

SWOT analysis of Lithuania

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2024 01 25



Information about the projects

Timeline of the process

In this paragraph, we are examining the strategies of semiconductor companies expanding their operations in Europe. A thorough analysis of the FDI Markets¹ database reveals a trend among industry leaders such as Intel, Infineon, STMicroelectronics, NXP Semiconductors, and ON Semiconductor. These companies typically initiate their ventures in Europe by establishing Research and Development (R&D) centers. After several expansions of these R&D facilities, they move forward to the establishment of fabrication plants. Such a pattern could offer insights for potential future operations in Lithuania.

An example of such a timeline can be seen in the Czech Republic. Where a small relocation plant was opened in 2003, then two R&D expansions, followed by a large factory in 2021. Similarly, Infineon entered Austria in 2004 and established an R&D facility. After five similar R&D-type expansions, the company opened its first manufacturing plant in 2011, further expanding in 2018 with a mega project valued at 1.7 bln.

Intel, in its strategic move, chose Poland for the location of its packaging site, investing a substantial 4.2 bln. Intel's story in Poland started in 1999 when they acquired a Polish semiconductor company and opened a laboratory expanding their R&D operations further in 2009.

As we understand, this process allows companies to develop a local talent pool and assess the viability of the ecosystem for potential expansions. Only after these efforts do companies decide on either expanding their operations through the establishment of manufacturing facilities or maintaining their R&D activities.

Intel ecosystem in Europe

Highlighting the need for a more balanced and resilient supply chain in the semiconductors industry, Intel, in March 2022 has pledged to invest 80 billion EUR into the European Union over the upcoming decade². With the help of the European Chips Act and Intel, Europe is focusing on creating the next-generation European chips industry ecosystem.

Intel's strategic plan involves establishing an end-to-end semiconductor manufacturing value chain in Europe. The process will kick off with wafer fabrication in Germany, followed by the transfer of wafers to Intel's state-of-the-art Fab 34 in Ireland³, and concluding with the assembly and testing of chips in Poland. Recognizing that hardware investments alone are insufficient for a fully functional ecosystem, Intel is also planning to set up an R&D and design hub in France. Additionally, the company is expanding existing R&D facilities in Ireland, Poland, Italy, and Spain⁴.

This envisioned value chain bears similarities to the current semiconductor production structure in Asia. Currently, silicon wafers are predominantly grown in South Korea and Japan, and then transported to Taiwan for chip manufacturing. The final stages of assembly and testing services are largely concentrated in China or Malaysia. Intel's initiative seeks to decentralize and diversify this process, establishing a robust and self-sufficient semiconductor ecosystem within Europe.

¹ [fDi Markets: the in-depth crossborder investment monitor from the Financial Times](#)

² [Intel Announces Investment of €80 Billion to EU](#)

³ [Intel's New Fab in Ireland Begins High-Volume Production of Intel 4](#)

⁴ [Intel Plans Investments in Europe](#)

Optoelectronics segmentation

Analyzing the optoelectronics sector, we've categorized projects into three main subsectors: Solar, Lighting, and Other types of projects.

Solar

Renewable energy is becoming an important topic in the European Union. That is why it was highlighted as a unique sub-sector in our database, where nearly 17% of all projects were in the solar category. However, it's noteworthy that only 4% of these solar projects find their way to the European market.

Lighting

This category comprises all lighting technologies, including the manufacturing of car headlights and taillights, LED devices, and general lighting devices. However, a challenge with these projects is that they may not necessarily provide high-added value, and as a country, Lithuania is not currently prioritizing such ventures.

All other optoelectronics

All other projects fall under this category. Projects mainly consist of sensor technologies (proximity sensors in cars, infrared sensors, etc.), display technologies (phone screens, car multimedia, etc.), and photonics. Notably, a handful of sensor projects have found their way to Lithuania, with a focus on driving assistance systems, involving companies like Littelfuse, Hella, and Continental.

Lithuania's photonics sector is already well-recognized globally. Expanding this sector with Foreign Direct Investment (FDI) projects would be highly beneficial. Such projects could bring valuable expertise to our country, contribute to the growth of the existing ecosystem, and enable us to take part in a broader segment of the value chain.

Project Destination Criteria

Among the different motivations mentioned for relevant FDI across Europe, especially the CEE region, the most common factor was the availability of a skilled workforce. Support from the government, connections to universities, quality of infrastructure, transport routes, pre-existing industrial base, competitive costs, and a positive business environment were also frequently cited as motives for the selected destination.

