financing (Sorbe et al., 2019^[4]). Lithuania limits the interest deductibility, including through the application of a thin capitalisation rule. Some countries, such as Belgium, Italy and Portugal have introduced an allowance for corporate equity (ACE), to address the asymmetry in tax treatment and make equity financing more attractive (Demmou et al., 2021^[49]; OECD, 2021^[15]). If well-designed, ACE can reduce leverage at the firm level, with the additional advantage in the post-COVID-19 era to provide support for firms without creating potential debt overhang problems (Branzoli and Caiumi, 2020^[50]; Demmou et al., 2021^[49]). Greater awareness among firms of equity financing instruments could also increase take-up. For instance, Portugal has developed a platform available to entrepreneurs that includes information on financial instruments (OECD, 2021^[51]).

Figure 19. The debt-bias in the Lithuanian corporate tax system could be reduced

Differences in effective tax rates for equity and debt financing, 2020



Source: OECD, Corporate Tax Statistics.

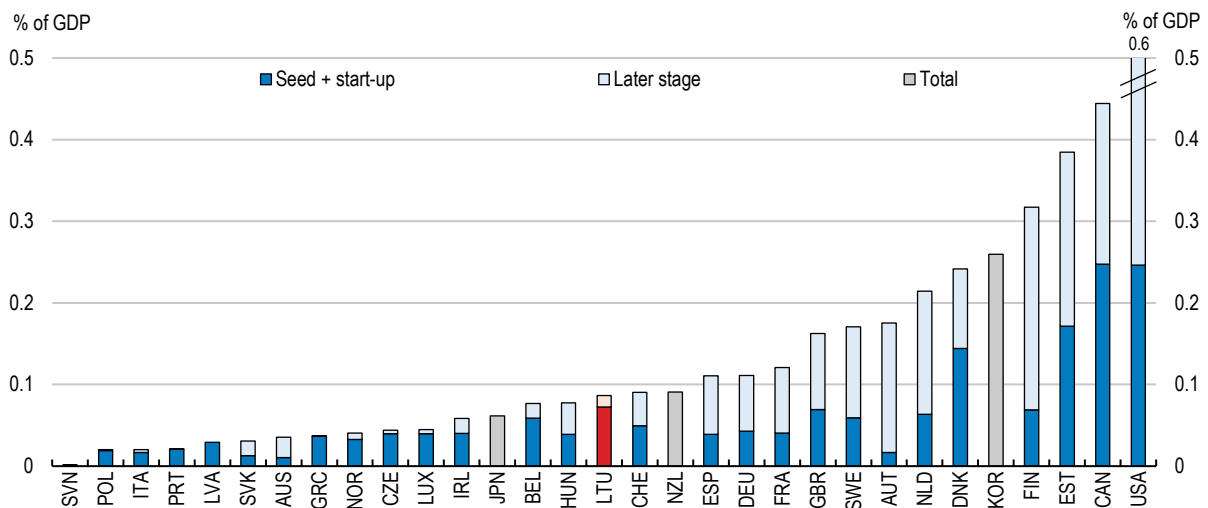
StatLink 2 <https://stat.link/4some>

The government supports SMEs through loans with preferential rates to obtain the necessary financing to start a business. Moreover, the national promotional institution INVEGA (Investment and Business Guarantees) provides guarantees of loan repayment for companies that do not have sufficient collateral (OECD, 2020^[52]). INVEGA has also started providing direct loans to young SMEs. This is a positive step towards facilitating access to funding for firms that are not financed by private financial institutions. The coverage of INVEGA loans should be expanded on the basis of careful assessment, targeting firms with a high innovation and productivity potential.

Venture capital (VC), an important source of investment of innovative start-ups, is growing but is still less developed than in many OECD countries (Figure 20). Several VC funds were designed by the government to support young firms with high innovation potential, including the Accelerator Fund, in particular, in operation since 2019, and a new venture capital instrument (“Accelerator 2”) since 2021 that will gradually replace the Acceleration Fund. The new accelerator scheme provides mentoring and acceleration services, in addition to investing in start-ups (EC-OECD, 2021^[53]). The availability of venture capital could increase further (Figure 20). In addition, there are concerns that a large number of financial assistance measures are targeting early-stage start-ups, whereas relatively few address business upscaling needs (OECD, 2021^[22]), with scope for a more balanced financing of the different stages of the start-up life-cycle. The government should consider engaging indirectly, through privately-owned venture funds, rather than directly in VC activity, in line with international experience. Indeed, most OECD countries have moved progressively towards co-investment funds and funds-of-funds that aim to leverage private investment on the rationale that government funding is most effective when disciplined by private management (Demmou and Franco, 2021^[54]).

Figure 20. Reliance on venture capital could increase

Venture capital investments, 2021 or latest year



Note: Venture capital (VC) is private equity capital provided to young enterprises not quoted on a stock market. VC stages are defined according to the OECD VC Harmonised Stages definition and include support for pre-launch, launch and early stages under “Seed/start-up/early stage”, which also includes support provided by angel investors, and support for expansion and growth stages under “Later stage”. Data refer to 2020, except for Australia (2019) and the United States (2019).

Source: OECD (2021), OECD Enterprise Statistics database.

StatLink 2 <https://stat.link/pa6sjw>

Financial technology (fintech) offers new digital financing solutions that can help to bridge the funding gap for young innovative firms, while also increasing competition in the SME lending and funding activities. Fintech lenders (non-banking lending participants), such as crowdfunding platforms, participate actively in the financial market in Lithuania (Box 5). Around 15% of the funding raised by the Lithuanian businesses in 2021 was attracted by fintechs alone (Invest Lithuania, 2021^[36]). The authorities expect increased activity in this segment of the market, as a result of the EU-wide harmonisation of crowdfunding regulation in November 2021. There is scope, however, to better connect companies and investors (OECD, 2020^[52]).

Box 5. Crowdfunding: an alternative source for financing SMEs with high-innovative potential

Crowdfunding can complement venture capital, especially in the case of start-ups at early stages. In particular, crowdfunding enables start-up companies to raise capital from a large group of financially unsophisticated individuals through open online platforms. Peer-to-peer lending can be particularly attractive for young innovative firms that lack credit records or collateral for bank loans. In addition to providing an alternative source of finance for young firms, crowdfunding works as a marketing channel, raising public attention to the company and its investment opportunities. At the same time, crowdfunding enables business angels (see below) to find investment opportunities in wider geographical areas.

In addition to financing undertaken by not-for-profit organisations (the patronage model), crowdfunding arrangements can take the following forms: i) the reward-based model, according to which investors receive a reward for their commitment either in the form of a donation or of preferential access to and prices for the new product; ii) the lending model, which resembles peer-to-peer lending: investors receive just a promise of repayment after a predefined period of time of the capital loaned plus interest; and iii) the equity model, in which investors receive a share of the company and effectively become shareholders.

Crowdfunding platforms seem to have a growing appeal among individual investors in OECD area, but they are still developing. In Lithuania, crowdfunding platform operators have been regulated for nearly five years, with the value of transactions made through crowdfunding platforms increased 60-fold during this period, according to official data. There are currently 21 crowdfunding platform operators in the country. As a step forward, an EU-wide regulation on crowdfunding came into force in November 2021 that synchronises divergent regulations, introducing common rules for platforms. The impact of this investment vehicle in bridging the funding gap of young innovative firms needs to be evaluated further.

Source: Bank of Lithuania; (Demmou and Franco, 2021^[54]).

As a further step towards strengthening the role of alternative financing for start-ups and SMEs, the government could consider providing support (logistical/and or financial) for the establishment of more formal business angel networks, in line with the experience in other countries (OECD, 2016^[55]). Several OECD countries also provide preferential tax treatment or tax relief on capital gains to promote business angel lending as for instance, the “tax shelter” scheme in Belgium that grants a 45% tax reduction in the personal income tax for investors in a start-up (OECD, 2016^[55]). Angel investment has increased considerably in the past few years in Lithuania but as a share of GDP it remains below the levels recorded in the Baltic peers and Finland (EBAN, 2021^[56]). Business angels may play an important role in providing not only finance but also business know-how to the companies they invest in.

The Bank of Lithuania has recently announced an action plan (Capital Market Development Action Plan) that aims to increase significantly by 2025 the alternative financing options for Lithuanian firms, including through a doubling of the crowdfunding market (Bank of Lithuania, 2022^[57]). The plan also provides a mechanism for innovative domestic firms to efficiently attract external financing on the capital market throughout their entire life cycle, i.e. from their start-up to sustainable development. A Capital Market Council will be set up to supervise the implementation of the plan, encompassing representatives of both public institutions and private sector associations. Assessing regularly the effectiveness of the measures included in the plan in terms of broadening the alternative financing options for smaller innovative firms is important.

3.4. Information on digital tools and management competencies also need to improve

Smaller firms are often unaware of the potential benefits of digital technologies and how to incorporate them in their day-to-day commercial activities. They also often lack the means and skills to adopt digital technologies (Digitally Driven, 2021^[58]). The government supports the digital transformation of SMEs in Lithuania mainly through the Business Consultant LT programme, providing business development consultations for SMEs (OECD, 2021^[59]). The programme provides, in particular, information and consultation to SMEs about the introduction of new technologies, sources of financing and other business organisation issues. Some financial support is also available. The Digitisation Industry initiative, for instance, supports SMEs to assess digitalisation opportunities (Lithuanian Innovation Center, 2020^[2]). Moreover, since 2021 (under the E-commerce model COVID-19), the government finances 85% of the cost incurred by the eligible micro and small and medium-sized enterprises for the implementation of e-commerce models. Consideration could be given, subject to fiscal space, to the provision of well-targeted financial support for the implementation of digital tools, such as cloud computing and big data analysis, that can have an important impact on the digital transformation of SMEs. Korea, for instance, offers grants for cloud services (Box 6). The financial support measures should be carefully designed and their effectiveness monitored closely.

Box 6. Supporting the digital advancement of SMEs: international experience

A number of OECD countries have actively engaged in supporting the digital uptake of SMEs, adopting different approaches:

- Targeted financial support to SMEs: Korea, for instance, offers grants for cloud services, while Denmark provides direct financial support to improve the adoption of digital technologies and e-commerce among SMEs; Estonia's financial support scheme aims at ensuring the implementation of digital technologies and robots, as well as enhancing automation in specific sectors.
- Consultancy and information to help SMEs: Lithuania's Business Consultant LT (see text) is one example in this regard; Germany supports SMEs in specific areas, such as IT security and digitalisation of business processes, through expertise provided by consultancy firms that assist businesses individually throughout the whole process.
- More comprehensive support to SMEs, combining financial and technical support with training and guidance services: the Robo-Lift programme in Sweden, for instance, aiming to support automation, provides small or medium sized businesses with financial support and access to training and gives them the opportunity to participate in networking exercises; Australia's Small Business Advisory Service grants tailored advisory services to small businesses, and since November 2020, new businesses accessing this service are offered an initial review of their needs and given access to webinars, workshops and one-to-one mentoring.

Source: (OECD, 2021^[59])

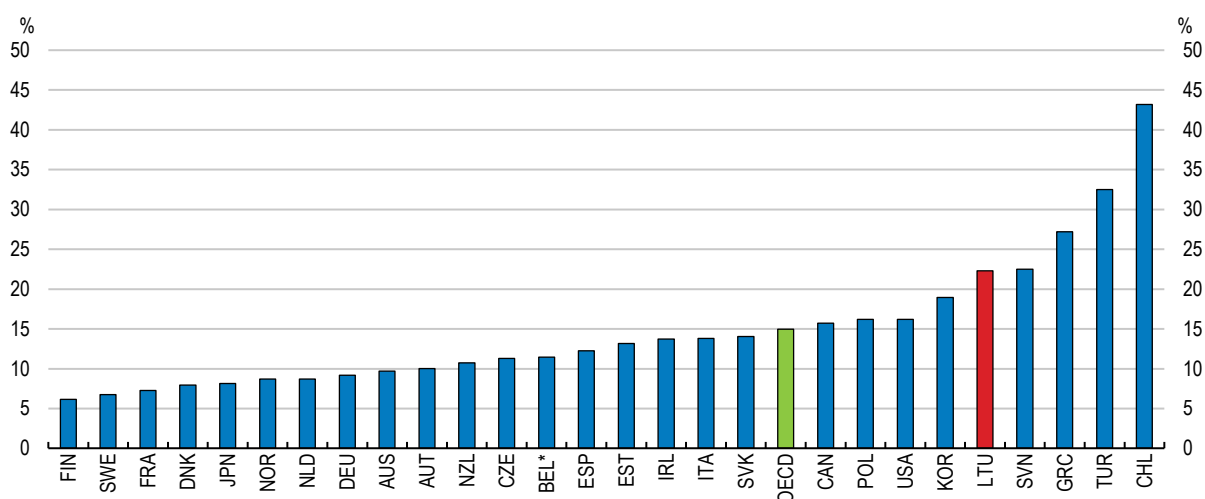
Increases in financial support to stimulate the uptake of digital technologies by SMEs should be accompanied by a more comprehensive network of advisory and mentoring services. Lithuania faces a shortage of experts who can assist companies to prepare action plans for digitalisation and integrate it in their longer-term strategy. Progress in this domain is vital. Germany, for instance, supports the digitalisation of business processes and digital market development of SMEs through expertise provided by authorised consultancy firms (Box 6) (OECD, 2021^[59]). Some countries, such as Australia and Sweden, complement the financial and technical support to facilitate the digital transformation of SMEs with training programmes and guidance for the required set of skills and organisational changes. Developing a

centralised platform to connect SMEs planning to digitalise with a network of experts would be an important step forward.

