VILNIUS TECH
Vilnius Gediminas Technical University

24-osios Lietuvos jaunųjų mokslininkų konferencijos „Mokslas – Lietuvos ateitis“ teminė konferencija
Proceedings of the 24th Conference for Junior Researchers “Science – Future of Lithuania”

EKONOMIKA IR VADYBA / ECONOMICS AND MANAGEMENT

eISSN 2029-7149
2021 m. spalio 21 d., Vilnius, Lietuva
21 October 2021, Vilnius Lithuania
eISBN 978-609-476-279-6
Article Number: vvf.2021.041

Šiuolaikinio verslo aktualijos / Actualities of Modern Business
http://jmk.vvf.vilniustech.lt

THE IMPACT OF INDUSTRY 4.0 ON BUSINESS

Jeyhuna SULTANOVA*

Department of Business Technologies and Entrepreneurship, Faculty of Business Management, Vilnius Gediminas Technical University, Saulėtekio al. 11, LT-10223 Vilnius, Lithuania
**E-mail: jeyhuna.sultanova@stud.vilniustech.lt*

Abstract. Industry 4.0 is an actual topic that means the essential innovation engine triggering the next wave of innovation in the new era of globalization. It aims to boost the development of machines and tools by using the power of advanced information technologies and innovative inventions to cope with the new era global challenges of the modern century. If the rate of changes outside of the company exceeds the rate of changes inside of the company, its end will be near. Industry 4.0 technologies will lay the foundation of high-tech competitive advantages of manufactures and companies in industries via digitalization and automation of every part of the business, as well as the production process. Enterprises should be aware, prepared, and assess how new digital technologies might affect the business location and its activities within the global value chain in order to become more competitive in the global market. In terms of research methodology, data was collected from the reports of international institute and organization. Data on the adoption of the latest technologies and the competition in services were processed by the simple linear regression analysis in order to demonstrate to what extent these technologies contribute to the competition in services accordingly. The research limitation is that Industry 4.0 is almost not well-known in real practice, it is investigated in the academic and scientific area and, scientific articles are more likely related to engineering and manufacturing.

Keywords: Industry 4.0, advanced information technologies, business, automatization, innovation, competitiveness, regression analysis.

Introduction

The Fourth Industrial Revolution-Industry 4.0 is being introduced today. It is clear evidence that Industry 4.0 and these technologies affect together many and many business areas in this rapidly changing world. Interlinking the real objects and virtual processes has gained importance meaning that machines and production systems operate autonomously without the need for human power. In this era, production is based on Cyber-Physical Systems (CPS) which focuses primarily on the establishment of intelligent machinery along the value chain. It is predicted that Industry 4.0 could reduce the cost of production by 10–30%, the cost of logistics by 10–30%, and the cost of quality control by 10–20% (Xu et al., 2018; Carvalho & Cazarini, 2019; Özüdoğru et al., 2018; Ortiz et al., 2019). Nowadays, governments, companies, and industry associations have been orienting to Industry 4.0 and investing in this field (Rocha et al., 2019).

There are four stages in the historical evolution of the industry. The First Industrial Revolution started with the mechanization of manufacturing with steam and water power in 1784. Small manufacturing plants and old-fashioned family enterprises had replaced their positions with big factories. Railway development has also been accelerated by the use of steam, steel, and iron as energy resources and raw materials. The Second Industrial Revolution is the age of electricity. It was symbolized by mass production by using the electric power in the production systems of various industries in 1870. This era embodies the introduction of the assembly lines in slaughterhouses (Cincinnati, USA, 1870). During the process, monorail trolleys were used for the sliced meat pieces. The Third Industrial Revolution has been described as the automatization of manufacturing though utilizing the electronics and ICT systems. The first programmable logic controller was created (PLC) in 1969. As a result, trade and industry had been grown worldwide. For Great Britain, the first industrial revolution improved efficiency, where the world economy and the international

division of labor were generated by the Second and Third Industrial Revolutions, which were responsible for the highest standards of life obtained in Europe. The Third Industrial Revolution centered on the advancement of digital technology, the progress of communication, the growth of the Internet, the creation of networks, and the development of new technologies (Ortiz et al., 2019).