These criteria were identified from publicly available statements, such as press releases, which provide a limited view of the business decision-making process.

Logistics in Lithuania

When international companies want to establish operations in Europe as a gateway to that regional market or to diversify the geography of their supply chain, then Lithuania can be a good option. The GDP contribution of the transport and logistics sector to the Lithuanian economy is around 12%, with its central position between Northern, Eastern, and Western Europe.

In the European region, there are major exporters of semiconductor manufacturing equipment and raw materials for wafers. In Lithuania, there is an active optoelectronics export market with lasers and optical coatings, as well as multiple businesses related to automotive electronic components – which is the main driver behind semiconductor demand in Europe. This makes for an attractive market to make partnerships within, with proximity to specialist suppliers and potential customers.

There are major international land transport routes passing through multiple Lithuanian cities such as Vilnius, Kaunas, Klaipėda, Šiauliai, and Panevėžys. Lithuania's largest transport hub is Klaipėda with its intermodal connectivity of port, railway, and highway. It also has inland waterway freight and is 39km away from Palanga airport.

The North-South routes are promising, with further improvement of the Pan-European Corridor I as part of the North Sea-Baltic Corridor (TEN-T) which connects Finland-Estonia-Latvia-Lithuania-Poland-Germany-Netherlands/Belgium. This includes upgrades to the International E-Road Via Baltica E67 (which also goes to Czechia), maritime transport improvements, and making the railways compatible with the European Standard rail as part of the Rail Baltica project. The Rail Baltica will have freight train speeds up to 120km per hour and cargo would reach as far as Milan. For passengers, it is expected that the high-speed trains will take 3.5 hours to travel from Kaunas to Warsaw.

There is also partially completed construction across the upcoming Via Carpatia highway from the Baltic Sea to the Black and Aegean Sea, which connects Lithuania-Poland-Slovakia-Hungary-Romania-Bulgaria-Greece. It may also become part of the TEN-T network in the future and include railway sections.

The East-West routes, such as the Pan-European Corridor IX, will be less useful for promoting investment at the current time since most of it is passing through Russia, Belarus, and Ukraine.

There are international airports at Vilnius, Kaunas, Palanga, and Šiauliai (24/7 cargo) with flight times to European centers like London and Brussels of less than 3 hours, however, Lithuania ranks 95th on the International Connectivity Index⁵.

⁵ [Quarterly Air Transport Chartbook Q1 2023 – IATA Sustainability&Economics](#)

Government Support

The semiconductor industries were recognized early by Asian governments as a strategic industry, with industrial policy and legislation to support growth for decades.⁶ Now governments all around the world try to incentivize technology companies to invest in their country, a major shift against the prior trend of globalization and outsourcing of supply chains due to the impacts of global health crises, climate change, and political tensions⁷. The newly implemented CHIPS and Science Act by the United States (2022) and the European Chips Act by the EU (2023) are both seeking to reinvigorate domestic manufacturing for a greater share of the market through a mixture of tax incentives, direct cash grants, and fast-tracking of bureaucratic services for this specific purpose. Even within nations, there is competition between regions as municipalities local governments provide additional support for potential FDI. When trying to attract for-profit enterprises, it can be difficult for nations with smaller economies to stand out on a purely financial value proposition. There are other features of government policy that can promote a good business environment, such as international trade agreements, intellectual property protection, public infrastructure, and visas for migrant workers.

A key feature of Lithuania is its EU membership, which means that some aspects of the public funding and legal environment are very similar to other countries in Europe. Some of the important benefits of EU membership is standardized regional IP protection through the European Patent Office, access to a greater pool of financial resources such as lending from the European Investment Bank, or European Commission funding from the EU Chips Act. Some of these can be directly applied to by private companies, others could be applied to by public institutions to support an FDI project indirectly – for example, structural funds to further develop a Free Economic Zone (FEZ)⁸.

The EU Chips Act made changes to state aid regulations, leading to a scale of subsidies that would not have been possible before. Some of the funds are redirected from similar tech-strengthening initiatives such as Horizon Europe, or based on contributions from national budgets such as the Important Project of Common European Importance (IPCEI) on Microelectronics⁹ - Lithuania is not currently participating in this project as a member state.