Managerial skills can be improved further. This is important for the adoption of digital technologies and their effective use (Andrews, Nicoletti and Timiliotis, 2018^[60]). While managers' skills are higher than average skill levels in Lithuania, according to the OECD 2021 Skills Strategy (OECD, 2021^[61]), they still lag behind in international comparison. For instance, around 22% of Lithuanian managers were found to have low skill levels above the OECD average and comparator countries such as Estonia and especially Finland (Figure 21). Entrepreneurship educational programmes play a significant role in the initial development of management skills (see below). Adult learning opportunities in the form of targeted training programmes for managers and owners of SMEs, especially those without specific previous training in management, as well as advanced management courses, on a part-time basis, at tertiary education institutions, would help strengthen managerial skills (OECD, 2021^[51]).

Figure 21. Managerial skills can be improved

Share of managers with low literacy and/or numeracy



Note: Data for Belgium refers to Flanders. For further details on PIAAC survey, refer to [Survey of Adult Skills \(PIAAC\) - PIAAC, the OECD's programme of assessment and analysis of adult skills](#).

Source: Skills Strategy Lithuania (OECD, 2021^[61]).

StatLink 2 <https://stat.link/acok16>

The creation of technological Lithuanian language resources, under Lithuania's Recovery and Resilience Plan, for Artificial Intelligence (AI) solutions to help Lithuanian citizens use advanced AI is expected to increase the capacity of smaller firms to effectively use digital technologies (European Commission, 2021^[8]) (Box 1).

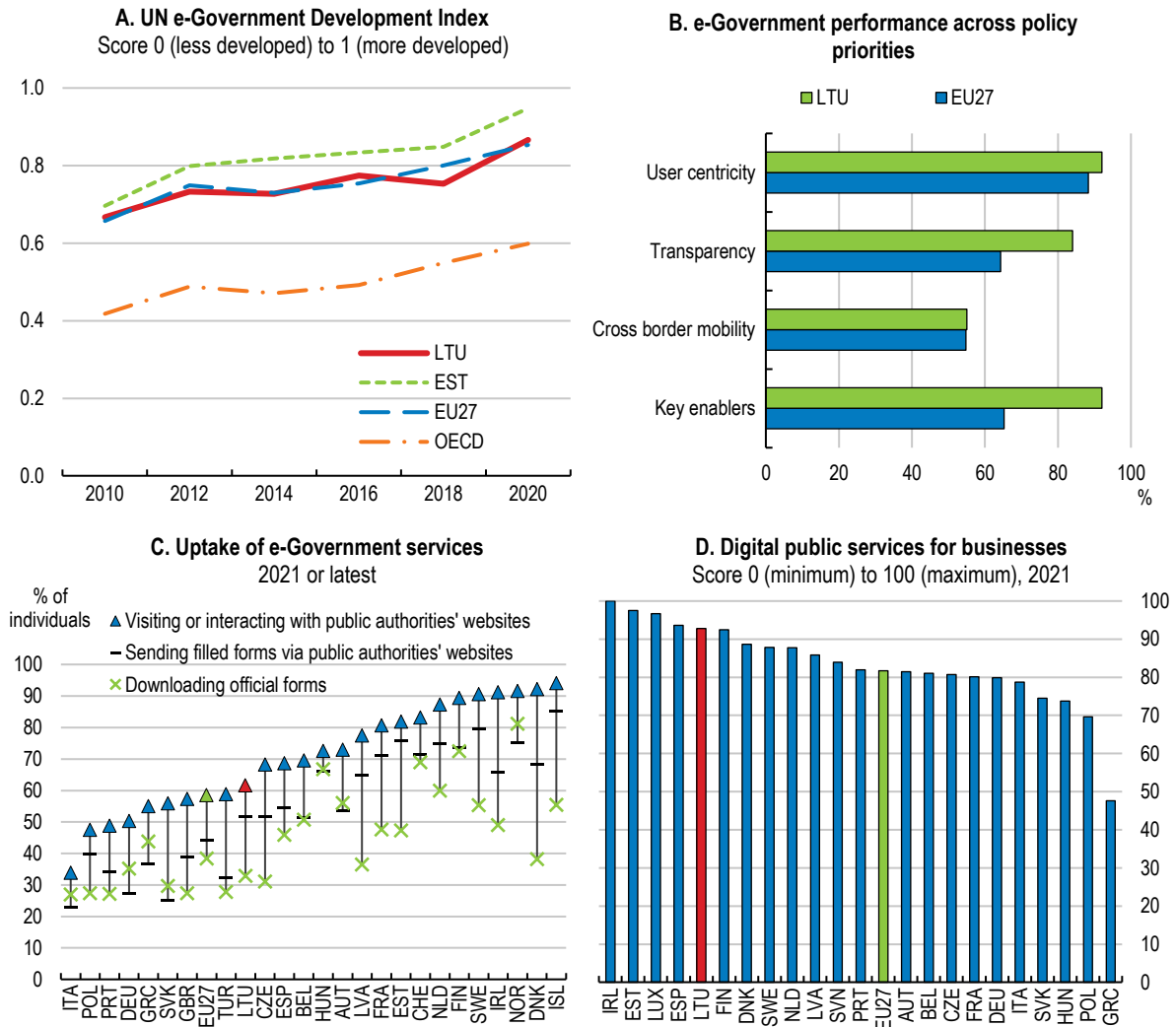
4. A well-developed digital government is key to successful digital transition

4.1. Accelerating progress towards digital government

The promotion of e-government is crucial for the digital transformation and the public sector can be a front-runner in this area, in close partnership with the private sector which constantly develops advanced tools and technological solutions. Lithuania has enhanced e-government capabilities in recent years, applying advanced ICT technologies to government operations (Figure 22). Around 60% of the population uses the Internet to interact with the government, and e-government services for businesses are well developed in

international comparison. The Electronic Government Gateway provides a single access point to e-government services, linking with information systems for taxation, e-health, education, municipal institutions, among other services (European Commission, 2021^[3]).

Figure 22. E-government indicators compare well internationally



Note: Panel A: the *e-Government Development Index* presents the state of e-Government Development of the United Nations Member States, and includes the provision of online services, telecommunication connectivity and human capacity. Panel B: *User Centricity* indicates the extent to which a service is provided online, its mobile friendliness and usability of the service. *Transparency* refers to the process of service delivery, responsibilities and performance of public organisations and personal data processed in public services. *Cross-border mobility* indicates the extent to which users of public services from another European country can use the online services. *Key enablers* indicate the extent to which technical and organisational pre-conditions for e-government service provision are in place. Panel D: the indicator broadly reflects the share of public services needed for starting a business and conducting regular business operations that are available online for domestic, as well as foreign users.

Source: UN (2021). Government Knowledgebase; European Commission, Digital Public Administration factsheet 2021 Lithuania; Going Digital: Shaping Policies, Improving Lives and OECD ICT Access and Usage by Households and Individuals Database (<http://oe.cd/hhind>); and European Commission, Digital Economy and Society Index Report 2022, [DESI | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/digital-economy/index).

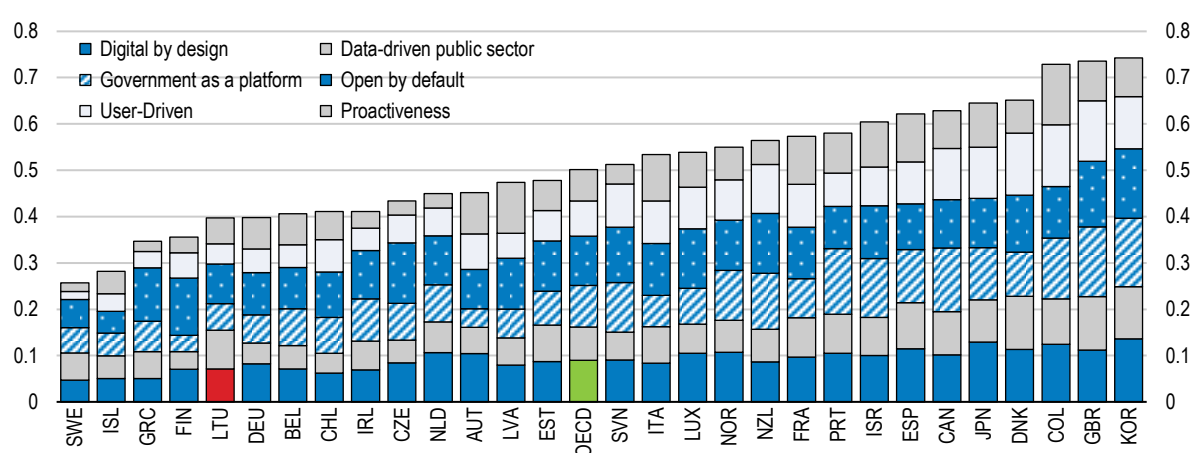
StatLink 2 <https://stat.link/dc30ek>

Much scope remains, however, to realise the full potential of digital government. An important obstacle is a weak interoperability among the numerous information systems and registers (Ministry of Economy and Innovation, 2021^[6]) Estonia's success in e-government, for instance, hinges upon the development of

'interoperability enablers' (Box 7). Lack of modern data-management practices in the public sector is an additional factor. The launching by the central bank in 2020 of the Data Management Maturity Program, an organisation-wide programme focusing on the areas of data governance, data collection and data storage and analytics (Bank of Lithuania, 2021^[62]), is a welcome step in this regard. In addition to improvements in data management within the central bank, the programme allows for an integration of the central credit register (managed by the central bank) with other information systems in the country, facilitating exchange of data. Efforts in this direction need to continue. Lithuania scores below average in the OECD Digital Government Index, which suggests room to make progress with a 'digital by design' approach when formulating policies and designing services, as well as to move to a more user-driven public sector (OECD, 2020^[63]) (Figure 23).

Figure 23. There is scope to move to higher levels of digital government maturity

Digital Government Index, 2019



Source: OECD Digital Government Index 2019.

StatLink 2 <https://stat.link/hfqoa5>

Box 7. Digitising government services: the case of Estonia

The success of Estonia's e-government (e-Estonia) hinges on the combination of two interoperability enablers, namely the Estonian digital ID (eID) and the X-road platform for data exchange:

- The digital ID-card is applicable across sectors, enabling customer identification and providing secure, transparent and traceable encrypted communication between public and private service providers and individuals (OECD, 2019^[64]). The system is based, in particular, on cryptographic keys, with a personal key used as the primary key in the majority of databases containing personal information. The enactment of digital signatures in 2000 enabled a number of government services requiring signature to go online.
- The data exchange platform, X-Road, allows e-service information systems to link up and operate as an integrated system to support citizens and businesses. To secure data sharing, all incoming and outgoing transfers are authenticated and encrypted. In addition, transactions are traceable, through a distributed ledger, which means that any transaction or information access will be recorded in several places (OECD, 2019^[64]).

The above reforms have simplified considerably the interactions of citizens and business with the government in Estonia. In addition, citizens and businesses can monitor the time and access point of their data files through the portal (X-Road platform). The use of digital signatures in Estonia is estimated to save 2% of GDP every year (OECD, 2019^[65]). Moreover, the use of X-Road saved the Estonian administration 804 working years, reducing state budget expenditure.

The digitalisation of the public sector is a high priority for the government (Box 1). Over half of the funds allocated in the digitalisation component of Lithuania's Recovery and Resilience Plan (RRP) are dedicated to digital public services and infrastructure (European Commission, 2021^[3]; European Commission, 2021^[8]). The focus is on the digitalisation of government processes, the expansion of digital public services, and the consolidation of state information resources, IT infrastructure and services. Ensuring reliable public data and the possibility to share them across sectors is an additional objective. The digitalisation of the health sector and public employment service are also key areas of public sector reform (Box 8).

