ANALYSIS OF INDUSTRY DIGITIZATION OPPORTUNITIES IN LITHUANIA

Daiva Bičkauskė, Artūras Jakubavičius, Mantas Vilys
Lithuanian innovation centre, Vilnius, Lithuania

In the context of globalization, fast-moving technologies and a rapidly evolving economy have triggered a new wave of change. Generally known as the Industry 4.0, it has been announced to underline the new industrial revolution. The biggest focus in on formulating the Industry 4.0 concept aiming to distinguish and articulate the main characteristics of digitization, comparing Lithuanian production trends in the context of digitization

Introduction. In scientific articles, authors emphasize the importance of digitization in production [1],[2]. They claim that companies need to implement the latest technology. The fourth industrial revolution will have a monumental impact on the global economy, so vast and multifaceted that it makes it hard to disentangle one particular effect from the next [3]. A non-innovative company is doomed to be pushed out of the market. The fourth industrial revolution is already beginning to change production processes, business models, and personal life.

Desires to digitize all processes horizontally (through all components that create value) and vertically (through all levels of automation). Concepts such as the Internet of Things, a smart factory, cyber systemsenable the implementation of the fourth revolution. Majority of the entrepreneurs recognize the concept of Industry 4.0 as a great opportunity for development and improvement in competitiveness[4]. The strengthening of digitalization processes in EU industry may put additional competitiveness pressures on Lithuanian manufacturing businesses. In order to maintain the competitiveness of Lithuanian industry, steps towards the digitalization of industry has to be implemented. Digitization offers the potential for quality improvement, flexibility and productivity [5].

The concept of the Industry 4.0. The industry is a part of the economy producing material goods that are mechanized and automated[6]. The future vision of the fourth industrial revolution includes modular and efficient production systems, characterized by scenarios in which products control their own production processes. The idea should realize individual production in small series, while maintaining the same economic benefits as mass production. Products in the factories will communicate with the environment and will affect the configurable systems[7].

Heiner [8] states that there are two main factors that determine the development of the new industrial revolution. The first factor is the "pull" of application, driven by the need for change. This factor is caused by social, economic and political factors:

− *Individualization on demand*: market breakthrough from seller to buyer.

− *Flexibility*: The new system requirements require a flexible product development process. The manufacturing cycle must be adaptive and flexible.

− *Short development times*: new technology, product development time must be shortened. Ugerman [9] also adds that this factor must improve and even change technology, but also people's thinking.

− *Decentralization*: faster decision-making by companies to cope with specific tasks requires the abandonment of a hierarchical organizational system.

− *Resources management*: Shrouf [10] argue that resource management needs to be more sustainable in managing resource depletion, increased prices, as well as changing social attitudes towards ecology.

On the other hand, the industry is undergoing a technological boost. This technological push has already affected people's personal lives. However, in an industrial context, innovative technologies are just beginning to enter the value chain, therefore we can identify technologically-driven advancement methods:

− *Digitization and Networking*: The ever-increasing digitization of production and production tools leads to an increasing database of actuators and sensors that supports control and analysis functions. It leads to a fully digitized environment. Lee and Kao [11] describe products as information carriers that are linked to other product modules and to the production process.

− *Increase in automation and mechanization*: more and more technical assistance will be used in the work process to facilitate physical work. Strandhagen [12] suggests that automation will have a major impact on transport, such as automated stand-alone chassis that will transport products in the factors.

− *Miniaturization*: There is a tendency to minimize everything. Even 15 years ago, in order to be able to control robots, controllers and computers occupied a lot of space in workplaces, now computers with high-speed speed and responsibility can be plugged into a human pocket.

Operative analysis of Lithuania in relation to Industry 4.0

While Lithuanian manufacturing industry is enjoying a period of dynamic growth, rapidly rising labour costs and lagging productivity as well as dominance of low value-added technology sectors in manufacturing systems in Lithuania's put considerable pressure on the competitiveness of the Lithuanian man-

ufacturing sector. Strengthening automation processes in EU industry can lead to additional competitive pressure on Lithuanian manufacturing companies.

The EU Digital Scoreboard [13] assesses the activities of the EU and its Member States in many areas, from communication and digital skills to the digitization of businesses and public services. The Scoreboard analyzes the country's performance through over 150 different digital economy and societal indicators.

The share of the manufacturing sector in GDP is used as an indicator to determine how the manufacturing sector, which is critically important to the Lithuanian economy, has developed. Manufacturing is the largest sector of the Lithuanian economy, generating 20.4% of Lithuanian Gross Domestic Product. Manufactured goods account for more than 80% of total exports of Lithuanian goods and services. Since the end of the global financial crisis, Lithuanian manufacturing production has expanded by 62% and is already significantly above the pre-crisis level. This expansion was driven by several factors. First of all, after the global financial crisis, Lithuanian manufacturing has significantly increased its attention on expansion into foreign markets. Secondly, gradual recovery in the EU region, which accounts for 80% of exports of goods of Lithuanian origin. Lastly, increased integration of Lithuanian manufacturing industry into the EU manufacturing value chains, coupled with an increased number of manufacturing businesses in Lithuania.

Thus, while Lithuania has a stable share of production in GDP, with the rapid growth of production in Europe, Lithuania's production lags behind the selected countries due to the implementation of “innovative production”. In fact, Eurostat data shows that in 2017 Lithuania had the lowest share of high value-added tech in manufacturing industry in the EU.