There are multiple public sector organizations and their branches which provide support to high-tech initiatives. Invest Lithuania and the Lithuanian Innovation Agency work under the Ministry of Economy and Innovation, would be the main starting points for most businesses. Startup Lithuania may be helpful for certain kinds of investors. Localized support from Municipality bodies such as Vilnius TechFusion, Kaunas IN, Klaipėda iD can be in collaboration with privately managed Tech Parks, Clusters or FEZs. European Digital Innovation Hubs¹⁰ and their partners provide consultations on how to access funding from different potential sources and other services. Many of these organizations are recognized as high performing in their sector, such as Invest Lithuania in 2nd place as an Investment Promotion Agency in the region¹¹ and Lithuanian cities winning awards for foreign direct investment strategy¹².

⁶ [RIETI - Strengthening semiconductor manufacturing: Lessons from East Asia](#)

⁷ [The Return of Industrial Policy in Data \(imf.org\)](#)

⁸ [€1 billion – for the Lithuanian economy: €30.6 million granted for the development of the Akmenė, Jonava and Mažeikiai industrial zones | Ministry of the Economy and Innovation of the Republic of Lithuania \(lrv.lt\)](#)

⁹ [Important Project of Common European Interest \(europa.eu\)](#)

¹⁰ [EDIH Catalogue | European Digital Innovation Hubs Network \(europa.eu\)](#)

¹¹ [Emerging Europe Investment Promotion Report 2023 \(emerging-europe.com\)](#)

¹² [Vilnius ranks second in Europe among medium-sized cities of the future | Lithuania](#)

The Free Economic Zones are locations with government support in the form of tax incentives, infrastructure development, and fast-tracked permits. There is a limited area to where the FEZ 0% Corporate tax benefits apply, however, there is also the Green Corridor for larger investments. This has similar types of incentives without location limitations, instead needing to meet job creation and Capex thresholds. Lithuania is 9th globally for its tax competitiveness¹³, however, this common technique to attract FDI might not be possible in the future due to new laws for EU members to commit to a minimum corporate tax rate for multinationals with revenue of more than €750 million a year, based on OECD goals.¹⁴

Lithuania ranks well globally and within the CEE on various measures for the accessibility of public services. The European Commission places Lithuania at 7th in eGovernment¹⁵, which is complemented by related strengths as one of the top-performing countries for Open Data¹⁶ and 2nd in the CEE for transparency and anti-corruption¹⁷. Reducing bureaucratic overheads (e.g. digitization), and having a reliable, business-friendly government for both foreign and local enterprises is beneficial for FDI project timelines, and confidence for the long-term investment environment. This enables more agile decision-making, and more security for agreements – for example, EU countries failing to meet standards for governance can lose funding which impacts universities, infrastructure projects, and national GDP which are all important factors in FDI.¹⁸

International relations are increasingly important factors in a business environment. For example, political cooperation between Taiwan and Lithuania has been highlighted as a potential pathway for strengthening the semiconductor industry¹⁹. Further strategic partnerships with nations that have an established high-tech manufacturing sector can help facilitate further connections and development in the private sector. One form of multi-lateral cooperation is through trade agreements, which for Lithuania is largely through the EU single market – this allows for free movement of goods, money and people, and standardizes industry regulations. The ability to smoothly participate in the larger EU market is vital for businesses which rely on exports to scale. Another tool to facilitate stronger international trade relations is through Double Tax Agreements. These will have renewed global attention due to the OECD's Base Erosion and Profit Shifting project²⁰, and Lithuania is currently missing key countries that have FDI or supply chain partnership potential such as Malaysia, Taiwan, and Vietnam.²¹

Lithuania's membership of the OECD, NATO, EU, and WTO (World Trade Organisation) means the country has already reached certain economic, regulatory, and political milestones and standards. For information-sensitive industries, there is access to intellectual property protection by the TRIPS Agreement of the WTO and geopolitical alignment which promotes trust. The trade agreements and corporate due diligence practices today are increasingly featuring provisions for Environmental, Political, and Social standards – an example of which can be seen in the updates to the OECD's Guidelines for Multinational Enterprises²². However, sometimes these

¹³ [2023 International Tax Competitiveness Index | Tax Foundation](#)

¹⁴ [A minimum tax rate of 15% on the profits of multinationals. | World Economic Forum \(weforum.org\)](#)

¹⁵ [EGovernment benchmark 2023 - Publications Office of the EU \(europa.eu\)](#)

¹⁶ [2023 OECD Open, Useful and Re-usable data \(OURdata\) Index](#)