Box 8. Modernising Lithuania's public sector through digitalisation

Lithuania aims to modernise its public sector and enhance the quality of the provided services. Two notable ongoing initiatives include:

Digitalising the health care system

The 2014–2025 National Health Strategy has among its main goals to complete this stage of development of the country's e-health system. It also foresees the integration of the Lithuanian system in the EU e-health systems. The overall aim is to develop a coordinated and interoperable e-health system. Lithuania's Resilience and Recovery Plan allocates around a third of the funds under the health component for the digitalisation of the health care sector.

The national e-health system became operational in 2015, with all health care providers (except dentists) connected. The system links to a register of insured people. Electronic prescribing was the most advanced section of e-health until 2019, but the pandemic has accelerated the development of the system with an increasing number of medical consultations taking place online (OECD and European Observatory, 2021^[66]). The pandemic has provided a powerful stimulus for improving data collection processes and increasing reporting speed, while enhancing information exchange.

Digitalising public employment services

Efforts are under way to digitalise the Public Employment Service (PES) and enhance its customer orientation, to ensure more effective activation policies. A reform, to be completed in 2024, includes a revision of working methods and automation of key processes, bringing about important changes in the structure of the PES. Underlying the reform is the creation of an employment platform, a new multifunctional IT tool that would be interoperable with other national IT systems, enabling 90% of services to be provided digitally (European Commission, 2021^[8]). The reform paves the way for more intensive personalised services by the PES not only through a better matching of information, but as well by freeing up human resources to be used for more tailored support to jobseekers.

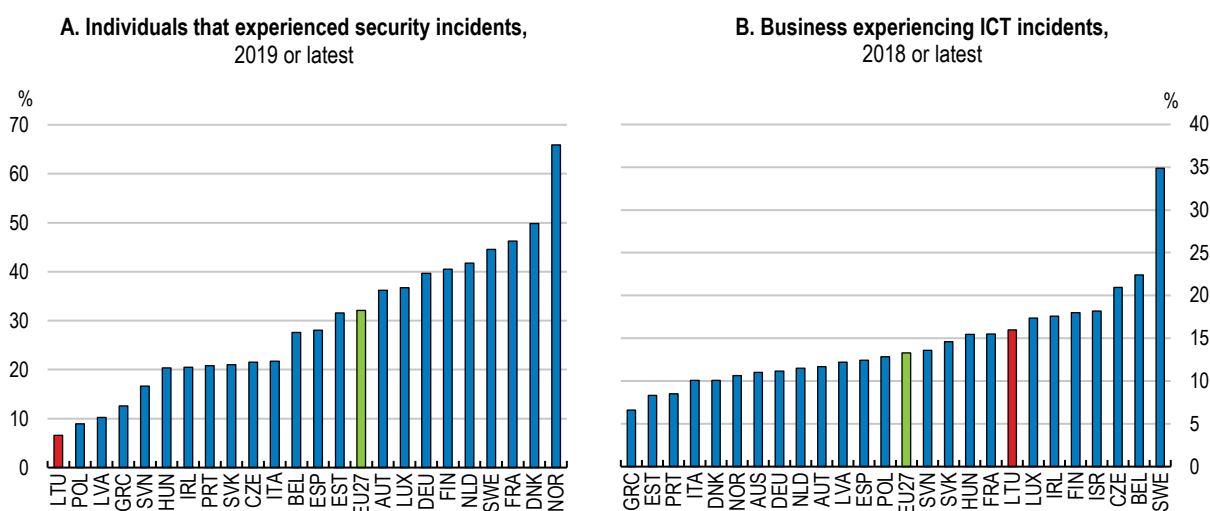
The priorities set by the government digitalisation agenda, and planned reform measures, are positive steps. Reforms should go ahead and be implemented within the envisaged schedule. Indeed, the pandemic has heightened the need to deploy digital technologies and process automation in the public sector. Further increasing the take-up of e-government services is important for the effectiveness of reforms. At 60%, the share of the population currently using public services (Figure 22, Panel C) is comparable to the EU average but still below countries such as Estonia and Finland. Also, the content of

online information created by the public sector is not always available for persons with disabilities, restricting access. Less than half of this group has access to digital services (Ministry of Economy and Innovation, 2021^[6]). The government aims to enhance the accessibility of digital services for persons with disabilities (Box 1). A user-driven approach, placing citizens' needs at the core of the development of processes and services, is key to ensuring inclusiveness in the provision of digital public services. Government plans to move towards customer-oriented services are therefore welcome (Box 8). Ensuring effective implementation of the agenda is critical, given that digital public services are an integral part of the digital transformation, with positive effects on productivity (Sorbe et al., 2019^[4]).

4.2. Digital security is high but there is scope to strengthen it further

Digital security (cybersecurity) is essential to build individuals' and businesses' trust in advanced new technologies and digital government (OECD, 2020^[7]). Lithuania is among the frontrunners in the field of digital security according to the 2020 Global Cybersecurity Index (which evaluates legal, technical and organisational measures, as well as capacity building and cooperation) (ITU, 2021^[67]). The National Cybersecurity Strategy (2018-2022) provides a comprehensive approach that also aims at promoting a culture of cybersecurity and stepping up public-private collaboration to combat cyber incidents (Ministry of National Defence, 2018^[68]). Survey data suggest that before the pandemic businesses were experiencing cybersecurity incidents more frequently than in many European countries (Figure 24). Across OECD countries, digital security risks have risen since the onset of the pandemic as the use of Internet and uptake of digital technologies has accelerated (OECD, 2020^[69]). The war in Ukraine may have implications with respect to digital security.

Figure 24. Cybersecurity incidences for businesses are relatively high



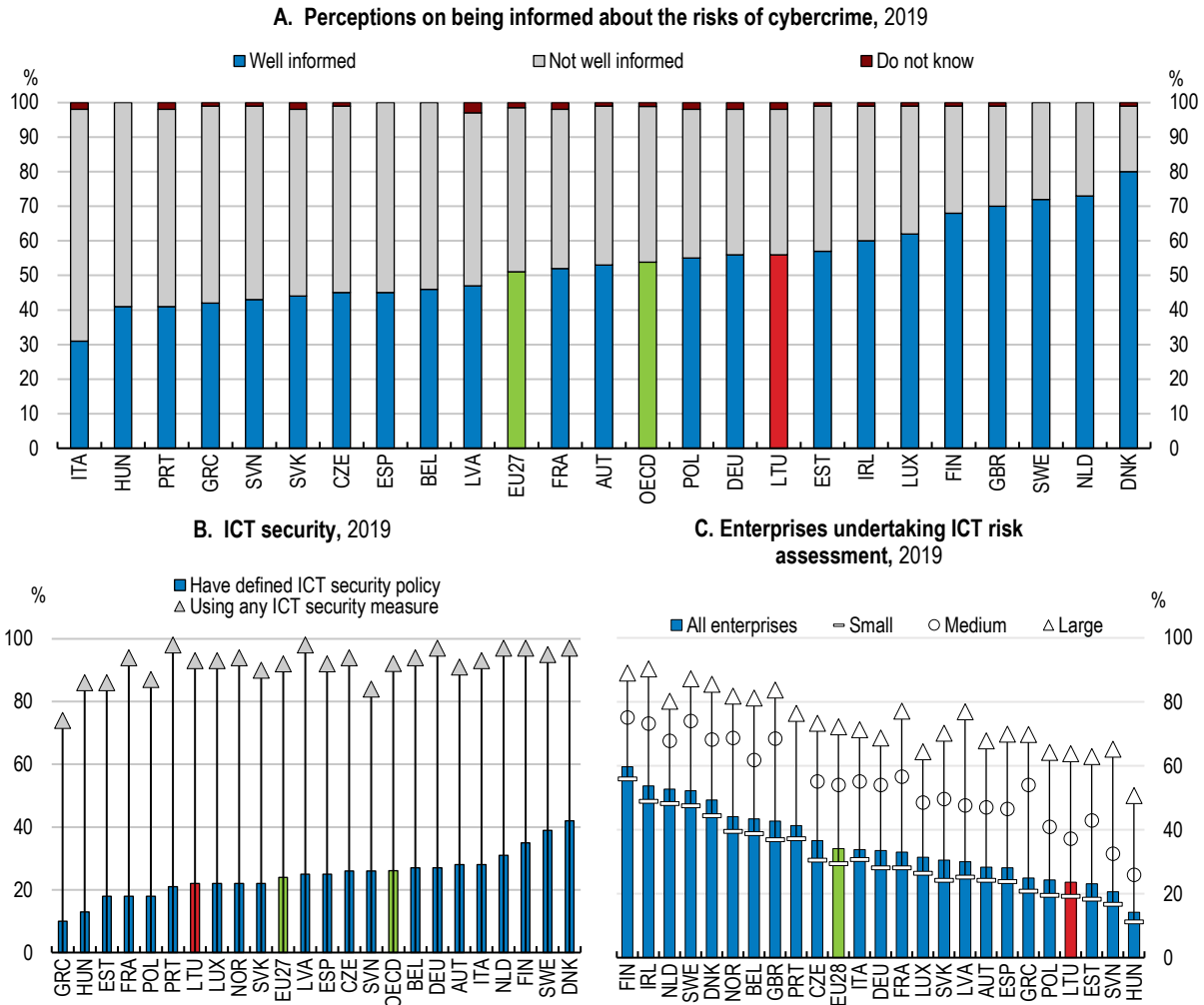
Source: OECD, ICT Access and Usage by Households and Individuals database; and OECD, ICT Access and Usage by Businesses database.

StatLink 2 <https://stat.link/vsb6x2>

Raising awareness about digital security risks among individuals and businesses is essential for developing a strong cybersecurity culture and promoting more pro-active cybersecurity practices. 42% of the Lithuanian participants in a special Eurobarometer survey on the attitudes towards cybersecurity reported that they were not well-informed about the risks of cybercrime; this share is not high compared to the EU average or Baltic peers, but still points to the need for more efficient dissemination of information on digital incidents (European Union, 2020^[70]) (Figure 25, Panel A). Well-designed and regularly updated

awareness-raising programmes and seminars for relevant demographic groups from public and private sectors, as well as academia, are crucial in this regard.

Figure 25. Awareness about cybercrime and risk assessment by firms need to be strengthened



Source: Special Eurobarometer 499 "Europeans' Attitudes Towards Cyber Security"; Eurostat, ICT Access and Usage by Households and Individuals database; and OECD based on Eurostat, Digital Economy and Society Statistics, Comprehensive database.

StatLink 2 <https://stat.link/jw4axv>

In addition, Lithuanian firms have scope to improve digital security risk management. Almost all firms in Lithuania implement ICT security measures, but less than a quarter had defined a cybersecurity policy in 2019, well below top performers such as Finland, Denmark and Ireland (Figure 25, Panels B and C). Risk assessment – a central practice in digital security risk management – is not widespread, especially among smaller firms that tend to have fewer resources for effectively evaluating digital security risks and implementing prevention and management measures (OECD, 2019^[37]). Less than 20% of small firms carried out risk assessments in 2019 – around 10 percentage points less than the EU average. The corresponding share for large Lithuanian firms was at least three times larger than for small firms, above the EU average. Enhancing awareness of good practices in digital risk management is important, especially in the case of SMEs that face distinct challenges in this regard (OECD, 2020^[7]).