Lithuania exports are heavily dominated by export of goods (manufactured by industrial businesses), which account to almost 80% of total export of goods and services. In comparison with other EU member states, Lithuania stands out as the country with particularly significant share of export of goods in GDP (62% of GDP). Lithuanian manufacturing, which is heavily linked with export markets, has been growing dynamically ever since 2010. In the last 5 years alone, manufacturing output rose by almost a third and is 34% above the precrisis level.

Unemployment in the industry was 21489 positions (2018) [14]. Meanwhile, vacancies in the industry amounted to 21.5%. The main reason why vacancies are not filled despite a high unemployment rate could be that a typical unemployed person is underqualified. This shows that, in order to fill vacant jobs in the industry, it is necessary to have a higher qualification (almost 57% of

job offers are for skilled workers). This trend will continue in the coming years, unskilled workers will be replaced by machines.

66% of employers from industry surveyed claimed they face a challenge to find employees. This creates additional costs and prevents companies from expanding their business more quickly. Although appropriate education, qualifications, and work experience are needed and valued by the employer, personal characteristics are no less important - motivation, ability to quickly adapt to innovation and experience are the most important factors when choosing an employee. Continuing lifelong learning, skills development (especially digital skills) will continue to be crucial in the industry.

Conclusion. Lithuania stands quite high (20,4%) in the size of the manufacturing sector and occupy leading positions (higher than the EU average 15%). Also, Lithuania managed to sustain or increase the share of manufacturing in GDP. In regard to the structure of the manufacturing sector, Lithuanian manufacturing is heavily dominated by the medium-low and low-tech sector, while in many other countries' economies, half of their manufacturing output is generated by the medium-high and high-tech sectors. Lithuania had the lowest share of high-tech industry in manufacturing output in the whole EU.

Growth in manufacturing output and labor working in this sector was noticed; however, it can be a sign of lagging investment into digitalization by Lithuania manufacturers. There are signs that businesses in Lithuania underinvest in digitalization processes. However, in order to remain competitive, companies will have to rethink their strategies concerning future investments.

REFERENCES

[1] Wang, S., Wan, J., Zhang, D., Li, D., & Zhang, C. (2016). Towards smart factory for industry 4 . 0 : a self-organized multi-agent system with big data base d fee dback and coordination, 101, 158–168. https://doi.org/10.1016/j.comnet.2015.12.017

[2] Qin, J., Liu, Y., & Grosvenor, R. (2016). A Categorical Framework of Manufacturing for Industry 4.0 and Beyond. Procedia CIRP, 52, 173–178. https://doi.org/10.1016/j.procir.2016.08.005

[3] Klaus S., The Fourth Industrial Revolution: what it means, how to respond, World Economic Forum, 2016.

[4] Ślusarczyk, B. (2018). Industry 4.0 – Are we ready? Polish Journal of Management Studies, vol. 17, no. 10, pp. 232–248.

[5] Hoellthaler, G., Braunreuther, S., & Reinhart, G. (2018). Digital Lean ProductionAn Approach to Identify Potentials for the Migration to a Digitalized Production System in SMEs from a Lean Perspective. Procedia CIRP, 67, 522–527. https://doi.org/10.1016/J.PROCIR.2017.12.255

[6] Lasi, H., Kemper, H.-G., Feld, D.-I. T., & Hoffmann, D.-H. M. (n.d.). BISE-CATCHWORD.

[7] Brettel M., Friederichsen N., Keller M., M. R. (n.d.). How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective

[8] Heiner L., Fettke P., Kemper H.G., Feld T., Hoffmann M. Industry 4.0. Business&Information Systems Engineering: The International Journal WIRTSCHAFTSINFORMATIK 6:239–42, 2014.

[9] Ungerman, O., Dedkova, J., & Gurinova, K. (2018). THE IMPACT OF MARKETING INNOVATION ON THE COMPETITIVENESS OF ENTERPRIS- ES IN THE CONTEXT OF INDUSTRY 4 . 0, 10(2), 132–148. https://doi.org/10.7441/joc.2018.02.09

[10] Shrouf, F., Ordieres, J., & Miragliotta, G. (2014). Smart Factories in Industry 4 . 0 : A Review of the Concept and of Energy Management Approached in Production Based on the Internet of Things Paradigm, 697–701.

[11] Lee, J., Kao, H., & Yang, S. (2014). Service innovation and smart analytics for Industry 4.0 and big data environment. Procedia CIRP, 16, 3–8. https://doi.org/10.1016/j.procir.2014.02.001

[12] Strandhagen, J. W., Alfnes, E., Strandhagen, J. O., & Vallandingham, L. R. (2017). The fit of Industry 4.0 applications in manufacturing logistics: a multiple case study. Advances in Manufacturing. https://doi.org/10.1007/s40436-017-0200-y

[13] EU Digital scoreboard, 2017 Statistics [online]. [cit.2019-09-18].

[14] OECD (2018). Job Creation and Local Economic Development 2018: Preparing for the Future of Work. 3. Paris: OECD Publishing. DOI: https://doi.org/10.1787/9789264305342-en

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АНАЛИЗ ВОЗМОЖНОСТЕЙ ДИГИТИЗАЦИИ ПРОМЫШЛЕННОСТИ В ЛИТВЕ

ANALYSIS OF INDUSTRY DIGITIZATION OPPORTUNITIES IN LITHUANIA

Доктор социальных наук **ЯКУБАВИЧЮС Артурас**
Начальник департамента услуг поддержки инноваций Литовского инновационного центра
Доцент Вильнюсского технического университета им. Гедиминаса

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