The objective of Industry 4.0 is to attain an advanced level of operational effectiveness and productivity, as well as a higher level of automatization. There are a lot of reasons demonstrating today's transformations are not only representing the extension of Industry 3.0 but rather the arrival of Industry 4.0. For example, Industry 4.0 has the potential to raise global levels of income, boost people's living standards all over the world, and make a positive global impact. Consumers are those who gain more from it by having access to the digital world. Technologies are able to create new products and services to make people's life more convenient and pleasant. All of these can now be done remotely, from booking a flight to purchasing a product, making a payment, watching a video, etc. Companies will benefit from technological developments along the global supply chain (Glas & Kleemann, 2016). Transportation and communication costs will diminish statistically significant. Efficiency, productivity displays in international trade that leads to economic growth.

The goal of this study is to evaluate the impact of Industry 4.0 on business. The research object is business, the subject is the evaluation of impacts – opportunities and challenges of Industry 4.0 on business. The hypothesis of the research is that the company's success will depend on its use of IT tools or adoption of technologies. So greater spending will promote better business performance.

Novelty – The effects of Industry 4.0 on business are not yet thoroughly investigated in the existing researches, and there is a need for more researches in the field of industrial systems, supply chain, logistics, human-machine interaction accordingly, this scientific article aims to fill the gap, clarify and emphasize the possible impacts of Industry 4.0 on business and its models and link the importance of investment on Industry 4.0 technologies to contribute to the business performance and use its opportunities to take its competitive advantages in markets.

1. Literature review

1.1. Theoretical aspects of Industry 4.0

Industry 4.0 has six design principles including virtualization, decentralization, interoperability, real-time capability, modularity, and service orientation.

Virtualization – The capability via CPS to regulate physical processes. Physical objects are followed in a virtual environment through utilizing sensors. Simulation models are possible in this virtual environment. The concept of virtualization is that a virtual twin can be abstracted from the industry by utilizing machine-to-machine (M2M) monitoring and communication. Virtual plant models and simulation models are connected to the sensor data. It is therefore possible to build a virtual copy of the physical world. An employee can be informed in the case of a problem. People view virtualization of Industry 4.0 as one of the most effective tools for assisting human work. By delivering, exchanging, and synthesizing information virtually, fast, and in real time, this approach streamlines the time, analysis, and decision-making of staff and established teams.

Decentralization – Devices have the ability to take decision and complete tasks. This results in a decentralized control system, which is critical given the growing market demand for products. In industry 4.0, decentralization is defined as the increased capacity of local enterprises and particular activities, including those carried out by machines, to make the decisions independently. Rather than depending on central computers or making decisions in a hierarchical manner, allowing local operators to respond to changes and make adjustments, this concept allows for more flexibility and makes expertise more accessible. This may be considered as a deconstruction of the traditional production hierarchy in preparation for the transformation of businesses into decentralized self-organizations.

Interoperability – a crucial idea, particularly in relation to the CPS, Internet of Services and IoT concepts. It implies allowing people, machines, and devices to communicate easily each other while exchanging data. In the industry 4.0 manufacturing environment, the idea of interoperability states that a cyber-physical system (CPS) consists of intelligent machines and intelligent storage systems and simplifies capable of automatically sharing information, starting

actions, and managing each other independently. By linking software and programs, embedded manufacturing systems are vertically integrated with business processes internally to industries and horizontally with the value chain.

Real-time capability – real-time data collection and analysis in order to be able to act quickly. It claims that during the production process, intelligent machines with particular software will automatically adapt to the procedures and decision-making via CPS to the productive demands, thereby monitoring product quality to make decisions at all times. This connectivity will reduce resource misuse, waste, and material waste while also increasing energy efficiency. One of the most notable elements of industry 4.0 is the real-time capability concept, which ensures that the industry has the fastest possible response time to internal and external stimuli by exchanging, obtaining, and evaluating data and information in real time.

Modularity – Adaptability to changing requirements and the ability to extend or alter modules. Modular systems are adaptable and advantageous, especially when product requirements vary seasonally. Modular systems may easily adapt to changing requirements by replacing or extending specific production modules, making adding and deleting modules considerably easier. These modular systems may thus be easily modified in the event of seasonal variations or changes in product manufacturing demands, such as when new technologies are introduced. As a result, without mistakes, productivity loss, or customer dissatisfaction, production can always respond to environmental, systemic, and changing consumer needs.