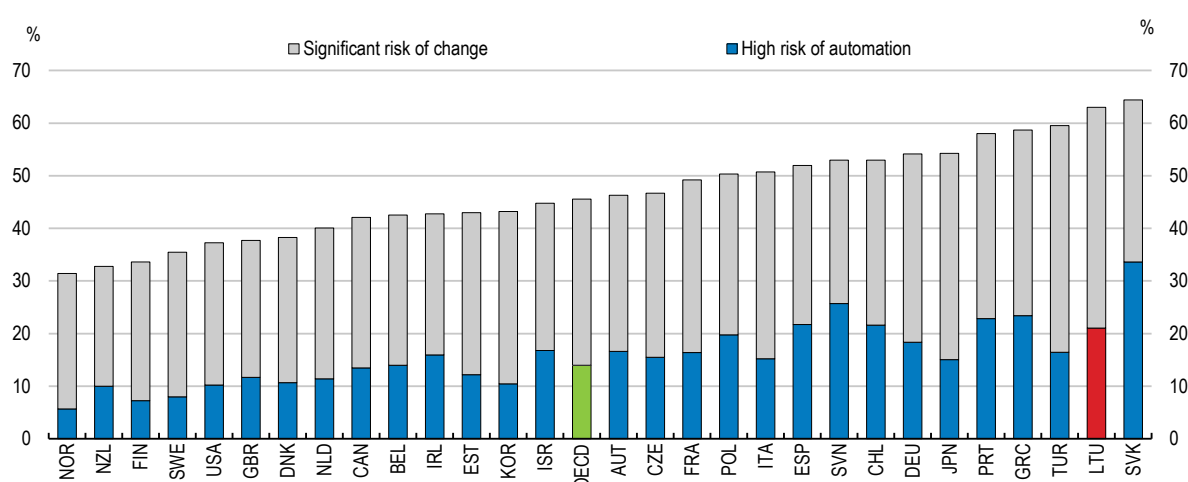
The government plans to introduce a revised set of cybersecurity requirements. Ongoing changes in IT management in the public sector, involving a move from traditional IT management to cloud computing, and a rise in digital security risks since the onset of the pandemic and as a result of the war in Ukraine, necessitate amendments to the National Cybersecurity strategy (see above). A key objective of the reform is to improve the implementation of organisational and technical cybersecurity requirements by cybersecurity managers. Swift progress towards the development of a unified system for monitoring the application and implementation of cybersecurity requirements is vital in this regard. At present, Lithuania lacks such a unified system (Ministry of Economy and Innovation, 2021^[6]). A stronger focus on firms, and digital security risk management in particular, would be advisable. The United Kingdom's National Cybersecurity Strategy, for instance, attempts to ensure that the regulatory framework for cybersecurity is outcome-focused and sufficiently flexible (HM Government, 2016^[71]). The war in Ukraine enhances the importance of digital security risk management at a firm level as some businesses' critical services might be more exposed and vulnerable to cyber incidents, increasing the need for higher cyber security preparedness levels (KPMG, 2022^[72]). Increasing the number of cybersecurity experts is an additional key challenge (see below). The focus of the National Cybersecurity Strategy, currently in place, on the development of advanced capabilities and cybersecurity skills (Ministry of National Defence, 2018^[68]) is appropriate and should be preserved.

5. Harnessing skills for a digital economy

Making the most of digitalisation is contingent on the development of relevant skills that respond to rapidly changing labour market needs in the digital era. This is also essential for boosting digital technology adoption by firms (Andrews, Nicoletti and Timiliotis, 2018^[60]). The labour market transformation is already underway with even more radical changes to come in view of rising automation trends. Lithuania faces among the highest risks of job automation among OECD countries (Figure 26). Approximately one-fifth of jobs are at high risk of being automated over the next 10 to 20 years, while another 40% face a risk of significant changes in their tasks due to automation, with both shares well above the OECD average.

Figure 26. Lithuania faces high risks of job automation in international comparison

Share of jobs at high risk of automation or at risk of significant change in OECD countries



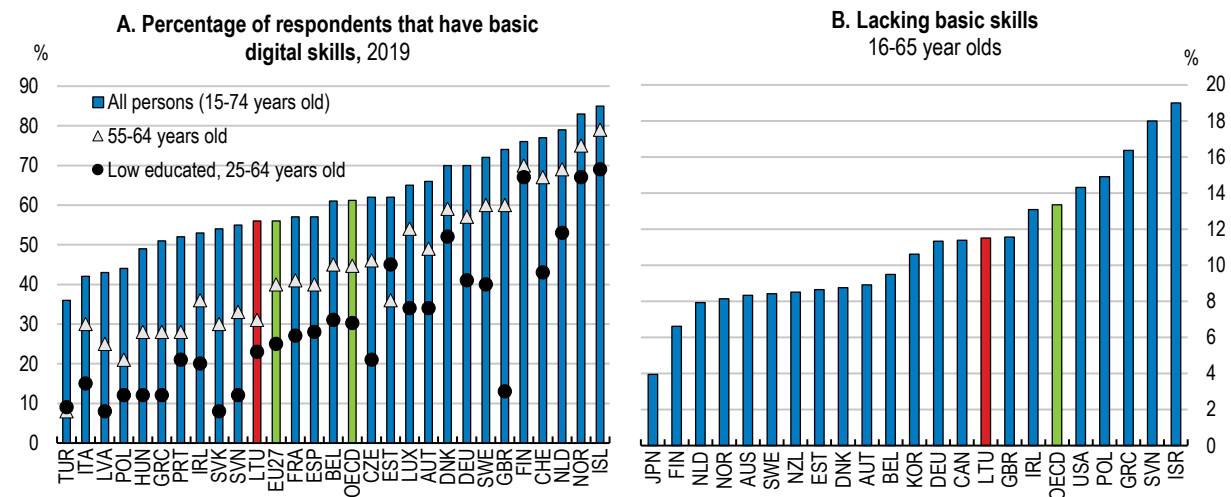
Note: Significant risk of change refers to the risk of automation between 50-70%, and high risk of automation refers to the risk >70%. Calculations are based on PIAAC 2012 data.

Source: OECD calculations based on Nedelkoska, L. and G. Quintini (2018).

StatLink 2 <https://stat.link/iulesk>

ICT-related skills, both advanced for digital specialists and generic used at work, are essential for the adoption of new technologies, including artificial intelligence (OECD, 2020^[42]). Lithuania has scope to further raise digital skills, especially among the less educated and elderly workers (Figure 27). Foundational skills also need to improve to ensure a solid digital skill base (OECD, 2019^[73]; OECD, 2020^[7]). The necessary pool of skills to work in a digitalised environment also includes social, communication and management skills. The challenge is heightened by a large skills mismatch and labour shortages, especially of highly qualified workers, already evident before the pandemic (OECD, 2018^[13]). The pandemic accelerated the digital uptake by firms, and with it the demand for specialised ICT skills. Equipping workers with relevant skills is also necessary to limit the rise in inequalities that may stem from digitalisation. In education, the main objectives of government policy are to ensure that children acquire basic digital skills at school, to digitise educational content and resources, and to provide digital skills training for adults (Government of the Republic of Lithuania, 2021^[33]).

Figure 27. There is scope to strengthen digital and foundational skills



Note: Panel B: individuals lacking basic skills score at most Level 1 (inclusive) in literacy and numeracy and at most Below Level 1 (inclusive) in problem solving (including failing ICT core and having no computer experience). Chile, Greece, Israel, Lithuania, New Zealand, Singapore, Slovenia and Turkey: Year of reference 2015. All other countries: Year of reference 2012. Data for Belgium refer only to Flanders and data for the United Kingdom refer to England and Northern Ireland jointly.
 Source: Eurostat, Digital skills database; OECD calculations based on OECD (2012) and OECD (2015), Survey of Adult Skills (PIAAC), www.oecd.org/skills/piaac/publicdataandanalysis; and OECD, PISA 2018 database.

StatLink 2 <https://stat.link/5zkfhw>

5.1. The education system needs to adapt to digital changes

5.1.1. Building solid foundational and basic digital skills at schools and reducing educational gaps

Many students in Lithuania lack strong foundational skills at the end of compulsory education (Figure 1.24 in (OECD, 2022^[5])) making it more difficult to acquire new skills over their lifetime and succeed in a digital environment. Moreover, as discussed in (OECD, 2022^[5]), educational achievements vary considerably across schools and regions. Like in other countries, the pandemic may have exacerbated educational inequalities as children from disadvantaged backgrounds are less likely to benefit from online learning (OECD, 2020^[74]).

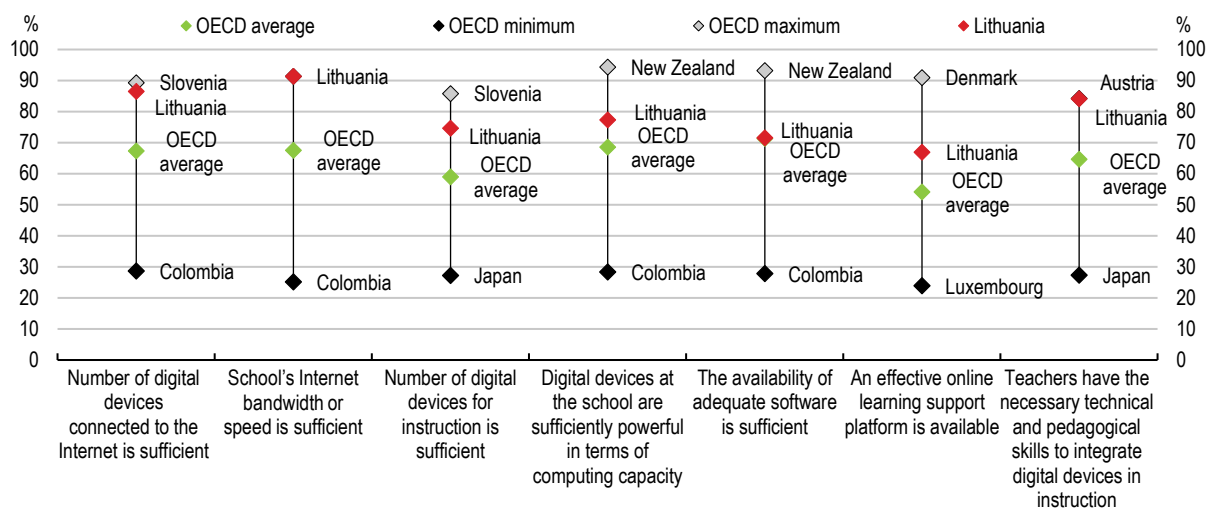
A school curriculum reform is under way. The aim is to introduce new competence-based curricula from 2022 (OECD, 2021^[61]). The reform paves the way for a more modern, and better adapted to the digital era, school curriculum framework and needs to be implemented within the envisaged timeframe. In the renewed school curriculum, the development of digital competences along with cognitive, social and creative competences will form a part of the learning process, allowing for a better integration of general competencies across subjects. The focus of the curriculum reform on equipping students with general digital skills and competencies, starting at primary school level, is welcome (European Commission, 2020^[75]). Particular subjects, such as computer science, will be strengthened, with teaching to start at primary level. The Informatics curriculum for primary education, in particular, includes algorithms and programming as one of the main teaching areas. The government also aims to integrate digital literacy better into STEM (science, technology, engineering, and mathematics) subjects (Seimas, 2020^[76]). Exposing students to computational thinking, through programming, at early stages of education helps them to improve digital competencies and provides a better understanding of new technologies. Such policy is also in line with international experience. Portugal, for instance, has included programming as a learning objective in its recently reformed national curriculum (OECD, 2021^[51]).

To reduce the risk that students in disadvantaged schools fall behind in terms of digital skills, the government could consider including attainment targets in the new curriculum for schools. The targets could be developed in collaboration with teachers and stakeholders (OECD, 2021^[77]). Moreover, the government should continue providing vulnerable students who lack adequate equipment with electronic devices (computer or tablet) and tutorials, addressing digital divides. It is also important to ensure that the new school curricula raise the relatively low digital problem-solving skills of students in vocational schools. PIACC data suggest that gaps in digital problem-solving skills between Lithuanian graduates from vocational education and training and those from general education are more pronounced than those for numeracy and literacy skills (Vandeweyer and Verhagen, 2020^[78]).

Adequate ICT tools in schools and teachers with the needed skills to use them effectively in classrooms are essential for students to develop digital skills for the future. Lithuania fares better than the OECD average, according to school principals' perceptions, when it comes to availability of digital devices in schools and teachers' ICT preparedness is high in international comparison (Figure 28). This is encouraging, but Lithuanian schools still have scope to improve ICT capacity in a number of areas, including the availability of effective online learning support platforms and software adequacy. As a positive step, the government started providing funding to schools for the purchase of ICT equipment and digital tools. Moreover, Lithuania's Recovery and Resilience Plan envisages improvements in school infrastructure (European Commission, 2021^[8]). The Digital Transformation in Education project under way aims to strengthen the use of ICT tools in schools, focusing in particular on children with special education or linguistic needs, and to enhance the digital skills of educators. It also opts to develop, in parallel, an innovation culture in schools by inviting education institutions and developers to cooperate in the development, testing and application of innovative solutions.

Figure 28. Lithuanian schools can further increase ICT capacity

Percentage of students in schools whose principal agreed or strongly agreed with statements about the school's capacity to enhance learning and teaching using digital devices, 2018



Source: Minea-Pic, A. (2020), ICT resources in school education: What do we know from OECD work?

StatLink 2 <https://stat.link/fx0e2n>

ITC training for teachers needs to be stepped up. Whereas a relatively high share of teachers (60% compared to an OECD average of 43%) perceive themselves as well prepared for the use of ICT in teaching, a quarter still report a high need for professional development in this domain, above the OECD average (OECD, 2019^[79]). Spending on training to boost digital skills is low, however. Only about 3% of the financial support provided to schools in 2020/21 to increase their ICT capacity was spent on such training, according to official data. The government should go ahead with plans to expand training opportunities for teachers and invest in the development of their digital competencies (European Commission, 2021^[8]). The Digital Transformation in Education project (see above) launched in 2022 aims to strengthen the digital competencies of educators at all levels, which is welcome. The effectiveness of the project needs to be closely monitored. Overall, the quality of teachers' continuous professional development needs to improve through better targeting support to the areas of identified training needs of teachers, providing innovative forms of formal training, as well as reducing fragmentation in the provision (OECD, 2021^[61]). Continuous professional development is currently provided by 60 teacher centres in Lithuania, undermining the system's coherence and training quality.