¹⁷ [2023 Corruption Perceptions Index - Transparency.org](#)

¹⁸ [Rule of law: EU reprimands Poland and Hungary – DW – 07/09/2023](#)

¹⁹ [Strengthening EU chip capabilities \(europa.eu\)](#)

²⁰ [OECD, BEPS, and the Multilateral Instrument: Navigating International Tax Treaties | Bloomberg Tax](#)

²¹ [Tarptautinės dvigubo apmokestinimo išvengimo sutartys - VMI](#)

²² [OECD Revises Guidelines for Multinational Enterprises on Responsible Business Conduct | Herbert Smith Freehills](#)

standards from multilateral organizations may also be considered a barrier to operations with chemically intensive sectors, such as semiconductor manufacturing companies which lobby against additional environmental laws²³ and threaten to relocate as they have done in the past²⁴.

Governments are also often lobbied by industries to make changes to migration policy to address their need for talent. Even countries that are considered to have a center of expertise need to include migration as part of their strategy for the tech sector²⁵. Lithuania, like many other countries, has specific visas and incentives available to high-skilled migrants. There is the EU Blue Card programme for migrants with sufficient tertiary education or work experience and an Arrival Allowance given to both employees and employers for high-added-value occupations. There are ongoing initiatives to assist with the integration and attraction of migrant workers through public funded projects such as International Houses in various cities, Work In Lithuania, and Renkuosi Lietuvą.

Technical Talent Pool

In high-tech sectors, one of the most critical resources needed is skilled employees. In many parts of the world, there is a growing demand for individuals with STEM backgrounds on top of already existing shortages, so there are concerns that there won't be enough staff to construct and then operate the new electronics facilities. Companies will assess the availability of people to hire through the graduation rates, unemployment rates, migration rates, and other population statistics, and by looking at the existing companies in the region that are competitors or in similar sectors. Other factors to consider include the opportunities for collaboration with academia, industrial cluster activities, and the relative cost of labor.

3,000 students chose engineering as their field of study in 2023²⁶. Lithuania also is within the Top 10 of OECD countries for the percentage of tertiary engineering graduates²⁷. Lithuania has the highest Bachelor's graduation rate in the OECD based on 2020 data²⁸. In addition to universities, there are also many vocational schools that would be a potential labor pool for technician roles or for initial construction. There are more than 100,000 total construction sector employees in Lithuania²⁹.

There are many local Science-Business collaborations with tertiary education and research institutes. Usually, the businesses have been the initiators of these partnerships, seeking better access to graduates, and intend to continue the cooperation – they are active participants in cluster development with motivation and support for University-Business collaboration exceeding the EU averages.³⁰ Many of the people working in Lithuania's optoelectronics sector have an educational background from Vilnius University's Physics Faculty, so the network of alumni have common connections which would improve collaboration. In recent years there have been many projects by universities to expand their external partnerships, such as Kaunas Technical University's M-LAB center, LinkMenų Fabrikas Innovation Centre at Vilnius Tech, and continued involvement in tech parks and clusters.

Clusters are normally led by one or more world-class manufacturers and a nearby research institute—a constellation that attracts small-to-medium enterprises and eventually creates an ecosystem to support research

²³ [Chemicals ban could derail EU's chips ambitions, lobbies warn – POLITICO](#)

²⁴ [American Chipmakers Had a Toxic Problem. So They Outsourced It - Bloomberg](#)

²⁵ [Taiwan's Semiconductor Talent Shortage – The Diplomat](#)

²⁶ [Education and Culture in Lithuania 2023 – Official Statistics Portal](#)

²⁷ [Tertiary Graduates by Field – OECD Data 2020](#)

²⁸ [Tertiary Graduation Rate, Bachelor's or equivalent level – OECD Data 2020](#)

²⁹ [Statistics Lithuania – 2023 Q3](#)

³⁰ [University-Business Cooperation in Europe 2017 \(ub-cooperation.eu\)](#)

and manufacturing.³¹ There is an established and growing optoelectronics cluster LITEK based around the Center for Physical Sciences and Technology (FTMC), which could be an attractive base for further investment - often there is a domino effect with FDI where prior success by competitors encourages others to enter the market. They can also be a basis of a 'soft-landing' in a new regional market, where the existing skilled employee network can be used by a new entrant for finding hires, suppliers and shared facilities.³² There are multiple locations with cluster presence in Lithuania, such as Visoriai, Sunrise Valley, FEZs, and large tech focused office sites which would be suitable for R&D operations. There are also businesses and clusters in adjacent industries such as electronics manufacturing services, automotive components and software development where workers can be found with overlapping skill sets.