Service orientation – a result of the using internet of things to link CPS and people. Because those services can be accessed through webs as service orientation can be internal or external. As a result, industry 4.0 maintains its network performance in collaboration with all of its stakeholders, including consumers, partner industries, and suppliers, among others. Using virtual and digital platforms that are available at all times, anybody may have access to helpful services, goods, and information about the sector (Carvalho & Cazarini, 2019).

In addition to being a technological challenge, Industry 4.0 is also a reality that will change the organizational structure of businesses considerably. There are five visions of Industry 4.0 as below:

1. The new level of socio-technical interaction: In value chains between companies, autonomous and self-organized production resources handle planning processes.
2. Smart products: To maximize manufacturing, these items can be grouped.
3. Individualized production: Flexible reconfiguration helps companies during the design, planning, production, and recycling process to understand the unique characteristics of consumer demand and needs.
4. Autonomous control: Employees monitor and customize smart production resources based on goals that are sensitive to the current context.
5. Product design controls product-related data: In controlling the product life cycle, product-related data becomes a core element (Carvalho & Cazarini 2019).

1.2. Application areas of Industry 4.0

In the future, technological innovation will also lead to development in supply chain management. Transportation and communication costs will significantly diminish, logistics and global supply chains will become more effective, and therefore the cost of trade will decrease. People are likely to use social media platforms to communicate, learn, and exchange information with each other. On the other side, companies will have an access to digital platforms of marketing, sales, and distribution and improve the quality of products and services to introduce to the market. Also, customers themselves will be involved in production and distribution. It will lay the foundation of the impact on consumer expectations, product quality, innovations in this way. These technology platforms could find new ways of consuming goods and services by using data-based services. It also aims the raising customer's welfare and creates new businesses from laundry to shopping, etc. Thus, Industry 4.0 benefits businesses in customer expectation, greater customer satisfaction, product enhancement, etc. (Man & Strandhagen, 2017; Müller & Däeschle, 2018).

There are lots of areas where Industry 4.0 is applied. There includes industrial manufacturing, food industry, heavy engineering, intelligent manufacturing, quality control, marketing, supply chain management, etc.

Intelligent manufacturing/Smart factory – A monitoring and control processes at the production can be automated on the production line where its machines can track and evaluate the current process, detect the deviation and trigger the necessary adjustments as corrective measures without the intervention of human. Artificial intelligence technology

helps machines to learn from previous experience by gathered dataset and to adjust to the new inputs from the setting, and remember the inputs for future optimization.

Quality Control – Diverse real-time data on the shape, color, or the appearance of foreign objects as small as 1.5×1.5 mm on the product surface, such as glasses and plastics, can be generated by the use of a camera or other viewing and inspection system. Based on the observed deviation in the process, analytical monitoring causes the appropriate changes. This ensures that appropriate standards for food safety are met and allows for early identification of a defect that ultimately eliminates food waste and expensive recalls. Due to labor power limitations, exhaustion, and variance in the judgment of operators, the technology has overcome problems. At the same time, in the case of customer complaints and concerns, the technology will automatically store data for documentation and proof. Better quality products and minimal errors are the outcomes of this process (Tay et al., 2018).

Food industry/Food traceability system – Traceability is characterized as the ability to find an animal, commodity, food product, or ingredient and to track its history (from its source to the consumer in the market) in the supply chain through recorded identification.

Intelligent marketing – Customer data collecting from various channels, digital technologies are playing a key role in the evaluation of consumer behavior through business analytics meaning that product customization (the ability to produce a particular product based on the customer's requirement) becomes crucial driver along the process. Thus, consumers are involved in product development, building new products or services, expanding or creating new markets (H. Trollman & F. Trollman, 2019; Rahman, 2020).

Supply chain management&logistics/ Digital Supply Network (DSN) – In order to drive the physical act of production and delivery, DSNs incorporate information from several distinct sources and locations. Automation and robotization implemented in a warehouse and inbound logistics, implementation of solutions such as the Internet of Things, 3D printing, 3D scanning, advanced materials, augmented reality is examples of the impact of Industry 4.0 on supply chain management (Batz et al., 2020).

Additionally, the aim of optimization in product manufacturing through autonomous robots is to reduce work in process. Work in progress requires storage space and carries an inherent risk of early expiration of the product life. As WIP inventories are reducing regarding the integrated communication along the value chain at the production, warehouse and other costs are decreasing.