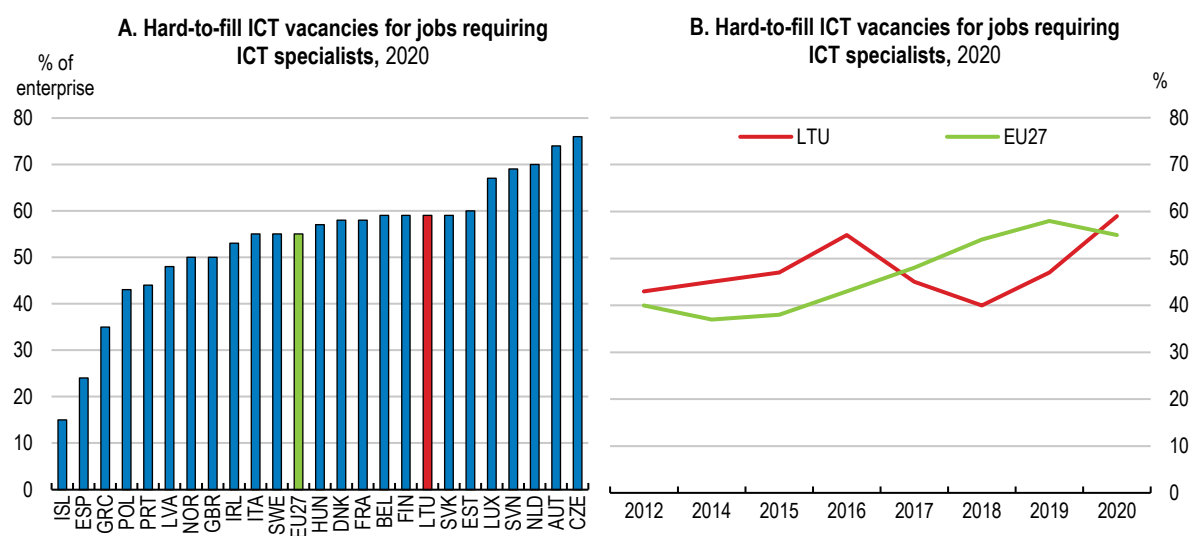
5.1.2. Responding more effectively to labour market needs for digital skills

Large shortages in ICT and ICT-related skills impede digital transformation and higher productivity growth. Approximately 60% of Lithuanian enterprises that recruited or tried to recruit ICT specialists in 2020 reported difficulties to fill such vacancies, above the EU average (Figure 29). Shortages of ICT skills are projected to grow substantially (OECD, 2020^[80]). Attracting highly-skilled workers is a key priority of Lithuania's immigration policy. Building on previous initiatives that have reduced restrictions to employment of workers from non-EU countries, the government in 2021 eased the migration procedures for computer specialists from such countries and the conditions for investors to transfer their employees to Lithuania (see above). The number of temporary residence permits issued in 2021 (first three quarters) increased almost six-fold compared to the previous year, according to official data, reflecting a rise in inflows of

specialists from Belarus as well as a relocation of firms from this country to Lithuania. High-skilled immigration can help ease shortages, and recent policy measures go in the right direction in this regard. However, more can be done to improve the responsiveness of the tertiary education system to changing skills needs. Indeed, in 2019 around 41% of tertiary graduates in employment recorded a mismatch by field of study and/ or qualification level (OECD, 2021^[61]).

Figure 29. Lithuania faces large and rising shortages in ICT skills

Share of enterprises that recruited or tried to recruit ICT specialists

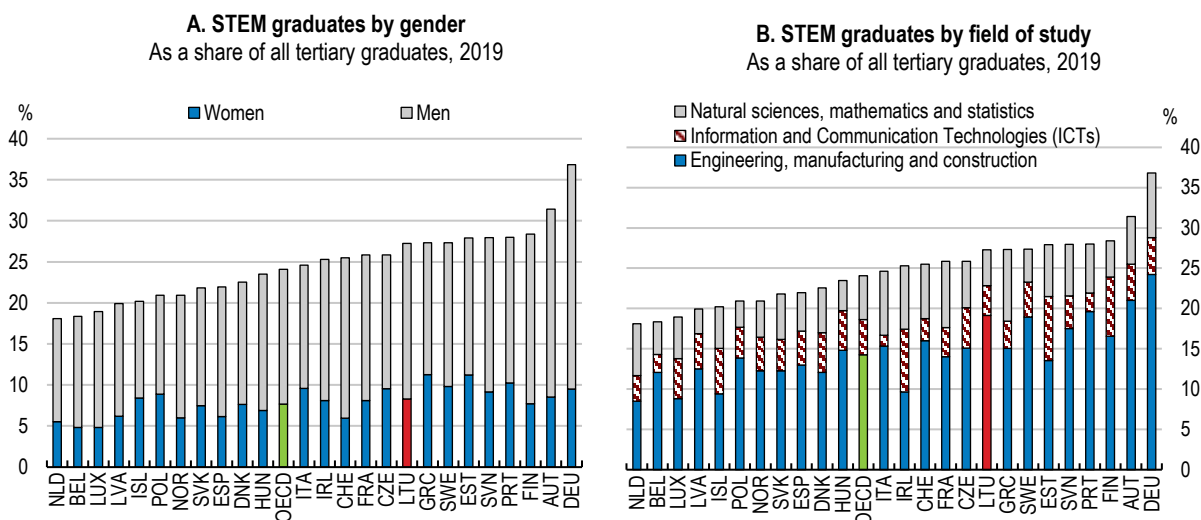


Source: Eurostat, ICT usage in Entreprises.

StatLink 2 <https://stat.link/u3y1pf>

Tertiary education funding should encourage institutions to address evolving skills needs. As a positive step, ongoing reforms plan to relate around 20% of public funding to higher education institutions to the achievement of the performance targets agreed with such institutions (Seimas, 2020^[76]). Introducing incentives in the new funding formula by providing additional funding to tertiary institutions for degree completions in disciplines which are important for the labour market, including digital transformation, would be advisable. For instance, degree completions from specific fields, such as certain disciplines within STEM (science, technology, engineering, and mathematics) fields, could receive additional funding. The share of graduates from STEM fields in Lithuania exceeds the OECD average, but a relatively small share complete their studies with an ICT specialisation (Figure 30). Broadening the set of performance indicators in the new funding system for tertiary education to include international mobility indicators would help increasing the comparatively low share of foreign students in total enrolment, with large potential benefits in terms of knowledge transfer (OECD, 2022^[5]). The government could further consider linking a part of public funding to labour market outcomes, as discussed in (OECD, 2022^[5]). This would encourage universities to better adapt the curriculum to demand. Developing a rigorous methodology for the assessment of current and anticipated skills needs and keeping track of graduates' employability is essential for a successful shift to an outcome-oriented tertiary funding system.

Figure 30. Relatively few STEM graduates have an ICT specialisation



Note: Tertiary graduates refer to the students graduating from programmes enrolled at ISCED 2011 5-8 levels.

Source: OECD, Education at a Glance database.

StatLink 2 <https://stat.link/owd18>

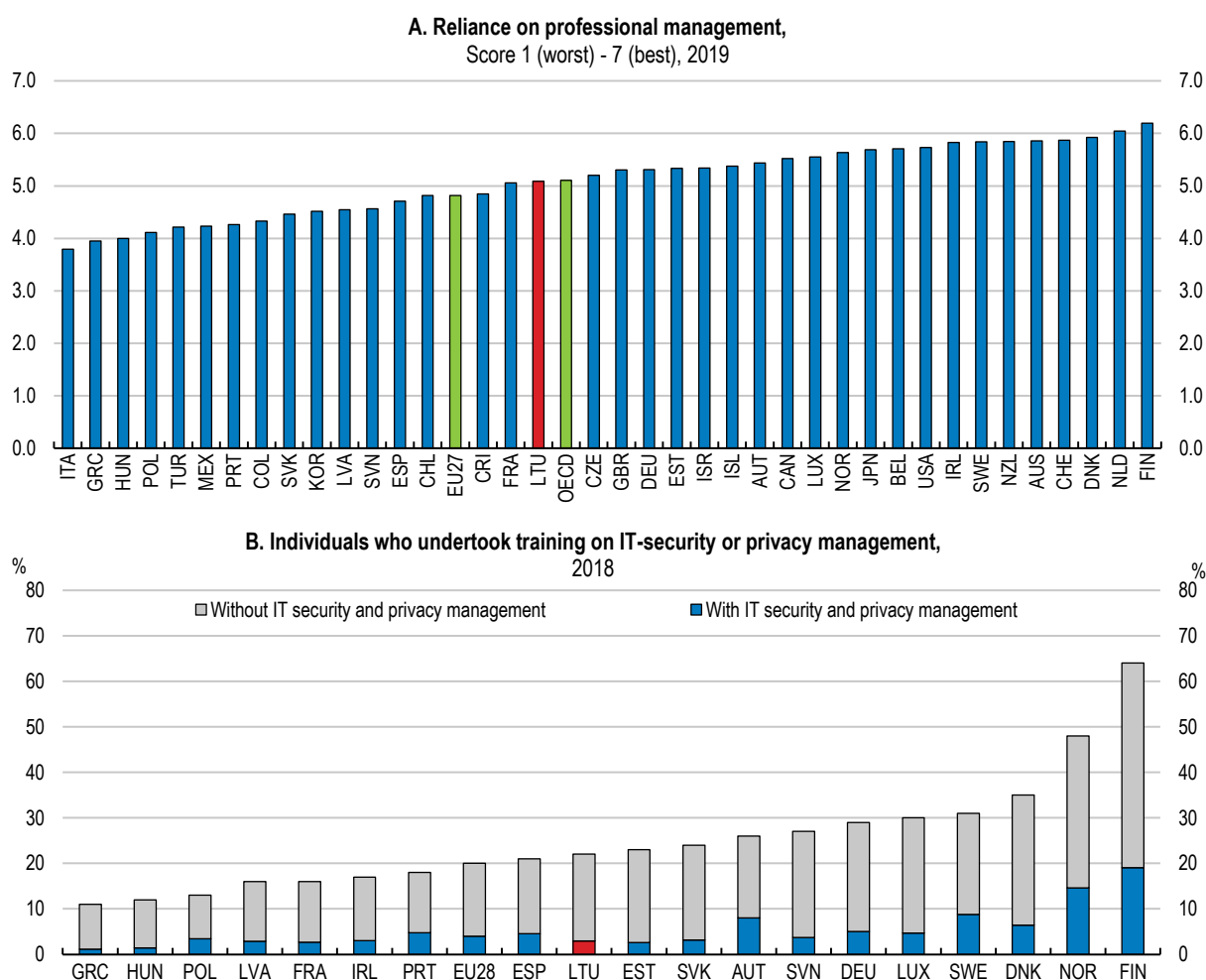
Strengthening admission standards to higher education is also vital for boosting skills for the future. In certain universities, over half of the students enrolled in 2016 did not meet the new threshold standards proposed in 2018 (Caturianas and Budraitis, 2019^[81]). Current efforts to modernise student assessment practices at schools are welcome. At present, such practices focus on subject matter knowledge rather than crosscutting competences and skills (OECD, 2021^[61]). At the same time, ongoing reforms to make schools more inclusive, including by extending the educational assistance provided, need to continue in order to ensure that students from disadvantaged are not left behind (OECD, 2020^[40]). Effective career guidance in schools and universities, along with quality information on graduates' labour market outcomes by field of study, are also important to improve the provision of ICT-related skills and reduce gender imbalances in STEM fields, thereby addressing longstanding shortages in this skills area.

There is scope for introducing new tertiary study programmes that contribute to building an innovation-rich skills base and meet digitalisation needs. The 2020-2030 Industry Digitisation Roadmap, for instance, highlights the need for the creation of digital production or related programmes at tertiary level that are vital for industry digitisation, as well as for institutionalising industrial doctorate programmes, along with reviewing higher education programmes that are closely related to digital production, such as engineering (Lithuanian Innovation Center, 2020^[2]).