Certain factors which are beneficial to FDI needs for hiring are not sector specific. A relatively high labor productivity in the CEE³³ means a cost-effective workforce. Another factor enabling multinational investment is that more than half of Lithuanians aged 15-44 speak English as an additional language³⁴. For attracting and retaining tech talent in high demand globally, employees can be attracted to new locations through tax incentives, lower cost-of-living, promotion of lifestyle factors such as walkability and access to nature.³⁵

It is more reliable to build talent locally, and this has been a priority for many private companies and public institutions. There is a long-term view to encourage more people into STEM fields through various strategies such as building interest amongst school children early with tour trips and company visits. There are also mentorships, reskilling programs, additional scholarships, career fairs, hackathons and incubator programs that seek to improve the innovative and knowledge-based economy participation of Lithuanians.

Infrastructure

Both the Optoelectronics and Semiconductor sectors need extremely controlled environments for manufacturing equipment, which requires large and expensive cleanrooms. The need to prevent contamination of sensitive materials and operation of high-precision tools is a common feature for other high-tech manufacturing industries too, such as Life Sciences. This means improvements to the availability of cleanrooms would have positive effects on other high-added-value sectors too.

A key feature of Semiconductor manufacturing projects is their large scale, which means investors look for large plots of land and high availability of electricity. Currently, there is a limited number of locations in Lithuania that would meet these requirements, and the speed for creating new greenfield projects is hampered by the time needed to expand distribution centers for electricity. This bottleneck is not unique to Lithuania - the electrical infrastructure supply chain has had ongoing issues globally for years, with doubled costs and lead times for new distribution equipment such as transformers³⁶ causing delays to many projects.³⁷

Electricity prices for industrial users in Lithuania are not significantly competitive, slightly lower than the EU average but more expensive than some neighboring nations³⁸. The majority (~65%) of Lithuania's electricity is imported

³¹ [Semiconductor design and manufacturing: Achieving leading-edge capabilities - McKinsey](#)

³² [Busting the cluster myths | fDi Intelligence](#)

³³ [Colliers | ExCEEDing Borders: Manufacturing and Warehousing sector in CEE-12](#)

³⁴ [Results of the 2021 Population and Housing Census of the Republic of Lithuania](#)

³⁵ [The Global Competition for Technology Talent – IMF Finance & Development Magazine | March 2019](#)

³⁶ [Electric power supply chain resilience | Deloitte Insights](#)

³⁷ [U.S. renewable, grid battery projects battle transformer shortage | Reuters](#)

³⁸ [Electricity price statistics - Statistics Explained \(europa.eu\)](#)

from Sweden, Latvia and Poland³⁹. A comparatively high share of energy is from renewable sources, placing Lithuania 3rd in CEE⁴⁰. Energy efficiency is important for reduced operating expenses, as well as meeting environmental responsibility targets, so low-emissions electricity will need to be available.⁴¹ The reliability of electricity is an important factor for manufacturing locations, where even short outages can lead to millions of dollars in losses in resetting equipment and disposing of ruined products.⁴²

With the competitive and fast-moving nature of the electronics industry, minimizing the amount of time spent on the construction of a new facility is a top priority.⁴³ This means that investors will select a location that has the foundational works already completed, such as connection to utilities, even if it comes at a higher cost. Governments will frequently spend millions on on-site development in anticipation of attracting target industries, which can be risky – it can be years before a company arrives to make a return on the investment.⁴⁴ There has been gradual expansion and upgrades to FEZ plots and other industrial areas, through re-investment by FEZ managers which is often supported with funding from Lithuanian⁴⁵ or EU grants.

One site with potential in Lithuania is Kruonis Tech Park, originally developed for Data Centre purposes.⁴⁶ A large-scale data center facility has similarities to Semiconductor fabs due to their intensive electricity and water requirements. This could potentially allow for adaptation in marketing strategy to find investors in the Semiconductor industry and not only server rooms.