1.3. Opportunities and challenges of Industry 4.0

It is predicted that the new industrial revolution brings updates on business management, creates new business models (smart products&services) through digitalization which will have a considerable impact on the world market. It seems like Industry 4.0 will affect the product life cycle to new ways of goods production meaning that companies will benefit from the improvement of production processes that increase their competitiveness in the market by aligning the business strategies according to the situation created by Industry 4.0 (Ilic et al., 2017). Due to the digital transformation brought by Industry 4.0 in the most innovative and digital economies, business processes such as procurement, manufacturing, maintenance, delivery, and customer service will be connected through the Internet of Things system. Here manufacture could achieve more efficient production, logistics, inventory management, quality control, cost optimization, etc. (Saturno et al., 2018).

There are four ways to conduct digital transformation in manufacturing companies:

- Internal and External Process Optimization – Advantages and outcomes of achieving the internal and external processes optimization are more efficient production, logistics, quality control, inventory management, knowledge exchange, the possibility of working at any place at any time, data-driven decision making, customization, individualized mass production, cost optimization.
- Customer Interface Improvement – It is focusing on value delivery (value proposition through product and service offering, customer segment, channels and customer relationship) improvement, customer loyalty. Possible changes include greater knowledge of customers via the market segmentation based on data analysis, more direct, closely and long-term relationships, an improvement on digital trade, creating new revenue streams, etc.
- New Ecosystems and Value Networks – This model refers to the drastic changes regarding the innovation on

business models which are orienting to the core business. Through this model, a company can get real-time information about the production, inventories, sales, availability of staff, access to the new consumer segments and expanding its services, etc.

New Business Models – Smart products and services- this type offers a distinctive new Business Model based on new technologies focused on Big Data, Cloud Computing, Intelligent Sensorisation and Embedded Systems, that enable us to offer innovative and smart goods and services. Company could achieve a direct relationship between stakeholders, dynamic and performance-based revenues, etc. (Ibarra et al., 2017; Dobrowolska & Knop, 2020).

Industry 4.0 has its opportunities as well as challenges. These concerns include security, privacy, capital, and employment challenges. Companies should acquire a deeper understanding of the fourth industrial revolution to be succeeded in the implementation of industry 4.0. They should address and aware of its challenges, particularly cyber-security challenges. Here companies should take into consideration some actions to be done:

- Companies should be aware of the importance of security and privacy and carry out special training for their employees to transmit specialized skills to them.
- Companies and organizations should prioritize security issues and consider them while making decisions on policies and rules, and fund the upgradation of security systems. On another side, although protecting companies from all possible cyberattacks become impossible, managers of companies could prioritize and mitigate the risks and provide companies revised risk management tools that support them in this way.
- Another key point to remember is that organization should determine the guidelines to be followed up by the employees which demonstrate liability issues for all the stakeholders. Therefore, stakeholders are already aware of which device they are liable to.
- Industry 4.0 is changing traditional manufacturing models to a machine to machine/machine to human communications where data-driven decision making is conducting as being more transparent management. For example, fully integrated data and products that flow within the borders of the manufacturing company. Work in progress inventories are reducing due to the integrated communication along the value chain. With displacing the least skilled workers with autonomous robots, higher-skilled labors are hiring to monitor and manage the factory. A company should qualify its employees to utilize them in high-powered jobs with high responsibilities meaning that professional development itself is one of the challenges for companies in the future. These processes will lead to an increase in productivity while reducing labor costs. This will give rise to a job market increasingly segregated into "low-skill/low-pay" and "high-skill/high-pay" segments, which in turn will lead to an increase in social tensions (Sony & Naik, 2018). Therefore, the question is arising on how to cope with unemployment challenges in the future. On the other hand, investing in high-technologies requires continuous investment. Capital is one of the biggest challenges faced by the company to strengthen its role in the market (Herceg et al., 2020; Ingaldi & Ulewicz, 2019; Ślusarczyk, 2018).
- Many businesses are struggling to break strong silos among departments of R&D, manufacturing, distribution, IT, and finance. These walls between roles make it hard to organize the strategy and projects of Industry 4.0 across the entire enterprise.
- According to surveys, manufacturers claim they lack the appropriate courage to accomplish technological and organizational changes required by Industry 4.0.
- Most applications for Industry 4.0 build on data from different sources. It is important to pull this data together to make Industry 4.0 work, but it can be a difficult task to incorporate data (Mckinsey&Company 2016).