Other relevant programmes for the digital era, including entrepreneurship and cybersecurity, need to be strengthened. Entrepreneurial teaching and learning at higher education institutions in Lithuania has increased noticeably over the past decade (OECD, 2021^[82]), but efforts should continue (Figure 31, Panel A). In addition, entrepreneurship programmes should go beyond focusing solely on start-up activities and be supported as an academic subject in order to foster entrepreneurial knowledge, skills and capacity with large innovation potential (OECD, 2021^[82]). The Norwegian Research School in Innovation provides an example of good international practice of interdisciplinary education, combining different sub-areas of innovation and entrepreneurship. Cybersecurity study programmes should also be increasingly offered as part of the curriculum in ICT specialist education in universities and vocational schools, while starting to build the fundamental knowledge on digital security early on in education. The share of Internet users in Lithuania who have received such training is comparatively low

(Figure 31, Panel B). Deepening teachers' knowledge on digital security through well-designed programmes is essential. Digital training programmes should be regularly updated.

Figure 31. Other important skills for the digital era also need to be developed further



Note: Score based on response to the question "In your country, who holds senior management positions in companies?" [1 = usually relatives or friends without regard to merit; 7 = mostly professional managers chosen for merit and qualifications].

Source: World Economic Forum (2020), The Global Competitiveness Index dataset; and OECD, based on Eurostat, Digital Economy and Society Statistics, Comprehensive Database, January 2019.

StatLink 2 <https://stat.link/23kr5g>

Broadening the talent pool entering higher education could strengthen digital skills. Tapping the potential of vocational education and training (VET) is essential in this regard. While legislated in 2018, tertiary institutions have not provided until recently short-cycle tertiary programmes, an important pathway for upper secondary VET graduates into higher education in many countries. Moreover, tertiary institutions offering vocationally oriented professional bachelor degrees account only for a relatively small share of higher education enrolments (about 30%) (OECD, 2021^[61]). As a positive step, new 2022 legislation introduces short-cycle tertiary programmes in the fields of computer engineering, programme systems and tourism. In addition, admissions to the first cycle college study programmes, in the same field of study, are to be simplified. The pathways from upper secondary vocational studies to tertiary education should be broadened, while ensuring strong skills and competences for VET students. Portugal, for instance, has

recently revised the tertiary entrance system and created a special access channel for VET students (OECD, 2021^[51]). Increasing student awareness and guidance regarding educational opportunities is important.

VET programmes could also be better adapted to rapid technological changes, providing more ICT-specialists. Over 50% of Lithuanian students in upper secondary vocational programmes in 2018 graduated from STEM fields, but the majority earned a qualification in the broad field of engineering, manufacturing and construction, with only 3% graduating from the ICT field (OECD, 2020^[83]). However, for VET to play a prominent role in the provision of skills for the future, including in meeting labour market needs for mid- to high-level STEM skills such as software development, enrolments need to increase, because Lithuania has one of the lowest VET participation rates among OECD countries (OECD, 2022^[5]). Increased efforts are also needed to promote work-based learning and apprenticeships through VET. Measures to this end include, for instance, a renewal of programmes and infrastructure, an updated admission model based on anticipated skill needs and enhanced incentives for apprenticeships (Seimas, 2020^[76]).

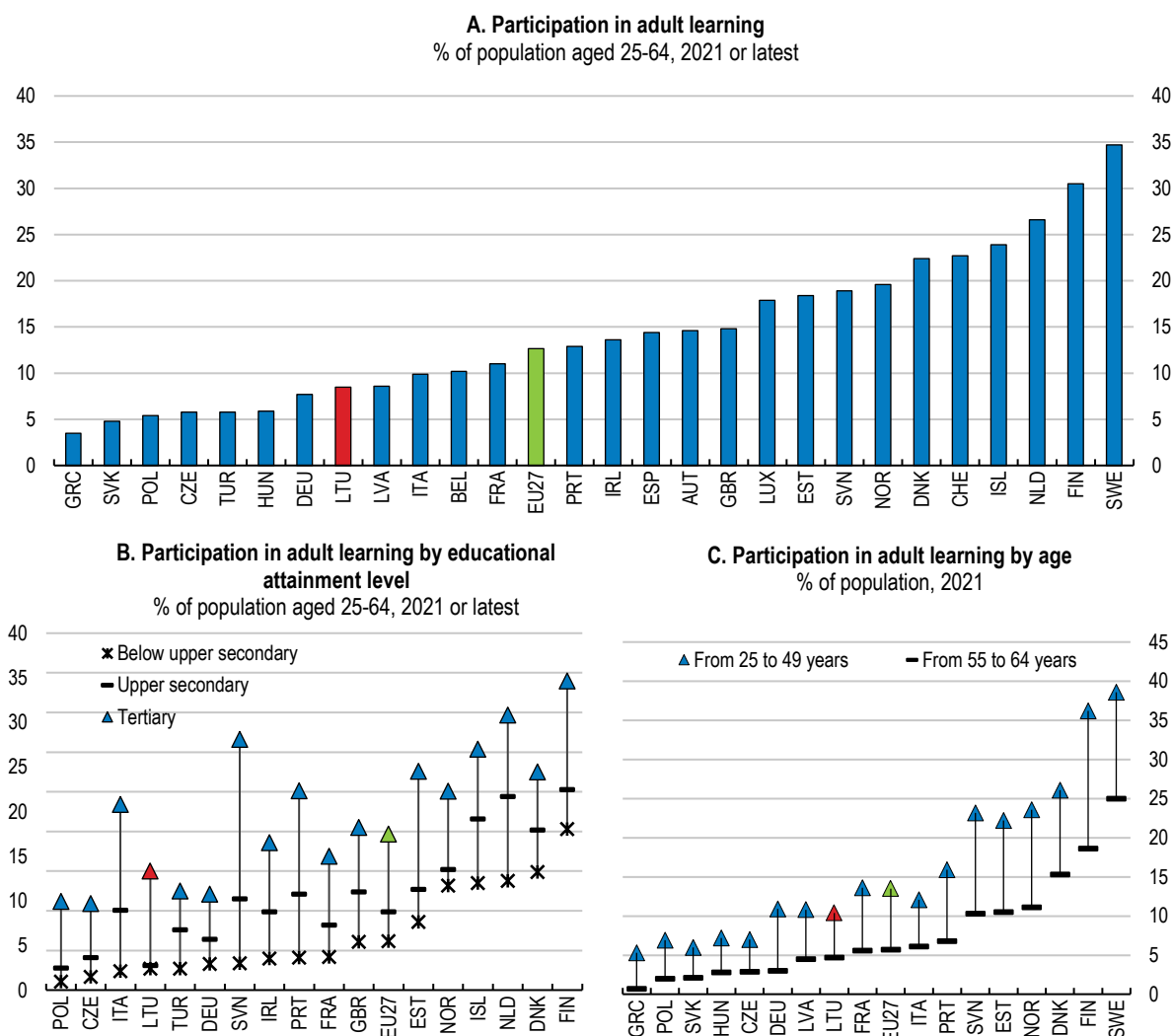
Overall, the tertiary education system has to provide the right mix of skills for the digital era and also adapt to it. Steps towards optimising the network of higher education institutions are important and need to continue to ensure that institutions have the capacity to embrace ICT technologies and their continuous advancements. Students and teaching staff also need to be increasingly familiarised with digital technologies, especially as on-line teaching, which accelerated with the pandemic, may become more of a norm in the future. Timely implementation of the Digital Transformation in Education project, aiming to strengthen the digital competencies of educators at all levels and develop the necessary learning resources for schools (discussed above), is vital. The envisaged review of the quality of tertiary education study programmes in 2025 is welcome.

Addressing social inequalities in tertiary education is vital to ensure a fair distribution of digitalisation dividends. As highlighted in the previous OECD *Economic Survey* (OECD, 2020^[40]), students from low-income families in Lithuania are much less likely to enrol in universities than their peers from more affluent families, and when enrolled, are less likely to attend high-ranking universities. The alignment of admission requirements for state-funded and non-stated funded student places in tertiary institutions, to come into effect in 2024, is a step forward. The much stricter entry requirements for state-funded places under the existing regime affects disproportionately less advantaged students who are more likely to opt for such places. Moreover, the provision of short-cycle tertiary studies is expected to provide an attractive pathway to higher education for students from low socio-economic background. The outcomes of these reforms need to be closely monitored.

5.2. The digital transformation heightens the need for lifelong learning

Participation in adult (lifelong) learning remains low in Lithuania compared to most EU countries, including neighbouring Estonia (Figure 32). As elsewhere, the less educated and those aged over 50 tend to engage less in lifelong learning. This is unfortunate, as such workers are most vulnerable to economic downturns and skills shifts related to technological changes, especially increased automation of jobs. Moreover, adult learning has a stronger impact on digital adoption in the case of low-skilled workers compared to high-skilled ones (Andrews, Nicoletti and Timiliotis, 2018^[60]).

Figure 32. Participation in adult learning remains low especially among the vulnerable groups



Note: In Panel B, 'below upper secondary' corresponds to less than primary, primary and lower secondary education level (ISCED 2011 levels 0-2); 'upper secondary' corresponds to upper secondary and post-secondary non-tertiary education levels (ISCED 2011 levels 3 and 4); and 'tertiary' corresponds to tertiary education level (SCED 2011 levels 5-8).

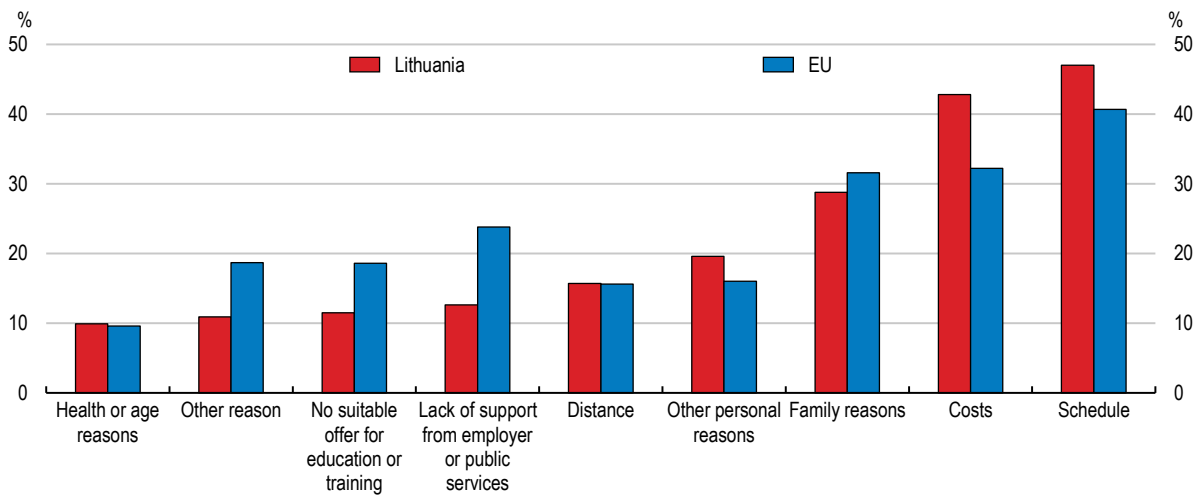
Source: Eurostat, Labour Force Survey.

StatLink 2 <https://stat.link/dr7mnf>

There are multiple barriers to participation in adult training in Lithuania, ranging from financial constraints to lack of suitable training opportunities (Figure 33). Addressing such barriers and, importantly, raising awareness of the lifetime benefits of skills investment and available opportunities, is crucial to boost engagement in adult learning. Indeed, around 67% of adults in Lithuania did not want to participate in training in 2016 compared to an EU average of 44.3%, according to survey data (Eurostat, 2016^[84]). Motivating employers to provide adult training is also essential. Approximately 13% of training takes place with employers in Lithuania compared to an EU average of 35% (Eurostat, 2016^[84]).

Figure 33. There are multiple barriers to participation in adult training

2016



Source: Eurostat, Adult Education Survey 2016.

StatLink 2 <https://stat.link/f3w84k>

Lithuania is currently developing a national lifelong learning online platform, that will serve as an “one-stop shop” for adult education, enabling individuals not only to access information regarding available adult learning opportunities, training costs, funding options and other elements, but also to enrol directly in the programmes. It will also provide career counselling in order to help adults decide on their career path. The reform is an important step towards a more effective adult learning system. Readily accessible information, including on the quality and outcome of the training courses that is currently hard to find, is essential for the effectiveness of the new platform as an informational and career guidance tool.

Plans for intensified information campaigns on adult learning should also go ahead, as they would help to reach lower-skilled adults who often are not aware of the need for and potential benefits of further training. Only 10% of adults sought information on lifelong learning in 2016 compared to 30% in Estonia and 25% Latvia, according to survey data (Eurostat, 2016^[84]). As an additional step, the government could provide support to enterprises, via training specialists, to assess their training needs, focusing first on SMEs (OECD, 2021^[61]).