While water usage is high in semiconductor manufacturing, much of it is recycled and reclaimed. This means availability of water doesn't appear to be a major factor, with new construction planned in locations such as Arizona and Taiwan despite recent droughts and scarcity.⁴⁷ In the last decade, there has been more capacity added in high-risk areas compared to low-risk areas⁴⁸. However, as the frequency of disruption increases due to climate change, and as the costs of new foundries get higher, it may be a point of difference that becomes more important to future-focused organisations wanting to protect their investments.⁴⁹ Lithuania has a very low risk of natural disasters which could disrupt manufacturing operations⁵⁰ and low political risk for investments based on independent assessments.⁵¹

³⁹ [Litgrid](#)

⁴⁰ [Renewable energy statistics - Statistics Explained \(europa.eu\)](#)

⁴¹ [The path to net zero: Semiconductor sustainability | McKinsey](#)

⁴² [Samsung Electronics' Memory Complex Halted due to a Minute-long Blackout - Businesskorea](#)

⁴³ [Navigating the Costly Economics of Chip Making | BCG](#)

⁴⁴ [The Role of Industrial Clusters in Reshoring Semiconductor Manufacturing \(csis.org\)](#)

⁴⁵ [EIMIN: Almost €12 million allocated to 7 municipalities for industrial zone development | Ministry of the Economy and Innovation of the Republic of Lithuania \(Irv.lt\)](#)

⁴⁶ [Data Centres in Lithuania | Invest Lithuania](#)

⁴⁷ [Fund managers see water risk in semiconductor bets being mispriced | Financial Post](#)

⁴⁸ [Recent Earthquakes Highlight Risk To Semiconductor Manufacturing Sites \(semiengineering.com\)](#)

⁴⁹ [The Heat is On: Assessing Climate-Related Supply Chain Disruption for Critical Industries | Climate on Demand \(moodys.com\)](#)

⁵⁰ [The WorldRiskReport 2023 – Disaster Risk and Diversity - World | ReliefWeb](#)

⁵¹ [S&P Global Ratings Assessed the Prospects of the Lithuanian Economy - Ministry of Finance of the Republic of Lithuania \(Irv.lt\)](#)

The cost of land is insignificant compared to the cost of the fab equipment and seismically isolated cleanrooms. In Lithuania, the industrial vacancy rates are low but increasing, in line with global trends making competition for industrial sites and new plots of land high. Land availability is especially important for the purpose-built needs of high-tech manufacturing, and the modern ESG requirements which make adapting existing buildings less of an option. Construction material shortages are expected to lessen in the future, which will reduce project delays. The CEE region has more availability of large land plots for industrial use compared to Western Europe which are needed for greenfield mega projects. Realtors across the CEE have noticed more inquiries coming from APAC investors looking to diversify the locations of their manufacturers or target European markets.⁵²

⁵² [Colliers | ExCEEDing Borders: Manufacturing and Warehousing sector in CEE-12](#)

SWOT analysis of Lithuania

Strengths Weaknesses Opportunities and Threats (SWOT) analysis of Lithuania in semiconductor and optoelectronics sector was constructed with the help of expert interviews, information of previous documents and this report by MITA – [Puslaidininkijų sektoriaus strateginė apžvalga \(lrv.lt\)](#)

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Great science basis in semiconductor fundamentals • FTMC and M-Lab research centers • Strong laser sector • Electronics hub in Kaunas 	<ul style="list-style-type: none"> • Lack of specialists • Low-value-added industry of Lithuania • Intellectual property challenges • Lack of tax incentives for R&D • Lack promotion programs for the semiconductor electronics industry • Lithuania is not able to support huge projects monetary-wise
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> • Teltonika is developing the semiconductor industry in Lithuania • Further development of the laser sector • Specialization in small-scale production • Industry 4.0 • Bilateral cooperation with foreign partners • Access to strategic value chains by joining to EU initiatives 	<ul style="list-style-type: none"> • Huge competition between the players • Increasing shortage of STEM specialists • Geopolitical risks • Increasing role of China • Overcapacity market distortion for the chips industry

STRENGTHS

Semiconductor research in Lithuania dates back to the 1950s⁵³. Nowadays, research institutions from Vilnius University, Vilnius Tech, Kaunas University of Technology, and Center for Physical Sciences and Technology – FTMC are all actively engaged in semiconductor and optoelectronics branches of science. In these institutions, both fundamental and applied research takes place and showcases a significant accumulation of scientific expertise and know-how. Lithuanian researchers are mainly concentrated into four main categories in this field:

- Laser science and laser applications.
- Optical semiconductor properties and optoelectronics with a focus on LED devices.
- Material science – in-depth research into semiconductor materials and their nanostructures.
- Semiconductor electronics – fundamental research of electronic devices.
- Strong OLED research group in the optoelectronics field.