2. Methodology

The methodology elaborated the selected research method and the information author has been gathering. Quantitive research methods have been selected for the study.

Firstly, *descriptive analysis* has been done in order to give preliminary information about the data. As the goal of the study is to evaluate the impact of Industry 4.0 on business, this study will show the *correlation of coefficient* to describe to what extent the relationship between the availability of the latest technologies and competition in services over the countries is strong to show the degree of contribution of those technologies on business performance.

In addition to the correlation, *simple linear regression model* will be analyzed in order to predict the model based on these variables meaning that it will show what dependent variable will do based on independent variable. The main reason why regression analysis was selected to process the data is to show how these technologies contribute to the competitiveness of markets respectively and the degree of relationship between these variables is statistically significant and strong.

Data gathered is secondary data. Data on the *availability of the latest technologies* were collected from the country profiles in the Network Readiness Index Report 2019. This variable is originally formed from The World Economic Forum's Executive Opinion Survey and aimed to find the answer to the question "to what extent are companies adopting Artificial intelligence| Robotics| App and web-enabled markets| Big data analytics| Cloud computing?" (1: not at all; 7: to a great extent) and transform the answers to numerical measures. In the end, the data refer to the simple mean of the average answers to five different emerging technologies (Dutta & Lanvin, 2019).

The purpose to choose the first variable-*aviability of the lates technologies* is that the indicator itself is based on the investment on Industry 4.0 technologies. It is showing how companies of these countries consider the digital preparedness to the Industry 4.0 age.

Another data on *competition in services* was collected from the country profiles in the World Economic Forum The Global Competitiveness Report 2019. As the first variable, it is also formed from The World Economic Forum's Executive Opinion Survey and aimed to find the answer to the question "In your country, how competitive is the provision of the following services: professional services (legal services, engineering, accounting etc.); retail services; and network sector (telecommunications, utilities, postal, transport, etc.)?" (1 – not at all; 7 – extremely competitive). As a score, it is a maximum of 100. In the variable data, a score was used as a measurement (The World Economic Forum, 2019).

In terms of the second indicator – *competition in services*, it is the dependent variable. Because, if companies in a country invest in these advanced technologies, those technologies direcly affect the business performances of the companies which will trigger the competition between the companies in the market. Thus, the indicator indicates the underlying impact of Industry 4.0 on business.

There are 119 countries assessed for data on the availability of the latest technologies in the Network Readiness Index 2019 and 141 countries assessed for data on the competition in services in the Global Competitiveness Report. By considering data availability in both reports and a confidence level of 95%, ideally sample size should be 91. In the calculations, 97 countries were used to process the data, and developed, developing, and also least developed countries were evaluated to sample data correctly. Data processing was conducted by using STATA software.

3. Results

In STATA software, firstly *descriptive statistics* of data were extracted in order to have an overview of the variables. As it is shown in Table 1, the number of observations – the number of evaluated countries are 97. According to data on the first variable, the average mean of values of countries data is approximately 5. In the same principles, the mathematical mean for the second variable is 66.5. The range of the first variable, which measures the spread of the scores, is 3.9, for the second variable, it is 38.9. As we know standard deviation tells us how our variables deviate from the best-fitted line (straight line). The spread of the scores around the mean- standard deviation shows 0.92 for the first variable, 7.7 for the second variable.

Table 1. Descriptive analysis

Variable	Obs	Mean	Std. Dev.	Min	Max
Adoption of latest technologies	97	4.957423	.9177523	2.71	6.61
Competition in services	97	66.49588	7.6969	42.6	81.5

In order to know the nature of the relationship between the variables, *scatter plot* and *correlation of coefficient* have been used. In Figure 1, the scatter plot illustrates a positive linear relationship between variables. A simple scatter plot is a type of diagram displays values for 2 variables in a dataset. It is useful for determining relationship among variables and it can be used to help identify the direction strengths and the nature of this relationship. As it can be seen from

the below graph the relationship between the availability of technologies and competition in services is positive. This tells us that as one variable increases in value so does the other. It means a change in the availability of technologies positively correlated with competition in services. This relationship is a positive linear.