Lithuania provides financial incentives for individuals to participate in adult learning but the cost of training remains an important barrier (Figure 33). Most of the funding for adult learning is provided through the Public Employment Services (PES). Unemployed and employed jobseekers (in certain cases) registered in the PES receive a voucher that covers the cost of vocational training, as well as other benefits. Nonetheless, adults, especially low-skilled ones, still cite the cost of training as the second important barrier to engage in lifelong learning. A new measure will expand the voucher system to also cover higher education modules, in addition to vocational training, with an emphasis to digital skills. To strengthen financial support for adult learning the authorities are advised to focus on adult jobseekers for whom training costs are a major obstacle to further learning, as well as on those in jobs facing a high risk of automation. Low-skilled workers tend to be vulnerable on both grounds. Indeed, some countries, such as France and the Netherlands, allocate training vouchers via individual learning accounts where training rights are accumulated over a certain period of time. The attraction of such schemes is the portability of training rights from one job to the other (Box 9). However, such schemes tend to be used more by high-skilled rather low-skilled individuals, and may also involve high administrative costs (OECD, 2019^[85]). The OECD Skills strategy for Lithuania (OECD, 2021^[61]) also highlights the need to complement subsidies for

adult learning with financial incentives for firms to increase training opportunities. The option of introducing a training levy on employers, as for example in Italy and the Netherlands, that can finance the establishment of training funds could be considered.

Box 9. Financial incentives to encourage participation in adult learning: international trends

A range of financial incentives is provided across OECD countries to enhance participation in adult learning. This is justified, as workers and firms may not fully internalise the need for further investment in skills. The financial incentives used include subsidies (in the form, for example, of vouchers, grants and scholarships), tax incentives, loans, and training leave measures. In Sweden, for instance, an education entry grant was introduced in mid-2017 with a focus on the low-qualified unemployed aged 25-56. In the United Kingdom, low-skilled adults have access to digital programmes that are fully-funded. The United States grants vouchers to unemployed low-skilled adults for training programmes that respond to in-demand sectors.

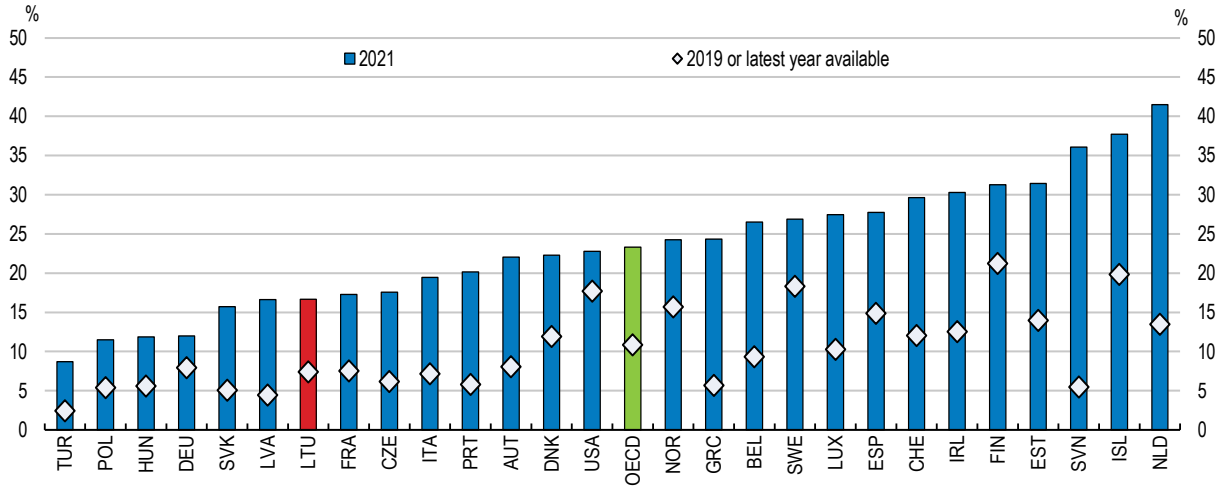
Some countries, for instance, France and the Netherlands, have introduced individual learning accounts (ILAs), where training rights are accumulated over time. Such schemes present attractive features as they allow for portability of training rights from one job to another. This could facilitate career transitions. However, such schemes have a poor record in terms of attracting low-skilled workers to adult training; in fact, ILAs are more likely to be used by high-skilled individuals, while they also can be relatively difficult to administer. ILAs have remained relatively uncommon, possibly because of these shortcomings and/or other reasons, such as limited awareness of the scheme among workers.

Source: (OECD, 2021^[61]).

Time-related constraints are another important barrier to participation in adult learning (Figure 33). Developing further online adult learning, also building upon the pandemic experience, would be important in this regard. Participation in online courses was low in international comparison before the onset of the pandemic, and even though it increased since then, the scope for catching up remains large (Figure 34). Massive open online courses, for instance, provide a wide range of courses by educational institutions and business sector, offering new learning opportunities for students and workers (OECD, 2019^[73]). By facilitating studying and working at the same time, e-learning further provides flexibility to workers and savings to firms, especially SMEs, while helping to reconcile work and family responsibilities. The government could encourage vocational and higher education institutions to enhance online courses by providing them methodological and technical support. The development of an online learning platform, that hosts courses from various Lithuanian educational institutions, could be given consideration (OECD, 2021^[61]). It is essential to ensure that online opportunities are also seized by lower-skilled workers. Based on cross-country experience such groups participate less in online courses than their higher-skilled counterparts (OECD, 2019^[73]). Appropriate course design is very important in this respect. Other measures, such as reducing child-care related gaps, could also contribute to reduce obstacles faced by individuals seeking to engage in lifelong learning.

Figure 34. There is scope to foster online learning

Share of individuals participating in online courses



Note: Participation in online courses over the past three months.
 Source: OECD, ICT Access and Usage by Households and Individuals database.

StatLink 2 <https://stat.link/hdzs49>

A comprehensive effort to increase participation in adult education and training programmes should also include initiatives to improve skills validation for non-formal learning, which is a core part of adult learning in Lithuania, as in other countries. At present, different vocational institutions require different levels of work experience as part of the skills recognition process. National guidelines and standards for the implementation of skills validation by the educational institutions are therefore needed to improve coherence while raising awareness of skills validation as an option among adults (OECD, 2021^[61]). Lithuania also needs to strengthen the quality of non-formal adult education and training, including through the introduction of a monitoring framework for the learning outcomes from such training. The Institute for Adult Education in Slovenia, for instance, has developed comparable indicators to monitor the quality of adult education providers.

Recommendations for unleashing the productive potential of digitalisation

Promoting investment in innovation to speed up digital transition	
The take-up of R&D tax incentives for businesses is low, despite generous provisions, and a relatively large share of smaller firms does not engage in innovative activities. Direct R&D support to firms is very low.	Provide R&D support through a more balanced combination of tax-incentives and direct support to smaller innovative firms.
The design of the R&D tax scheme and the relevant administrative and compliance procedures were not modified since its introduction in 2008.	Regularly evaluate the effectiveness of R&D tax incentives to inform policy choices and further reforms.
Researchers lack strong incentives to collaborate on innovation with the business sector.	Introduce collaboration-related (“engagement”) criteria in the appointment and promotion arrangements for academics.
The innovation system suffers from weak co-ordination among government institutions and fragmented provision of support schemes.	Ensure that the newly established Single Innovation Agency becomes operational, consolidating at a later stage more innovation agencies.
Fostering the digitalisation of firms, especially smaller ones	
Despite progress, the share of households with access to fast broadband is low in international comparison, especially in rural areas.	Proceed with the implementation of the National Broadband Plan, ensuring universal access to high-speed broadband by 2027.
Licensing procedures remain overly complex, holding back digital innovation by hampering the entry of young firms. A licensing review in the health sector is underway, with plans to cover other priority sectors.	Review and simplify swiftly licensing procedures in priority sectors.
Venture capital is not yet well developed.	Support the development of venture capital by prioritizing public support through privately-owned funds rather than direct engagement.
Many smaller firms are not aware of the potential benefits of digital technologies and how to use such technologies.	Continue current efforts to develop a comprehensive network of advisory and mentoring services for SMEs.
Accelerating progress towards digital government and strengthening digital security	
Lack of interoperability of state information systems along with the absence of modern data-management practices in the public sector, hinder the development of digital government.	Proceed with the digitalisation of public sector, implementing the planned reforms within the envisaged timeframe.
A relatively small share of firms define a cybersecurity policy and undertake a digital security risk assessment.	Enhance awareness of good practices in digital risk management, especially in the case of SMEs.
The cybersecurity requirements are being amended in response to ongoing changes in IT management in the public sector and a rise in digital security risks since the onset of the pandemic and as a result of the war in Ukraine.	Proceed with the timely introduction of the revised cybersecurity requirements.
Harnessing skills for a digital economy	
Many students lack strong foundational skills.	Ensure timely implementation of the new curricula for schools, including attainment targets for digital skills.
A comparatively high share of teachers report a need for professional development in ICT skills for teaching.	Strengthen the digital competencies of teachers by expanding, as envisaged, training opportunities in ICT areas.
University funding does not address skills mismatch and large ICT shortages. The share of foreign students is low.	Introduce labour market outcome and international mobility indicators in university funding formulas. Provide additional funding to tertiary institutions for degree completions in disciplines that are important for the labour market, including digital transformation.
The tertiary education programmes do not provide sufficiently broad skills.	Encourage higher education institutions to introduce new programmes, such as digital production, and increase the provision of entrepreneurship and other relevant programmes for the digital era.
Participation in adult learning remains low, especially among the less educated and elderly workers.	Proceed with the development of national lifelong learning platform that will serve as a “one-stop shop” for adult education, complementing it with intensified information campaigns and provision of career counselling.

Note: Key recommendations are in bold.

References

- Andrews, D., C. Criscuolo and P. Gal (2015), “Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries”, *OECD Productivity Working Papers*, No. 2, OECD Publishing, Paris, <https://doi.org/10.1787/5jrql2q2jj7b-en>. [23]
- Andrews, D., G. Nicoletti and C. Timiliotis (2018), “Digital Technology Diffusion: A Matter of Capabilities, Incentives or Both?”, *OECD Economics Department Working Papers*, No. 1476, OECD Publishing, Paris, <https://doi.org/10.1787/7c542c16-en>. [60]
- Angelis, J. et al. (2020), *Enhancing the Efficiency of the Cooperation Between Business and Science – Moving Away from Silos Through, Mission-Orientated STI Policy*, Final Report. [29]
- Appelt, S. et al. (2016), “R&D Tax Incentives: Evidence on Design, Incidence and Impacts”, *OECD Science, Technology and Industry Policy Papers*, No. 32, OECD Publishing, Paris, <https://doi.org/10.1787/5jlr8fldqk7j-en>. [14]
- Bank of Lithuania (2022), *Bank of Lithuania Promotes Capital Market Development by Offering a Competitive and Attractive Credit and Investment Alternative*, News, 12 May, <https://www.lb.lt/en/news>. [57]
- Bank of Lithuania (2021), “Becoming a Data-centric Organisation: A Guide to Data Management Initiative at the Bank of Lithuania”, *Occasional Paper Series*, No 39/2021, https://zbw.eu/econis-archiv/bitstream/11159/6419/1/1774337002_0.pdf. [62]
- Bank of Lithuania (2021), “Study of Financing Possibilities for Small and Medium Businesses”, *Analysis and Research Series*, No. 11/2021 (in Lithuanian). [46]
- Branzoli, N. and A. Caiumi (2020), “How Effective is an Incremental ACE in Addressing the Debt Bias? Evidence from Corporate Tax Returns”, *International Tax and Public Finance volume 27*, pages 1485–1519, <https://doi.org/10.1007/s10797-020-09609-2>. [50]
- Caturianas, D. and M. Budraitis (2019), “Assessment of the Ongoing Higher Education Reforms in Lithuania”, NESET Ad hoc question, No. 3/2019. [81]
- CSIRO (2022), *Innovation Connections*, <https://www.csiro.au/en/work-with-us/funding-programs/programs/Innovation-Connections/About-the-program>. [30]
- Demmou, L. et al. (2021), “Insolvency and Debt Overhang Following the COVID-19 Outbreak: Assessment of Risks and Policy Responses”, *OECD Economics Department Working Papers*, No. 1651, OECD Publishing, Paris, <https://doi.org/10.1787/747a8226-en>. [49]
- Demmou, L. and G. Franco (2021), “Mind the Financing Gap: Enhancing the Contribution of Intangible Assets to Productivity”, *OECD Economics Department Working Papers*, forthcoming. [54]
- Demmou, L., G. Franco and I. Stefanescu (2020), “Productivity and Finance: The Intangible Assets Channel - A Firm Level Analysis”, *OECD Economics Department Working Papers*, No. 1596, OECD Publishing, Paris, <https://doi.org/10.1787/d13a21b0-en>. [48]
- Digitally Driven (2021), “Digitally Driven in Collaboration with Google, Greenberg and Catalyst Research”, in *European Small and Medium-Sized Enterprises (SMEs); Transformation, Innovation, and Resilience During the COVID-19 Pandemic*, <https://digitallydriven.connectedcouncil.org/europe/>. [58]