M-Lab is a new prototyping and design center affiliated with Kaunas University of Technology⁵⁴. Since Kaunas is an electronics hub in Lithuania, M-Lab will focus on developing, designing, and testing microelectronics. It has a laboratory with the most advanced design software, testing, and packaging capabilities. The laboratory was designed to collaborate with large businesses providing end-to-end solutions from conceptualization to mass

⁵³ [Istorija | PUSLAIDININKIŲ FIZIKOS KATEDRA \(vu.lt\)](#)

⁵⁴ [KTU „M-Lab“](#)

production. Furthermore, Kaunas University of Technology has plans to initiate a microelectronics study program and align its curriculum with the industry's needs.

FTMC and M-Lab are Lithuania's primary research and innovation hubs in optoelectronics and semiconductor fields, closely affiliated with Vilnius University and Kaunas University of Technology. These centers showcase Lithuania's ability to produce high-quality researchers and students. They can serve as examples to attract foreign companies looking to establish R&D centers.

Lithuania's global recognition of its laser sector is a sign that we have great talent, which applies to the semiconductor or optoelectronics industries. Laser science is closely related to the semiconductor field either through laser cutting, marking, or other applications in the manufacturing process⁵⁵.

Lithuania already has a few companies which are working in the semiconductor field. "Brolis Semiconductors" designs and manufactures semiconductor devices and sensors. "NT lab" is designing interconnected circuits, semiconductor chips, and radioelectric systems.

Lithuania also has an electronics hub in Kaunas. It consists of Kaunas Technical University (KTU) and well-known companies like Continental, Hella, and Littelfuse. These companies are making electronic vehicle parts, mainly different types of sensors. This ecosystem is proof that electronics companies in Lithuania can find enough talent for growth and further development.

WEAKNESSES

Lack of talent and specialists is often recognized as one of the most important challenges within the sector. This problem is already relevant to our current high-tech industry and the development of the semiconductor industry. A shortage of workers is pushing companies to look for employees among students in related fields. Such shortage of talent can be seen among all STEM-related fields and is recognized as both a regional and global problem⁵⁶.

Currently, Lithuania's industry is mainly low-value-added. It lacks scientific intensity and creativity. This limits Lithuania's capability to innovate and explore more science-intensive sectors of high-tech industry.

Even though patents are recognized as an important step to start selling your products, especially in high-tech business, Lithuanian companies still often avoid patenting their products and technologies due to costs and potential leakage of trade secrets and technology.

Tax incentives for R&D are a crucial way to boost R&D activities in the country. In Lithuania, these incentives are mainly focused on profitable businesses that are investing in such activities, but that is certainly not enough⁵⁷. Such a system becomes problematic for companies with lower profits, which are not able to effectively use these initiatives, therefore it is hard for them to develop rapidly.

Exploring new areas within the semiconductor industry doesn't necessarily motivate researchers to take on research in new directions. This is because any new course of research requires a few years of work to produce meaningful results. In that window, there will be fewer achievements, and it will have an impact on the scientist's evaluation. To tackle this problem new incentives and evaluation programs will have to be created.

Semiconductor facilities are extremely expensive to build and maintain. Most of the new FDI projects in the semiconductors industry are backed by the destination country of the project. For instance, Germany has pledged 3.5 bln. EUR to build a TSMC facility in the country and around 10 bln. EUR for Intel's chip complex in the country.

⁵⁵ [Role of Lasers in Semiconductor Manufacturing](#)

⁵⁶ [Commission report finds labour and skills shortages persist](#)

⁵⁷ [Tax incentives for R&D and innovation - OECD](#)

Intel is also building testing and packaging facilities in Poland, but the subsidy here is not disclosed, because it will not just take the form of direct subsidy⁵⁸.

OPPORTUNITIES

Teltonika has pledged to create a semiconductor industry in Lithuania. This is viewed as a great opportunity to start developing the semiconductor industry within the country. Teltonika's plans include building an R&D center, chip factory, packaging and testing facilities⁵⁹. This will allow the company to capture a large portion of the value chain and grow competencies along it. It will encourage more people to choose relevant STEM sciences in electronics and semiconductor technologies, potentially expanding the industry in the future.