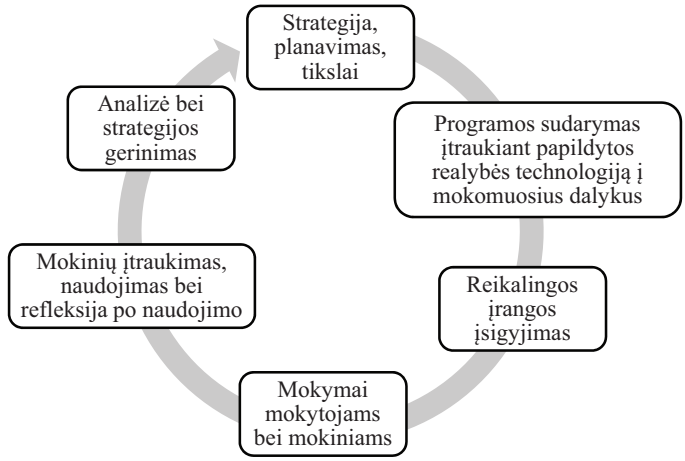

Figure 1. Scatter plot

Additionally, *correlation of coefficient* of the variables has been calculated and it is 86%. It measures the strength of a linear relationship. In this case, it is a strong positive relationship.

Regression analysis hypothesizes that there is a relationship between a dependent (Y) and independent (X) variables and this relationship can be a straight line. Every change in X triggers a change in the Y variable consequently.

In the *simple regression analysis*, the availability of the latest technologies is considered as an independent variable (X) and competition in services is supposed as a dependent variable (Y).

$$Y_i = b_0 + b_1 X_i$$

is the Simple Linear Regression Equation where b_0 is sample intercept and b_1 is sample slope. (Kowal, 2016) Identically, the equation for this case is Competition in services = $b_0 + b_1$* Adoption of latest technologies STATA software process the data by regression analysis as below:

Table 2. Model summary 1

Source	SS	df	MS	Number of obs = 97 F(1, 95) = 267.32
Model	4196.07045	1	4196.07045	Prob > F = 0.0000
Residual	1491.188	95	15.6967158	R-squared = 0.7378
				Adj R-squared =

Table 3. Model summary 2

Competition in services	Coef.	Std. Err.	t	P > |t|	[95% Conf. Interval]	
Adoption of technologies	7.203777	.4405988	16.35	0.000	6.329078	8.078476
_cons	|30.78371	2.220969	13.86	0.000	26.37453	35.19289

With this analysis, it is possible to statistically demonstrate the relation between variables with concluding that companies that make a greater investment in the latest technologies will see its impact on better business performance and competitive market.

In general, SSR (regression sum of squares), SST(total sum of squares), and SSE (error sum of squares) provide little information. Therefore, we could find r^2 (coefficient of determination) – the ratio which is calculating with regression sum of squares dividing by the total sum of squares. It measures the proportion of variation in Y that is explained

by the X in the regression model. According to statistical calculations of STATA in the Table 2, R-squared illustrates 74 percent of data. Generally, the higher R squared means data fits better to the model. R-square shows the amount of variance of the Y variable explained by the X variable. If R-squared value r > 0.7 this value is generally assumed strong effect size. Adjusted R^2 (R squared) is 74% meaning that the model is more accurate. Root mean squared error is the standard deviation of the regression. The closer to zero means better the fit to the model. In the model, it is 3.9619.

If Model Sum of Squares (MSS) shows closer to TSS it means the better fit to the model. In the Table 2, it is 4196.07045 and closer to 5687.25845. 1491.188 indicates the residual sum of the square of the model.

In order to identify the linear relationship between the X and Y variables, we can test if the slope is equal to 0 or not. If it is 0, it means that there is no relationship between Y and X (Berenson et al., 2012). The null and alternative hypotheses are as below:

$$H_0: B_1 = 0;$$

$$H_1: B_1 \neq 0.$$

The p-value of the model is shown in Table 3. A p-value lower than 0.05 is needed in order to show a statistically significant relationship between X and Y variables. P-value is less than 0.05. That's why we reject H_o. P-value in the above is 0.000. pstat < 0.05. So we reject the null hypothesis. And β1 is statistically significant at the 95% level.