- EBAN (2021), *EBAN Statistics Compendium - European Early Stage Market Statistics 2020*, European Business Angel Network. [56]
- EC-OECD (2021), *Lithuania, Equity Financing*, STIP Compass, International Database on STI Policies, <https://stip.oecd.org/stip/interactive-dashboards/countries/Lithuania>. [53]
- ECOVIS (2020), *Lithuanian Fintech Landscape: Trends and Developments*. [35]
- European Commission (2021), *Survey on the Access to Finance of Enterprises (SAFE)*, https://ec.europa.eu/growth/access-finance-smes/data-and-surveys-safe_fr. [47]
- European Commission (2021), *Analysis of the Recovery and Resilience Plan of Lithuania*, Commission Staff Working Paper, SWD (2021) 187. [8]
- European Commission (2021), *Digital Economy and Society Index (DESI) 2021: Lithuania*, <https://digital-strategy.ec.europa.eu/en/policies/desi-lithuania>. [3]
- European Commission (2021), “High Growth Enterprises in the COVID-19 Crisis Context”, *Technical Report*, Joint Research Centre. [1]
- European Commission (2020), *Education and Training Monitor 2020: Lithuania*, <https://op.europa.eu/webpub/eac/education-and-training-monitor-2020/countries/lithuania.html>. [75]
- European Commission (2019), *Country Report Lithuania 2019, Staff Working Document*. [12]
- European Future Innovation Centre (2020), *Enhancing the Efficiency of the Cooperation Between Business and Science – Moving Away From Silos Through A Mission-orientated STI Policy*, December, EFIS. [25]
- European Union (2020), *Special Eurobarometer 499 “Europeans’ Attitudes Towards Cyber Security” Report*, https://data.europa.eu/data/datasets/s2249_92_2_499_eng. [70]
- Eurostat (2016), *Adult Education Survey 2016*. [84]
- Government of the Republic of Lithuania (2021), *Economic Recovery and Resilience Plan “New Generation Lithuania”*. [33]
- Guellec, D. and C. Paunov (2018), “Innovation Policies in the Digital Age”, *OECD Science, Technology and Innovation Policy Papers*, No. 59, OECD Publishing, Paris, <http://www.oecd.org/going-digital>. [24]
- Hewitt-Dundas, N., A. Gkypali and S. Roper (2017), “Accessibility, Utility and Learning Effects in University-Business Collaboration”, *Enterprise Research Centre Paper*, No. 57, February. [26]
- HM Government (2016), *National Cyber Security Strategy 2016-2021*, <https://www.gov.uk/government/publications/national-cyber-security-strategy-2016-to-2021>. [71]
- IMF (2017), “Republic of Lithuania: Selected Issues”, *IMF Country Reports* 17/178. [20]
- Invest Lithuania (2021), *The Fintech Landscape in Lithuania 2021 - 2022 Report*. [36]
- ITU (2021), *Global Cybersecurity Index 2020: Measuring Commitment to Cybersecurity*, International Telecommunication Union. [67]
- KPMG (2022), *Cyber Considerations from the Conflict in Ukraine*. [72]

- Larrue, P. (2021), “The Design and Implementation of Mission-Oriented Innovation Policies: A New Systemic Policy Approach to Address Societal Challenges”, *OECD Science, Technology and Industry Policy Papers*, No. 100, OECD Publishing, Paris, <https://doi.org/10.1787/3f6c76a4-en>. [34]
- Lithuanian Innovation Center (2020), *Lithuanian Industry Digitisation Roadmap 2020-2030*. [2]
- Ministry of Economy and Innovation (2021), *National Digitisation Development Programme 2021-2030*, <https://eimin.lrv.lt/lt/ekonomikos-ir-inovaciju-ministerija/administracine-informacija/planavimo-dokumentai/pletros-programos> (in Lithuanian). [6]
- Ministry of National Defence (2018), *National Cyber Security Strategy (English translation)*, <https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map/national-cyber-security-strategies-interactive-map?selected=Lithuania>. [68]
- OECD (2022), *OECD (2022), OECD Economic Surveys: Lithuania 2022*, OECD Publishing, Paris, <https://doi.org/10.1787/0829329f-en>. [5]
- OECD (2022), *OECD Handbook on Competition Policy in the Digital Age*, <https://www.oecd.org/daf/competition-policy-in-the-digital-age>. [43]
- OECD (2021), “Ex Ante Regulation and Competition in Digital Markets”, *OECD Competition Committee Discussion Paper*, <https://www.oecd.org/daf/competition/ex-ante-regulation-and-competition-in-digital-markets.htm>. [44]
- OECD (2021), “Improving Knowledge Transfer and Collaboration Between Science and Business in Spain”, *OECD Science, Technology and Industry Policy Papers*, No. 122, OECD Publishing, Paris, <https://doi.org/10.1787/4d787b35-en>. [32]
- OECD (2021), “Improving the Effectiveness of Lithuania’s Innovation Policy”, *OECD Science, Technology and Industry Policy Papers*, No. 123, OECD Publishing. [22]
- OECD (2021), *OECD Compendium on Information on R&D Tax Incentives*, <https://www.oecd.org/sti/rd-tax-stats-compendium.pdf>. [17]
- OECD (2021), *OECD Economic Surveys: Iceland 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/c4edf686-en>. [15]
- OECD (2021), *OECD Economic Surveys: Netherlands 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/dd476bd3-en>. [77]
- OECD (2021), *OECD Economic Surveys: Portugal 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/13b842d6-en>. [51]
- OECD (2021), *OECD Economic Surveys: Spain 2021*, OECD Publishing, Paris, <http://10.1787/79e92d88-en>. [38]
- OECD (2021), *OECD R&D Tax Incentives Database, 2021 Edition*. [10]
- OECD (2021), *OECD Regulatory Policy Outlook 2021*, OECD Publishing, Paris, <https://doi.org/10.1787/38b0fdb1-en>. [45]
- OECD (2021), *OECD Services Trade Restrictiveness Index (STRI): Lithuania - 2021*. [41]

- OECD (2021), *OECD Skills Strategy Lithuania: Assessment and Recommendations*, OECD Skills Studies, OECD Publishing, Paris, <https://doi.org/10.1787/14deb088-en>. [61]
- OECD (2021), *R&D Tax Incentives : Lithuania, 2021*, <http://oe.cd/rdtax>. [9]
- OECD (2021), *R&D Tax Incentives: Japan, 2021*, <https://www.oecd.org/sti/rd-tax-stats-japan.pdf>. [18]
- OECD (2021), *Supporting Entrepreneurship and Innovation in Higher Education in Lithuania*, OECD/European Union, https://www.oecd.org/cfe/smes/HEInnovate-Lithuania_2021r.pdf. [82]
- OECD (2021), *The Digital Transformation of SMEs*, OECD Studies on SMEs and Entrepreneurship, OECD Publishing, Paris, <https://doi.org/10.1787/bdb9256a-en>. [59]
- OECD (2020), *Dealing with Digital Security Risk During the Coronavirus (COVID-19) Crisis*, <https://www.oecd.org/coronavirus/policy-responses/dealing-with-digital-security-risk-during-the-coronavirus-covid-19-crisis-c9d3fe8e/>. [69]
- OECD (2020), “Digital Government Index: 2019 Results”, *OECD Public Governance Policy Papers*, No. 03, OECD Publishing, Paris, <https://doi.org/10.1787/4de9f5bb-en>. [63]
- OECD (2020), *Education at a Glance 2020: OECD Indicators*, OECD Publishing, Paris, <https://doi.org/10.1787/69096873-en>. [83]
- OECD (2020), *Financing SMEs and Entrepreneurs 2020: An OECD Scoreboard*, OECD Publishing, Paris, <https://doi.org/10.1787/061fe03d-en>. [52]
- OECD (2020), “Going Digital Integrated Policy Framework”, *OECD Digital Economy Papers*, No. 292, OECD Publishing, Paris, <https://doi.org/10.1787/dc930adc-en>. [42]
- OECD (2020), “How Effective are R&D Tax Incentives? New Evidence from the OECD microBeRD Project”, *STI Policy Note*, OECD, Paris, <http://www.oecd.org/sti/microberd-rd-tax-incentives-policy-note.pdf>. [19]
- OECD (2020), *OECD Compendium of Information on R&D Tax Incentives, 2020*, <http://oe.cd/rdtax>. [11]
- OECD (2020), *OECD Digital Economy Outlook 2020*, OECD Publishing, Paris, <https://doi.org/10.1787/bb167041-en>. [7]
- OECD (2020), *OECD Economic Surveys: Lithuania 2020*, OECD Publishing, Paris, <https://doi.org/10.1787/62663b1d-en>. [40]
- OECD (2020), *OECD Economic Surveys: United Kingdom 2020*, OECD Publishing, Paris, <https://doi.org/10.1787/2f684241-en>. [16]
- OECD (2020), *OECD Employment Outlook 2020: Worker Security and the COVID-19 Crisis*, OECD Publishing, Paris, <https://doi.org/10.1787/1686c758-en>. [80]
- OECD (2020), “The Impact of COVID-19 on Student Equity and Inclusion: Supporting Vulnerable Students During School Closures and School Re-openings”, *OECD Policy Responses to Coronavirus (COVID-19)*, OECD Publishing, Paris, <https://doi.org/10.1787/d593b5c8-en>. [74]
- OECD (2019), *Digital Opportunities for Better Agricultural Policies*, OECD Publishing, Paris, <https://doi.org/10.1787/571a0812-en>. [65]

- OECD (2019), *Individual Learning Accounts : Panacea or Pandora’s Box?*, OECD Publishing, Paris, <https://doi.org/10.1787/203b21a8-en>. [85]
- OECD (2019), *OECD Economic Surveys: Estonia 2019*, OECD Publishing, Paris, <https://doi.org/10.1787/f221b253-en>. [64]
- OECD (2019), *OECD Skills Strategy 2019: Skills to Shape a Better Future*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264313835-en>. [73]
- OECD (2019), *OECD SME and Entrepreneurship Outlook 2019*, OECD Publishing, Paris, <https://doi.org/10.1787/34907e9c-en>. [37]
- OECD (2019), *TALIS 2018 Results (Volume I): Teachers and School Leaders as Lifelong Learners*, TALIS, OECD Publishing, Paris, <https://doi.org/10.1787/1d0bc92a-en>. [79]
- OECD (2019), “The Road to 5G Networks: Experience to Date and Future Developments”, *OECD Digital Economy Papers*, No. 284, OECD Publishing, Paris, <https://doi.org/10.1787/2f880843-en>. [39]
- OECD (2019), *University-Industry Collaboration : New Evidence and Policy Options*, OECD Publishing, Paris, <https://doi.org/10.1787/e9c1e648-en>. [31]
- OECD (2018), *OECD Economic Surveys: Lithuania 2018*, OECD Publishing, Paris, https://doi.org/10.1787/eco_surveys-ltu-2018-en. [13]
- OECD (2016), *Financing SMEs and Entrepreneurs 2016: An OECD Scoreboard*, OECD Publishing, Paris, https://doi.org/10.1787/fin_sme_ent-2016-en. [55]
- OECD (2016), *OECD Reviews of Innovation Policy: Lithuania 2016*, OECD Reviews of Innovation Policy, OECD Publishing, Paris, <https://doi.org/10.1787/9789264259089-en>. [21]
- OECD and European Observatory (2021), *State of Health in the EU - Lithuania : Country Health Profile 2021*, <https://www.oecd.org/publications/lithuania-country-health-profile-2021-20b64b36-en.htm>. [66]
- Seimas (2020), *Resolution No XIV-72 on the Programme of the Eighteenth Government of the Republic of Lithuania*. [76]
- Sorbe, S. et al. (2019), “Digital Dividend: Policies to Harness the Productivity Potential of Digital Technologies”, *OECD Economic Policy Papers*, No. 26, OECD Publishing, Paris. [4]
- University-Business Cooperation in Europe (2018), *State of University-Business Cooperation: Lithuania, Business Perspective*. [28]
- University-Business Cooperation in Europe (2018), *State of University-Business Cooperation: Lithuania, University Perspective*. [27]
- Vandeweyer, M. and A. Verhagen (2020), “The Changing Labour Market for Graduates from Medium-level Vocational Education and Training”, *OECD Social, Employment and Migration Working Papers*, No. 244, OECD Publishing, Paris, <https://doi.org/10.1787/503bcecb-en>. [78]