Further development of Lithuania's laser sector could be an opportunity to tap into semiconductor and chip processing systems. Theoretically, Lithuanian lasers are capable of performing these operations and even outperform the competitors, but the market is still underexplored. The situation could be improved by attracting FDI projects, which would integrate our lasers into their processing machines and sell the whole product in the later stage of the value chain. This symbiotic relationship could expand our current ecosystem, improve our know-how, and expand relations within the sector.

An emerging trend of customized chips for specific purposes, such as specialized chips for individual car sensors, poses an opportunity for Lithuania. Since the whole field is new and even the main players are yet to explore it, we could grow specific competencies in this field of the sector and become an important player in the market. Our engineers can focus on small-scale production, which has a high added value and huge potential⁶⁰.

The upcoming industry revolution, also known as Industry 4.0, is centered around automation and robotization. This will require the transformation of the current systems introducing various sensor and robotization technologies. Lithuania already has some great scientific hubs in specific semiconductor and sensor technologies in Kaunas and Vilnius, especially the newly built M-Lab complex and FTMC. Scientific potential and technological know-how in these fields already exist in our country, it is only a question of what can be developed further and will the business and science collaboration be enough to facilitate enough innovation in the sector.

Opportunities in the semiconductor and optoelectronics sectors are closely tied to international cooperation. Establishing bilateral relations with leading countries in this sector, particularly Taiwan and the USA, could help us acquire competencies and necessary know-how in the field. Such partnerships could pave the way for internships for our specialists and students in foreign companies and universities. For example, internships in designing integrated circuits and chip architecture would allow us to learn how to design chips ourselves and then create original designs and products for the industry.

EU initiatives like the European Chips Act or Industrial Alliance of Processors and Semiconductor Technologies⁶¹ allow us to access the value chains of semiconductors and optoelectronics industries. Even without existing contacts companies can participate in projects, develop competencies, and build their client base. Additionally, there are substantial financial incentives to develop these industries within the country, coming from the EU Commission in the form of the Chips Act. European Digital Innovation Hubs could serve as accelerators for these initiatives and help with the development of the ecosystem.

⁵⁸ [Intel launches 'largest investment in Polish history'](#)

⁵⁹ [Taivano puslaidininkiu ekspertų darbo grupė Teltonikoje](#)

⁶⁰ [Automotive semiconductors for the autonomous age | McKinsey](#)

⁶¹ [Alliance on Processors and Semiconductor technologies](#)

THREATS

Return on investment (ROI) is identified as one of the main risks in the semiconductors sector. In order to become a player in this sector, a huge initial investment is required, and it would go to an area of extreme competition. With the rapid developments in this sector and the leading players growing their share of the industry's profits over the years, it is very risky to invest large sums in this sector⁶². The main risks are that your technology can quickly become obsolete, or you will be pushed out of the market by big players. When creating such an industry in Lithuania it is necessary to consider whether the production or development of semiconductors will be competitive enough and whether would it justify large investments of money, time, and scientific expertise.

The shortage of specialists is relevant to all STEM fields in Lithuania and Europe. An assumption can be made that the development of the semiconductor industry would stimulate interest in related fields. Higher salaries might solve this problem by attracting specialists from abroad, but such a solution is only valid on a short-term scale. However, currently, the need for specialists is so huge that companies are employing bachelor students. This creates a deeper problem, where the number of master's and doctorate students is decreasing, which will later result in the lack of professors for universities and only deepen the problem.

China is the global powerhouse in electronics manufacturing. It is also making a lot of advancements in the semiconductors sector, to support its Artificial Intelligence needs and further electronics advancements. Since electronics is a key part of our world and nowadays a lot of components and products come directly from China, it has the main role in the industry. China's domination increases risks for our developments in the industry since it can outcompete and push our companies out of the market, providing cheaper products in larger quantities⁶³.

Geopolitical risks are an important question when we think about the creation of the semiconductor industry in Lithuania. If Lithuania would be able to find its niche in the semiconductor industry and become one of the key players of that niche in Europe, then it would be an important economic, but also a political safety lever. Such a position might create some political leverage in case of any threats in the region. On the other hand, those regional threats can become hindrances for the development of the industry. Investors might hesitate to commit to a long-term, expensive, and strategic project in a relatively unstable region.

⁶² [Value creation: How can the semiconductor industry keep outperforming? | McKinsey](#)

⁶³ [Security And Reversing China's Electronics Dominance \(forbes.com\)](#)

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