T value in the model is 16.35 which is more than 1.96 tstat > 1.96. That's why we reject the null hypothesis. Therefore, adoption of the latest technologies is statistically significant and 1 increase in an independent variable causes competition in services to increase by 7.203777.

By using intercept and slope calculated in the model, the equation is as below:

$$\textit{Competition in services} = 30.78371 + 7.203777 \times \textit{Adoption of latest technologie}.$$

As we could see that there is a strong positive relationship between the variables – the adoption of the Industry 4.0 technologies by companies and the competition in services in markets. One of the major consequences of Industry 4.0 on business is a competitive advantage. Adopting Industry 4.0 technologies reinforces a company's position in the market, gives it the ability to be a well-improved business and creates a favorable innovative environment for company to stay competitive in the long-term. Thus, Industry 4.0 will stimulate the industry with human-to-machine cooperation to increase efficiency and productivity growth. In countries where a production that is compliant with Industry 4.0, unit costs are becoming cheaper as less labor would be hired. This reduces the advantages of countries like China having the lowest labor costs relative to countries compliant with Industry 4.0. The rise in the manufacture of personalized products would lead to a considerable increase in revenue and production. Smart systems will increase the quality of manufacturing, eliminate loss and reduce costs. As a result, business leaders will focus on investing in these technologies to protect their business in the future.

Some of the companies already digitized their products and enlarged their portfolio to introduce automated and connected service. Therefore, companies should achieve digitization of their products and service portfolio and take the measures as below:

- Companies should take into account the integration of digital transformation into the strategy of the company. Because, not only the digital transformation should be handled within the context of day-to-day business, but also it should be consistently incorporated into the strategy of the organization.
- Companies should develop their own data strategy. Because only a clear data strategy can enable companies to realize data analysis up to Big Data Analytics.
- Company employees should be traineed, then involved in the digital transformation of the company, communicate actively, and contribute to the processes.
- Companies should create favorable conditions for employees regarding further trainings, etc.

Conclusions

1. Industry 4.0 is characterized by more automation, more data, decentralized control, delimitation of work, facilitation of value creation, personalized customer needs, new business models. Industry 4.0 will stimulate the industrial sector with human-to-machine collaboration to improve efficiency and productivity.

2. Companies can benefit from Industry 4.0 opportunities, which allows them to improve productivity, reduce and mitigate the risks, rise and create new revenues thereby having in-depth knowledge in the field of customer understanding, strengthening the integration and channels to customers, finding sources of growth for the core business, creating new products and services, expanding the market. With increasing cybersecurity attacks, enterprises should take into account and prioritize upgradation of security systems as well as trainings for the employees.
3. Adoption of the Industry 4.0 technologies triggers the competitiveness in the market.
4. Consequently, associated with benefiting from Industry 4.0 opportunities, companies need to set up a dedicated cross-functional team to realize innovation based on a culture that is open to changes and experimentation.

References

Batz, A., Oleśków-Szłapka, J., Stachowiak, A., Pawłowski, G., & Maruszewska, K. (2020). Identification of logistics 4.0 maturity levels in Polish companies–Framework of the model and preliminary research. In *Sustainable logistics and production in Industry 4.0*. Springer. https://doi.org/10.1007/978-3-030-33369-0_10

Berenson, M. L., Levine, D. M., & Krehbiel, T. C. (2012). *Basic business statistics* (12th ed.). Pearson.

Carvalho, N. G. P., & Cazarini, E. W. (2019). *Industry 4.0 - What is it?* https://www.intechopen.com/chapters/69994

Dobrowolska, M., & Knop, L. (2020). Fit to work in the business models of the Industry 4.0 Age. *Sustainability*, *12*(12), 4854. https://doi.org/10.3390/su12124854

Dutta, S., & Lanvin, B. (Eds.). (2019). *The Network Readiness Index 2019: Towards a future-ready society.* https://networkreadinessindex.org/2019/wp-content/uploads/2020/03/The-Network-Readiness-Index-2019-New-version-March-2020-2.pdf

Glas, A. H., & Kleemann, F. C. (2016). The impact of Industry 4.0 on procurement and supply management: A conceptual and qualitative analysis. *International Journal of Business and Management Invention*, *5*(6), 55–66.

Herceg, I. V., Kuč, V., Mijušković, V. M., & Herceg, T. (2020). Challenges and driving forces for Industry 4.0 implementation. *Sustainability*, *12*(10), 4208. https://doi.org/10.3390/su12104208

Ibarra, D., Ganzarain, J., & Igartua, J. I. (2017, October 5–6). *Business model innovation through Industry 4.0: A review* [Conference presentation]. 11th International Conference Interdisciplinarity in Engineering, INTER-ENG 2017, Tirgu-Mures, Romania.

Ilic, Td., Markovic, B., & Milosevic, D. (2017). Strategic business transformation: An Industry 4.0 perspective. *International Journal of Economics & Law*, *20*, 49–59.

Ingaldi, M., & Ulewicz, R. (2019). Problems with the implementation of Industry 4.0 in enterprises from the SME sector. *Sustainability*, *12*(1), 217. https://doi.org/10.3390/su12010217

Kowal, R. (2016). Characteristics and properties of a simple linear regression model. *Folia Oeconomica Stetinensia*, *16*(1), 248–263. https://doi.org/10.1515/foli-2016-0016

Man, J. C. D., & Strandhagen, J. O. (2017). An Industry 4.0 research agenda for sustainable business models. *Procedia CIRP*, *63*, 721–726. https://doi.org/10.1016/j.procir.2017.03.315

Mckinsey&Company. (2016). *Industry 4.0 after the initial hype: Where manufacturers are finding value and how they can best capture it*. https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/getting%20the%20most%20out%20of%20industry%204%200/mckinsey_industry_40_2016.ashx

Müller, J. M., & Däschle, S. (2018). Business model innovation of Industry 4.0 solution providers towards customer process innovation. *Processes*, *6*(12), 260. https://doi.org/10.3390/pr6120260

Ortiz, J. H., Marroquin, W. G., & Cifuentes, L. Z. (2019). *Industry 4.0: Current status and future trends*. https://www.intechopen.com/chapters/70465

Özüdoğru, A. G., Ergün, E., & Ammari, D. (2018). How Industry 4.0 changes business: A commercial perspective. *International Journal of Commerce and Finance*, *4*(1), 84–95.

Rahman, A. A. A. (2020). *Revolution of production system for the Industry 4.0*. https://www.intechopen.com/chapters/70706

Rocha, C. F., Mamédio, D. F., & Quandt, C. O. (2019). Startups and the innovation ecosystem in Industry 4.0. *Technology Analysis and Strategic Management*, *31*(12), 1474–1487. https://doi.org/10.1080/09537325.2019.1628938

Saturno, M., Pertel, V. M., Deschamps, F., & de F. R. Loures, E. (2018). Proposal for new automation architecture solutions for Industry 4.0. *LogForum*, *14*(2), 185–195. https://doi.org/10.17270/J.LOG.266

Ślusarczyk, B. (2018). Industry 4.0 – Are we ready? *Polish Journal of Management Studies*, *17*(1), 232–248. https://doi.org/10.17512/pjms.2018.17.1.19

Sony, M., & Naik, S. (2018). Key ingredients for evaluating Industry 4.0 readiness for organizations: A literature review. *Benchmarking: An International Journal*, *27*(7), 2213–2232. https://doi.org/10.1108/BIJ-09-2018-0284

Tay, S. I., Lee, T. C., Hamid, N. Z. A., & Ahmad, A. N. A. (2018). An overview of industry 4.0: Definition, components, and government initiatives. *Journal of Advanced Research in Dynamical and Control Systems*, *10*(14), 1379–1387.

The World Economic Forum. (2019). *The Global Competitiveness Report 2019*. https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

Trollman, H., & Trollman, F. (2019). *A sustainability assessment of smart innovations for mass production, mass customisation and direct digital manufacturing*. https://doi.org/10.5772/intechopen.88897

Xu, L. D., Xu, E. L., & Li, L. (2018). Industry 4.0: State of the art and future trends. *International Journal of Production Research*, *56*(8), 2941–2962. https://doi.org/10.1080/00207543.2018.1444806

„PRAMONĖS 4.0“ POVEIKIS VERSLUI

Jeyhuna SULTANOVA

Santrauka. „Pramonė 4.0“ yra aktuali tema, kuri reiškia esminį inovacijų variklį, suaktyvinantį kitą naujovių bangą naujoje globalizacijos eroje. Juo siekiama paskatinti mašinų ir įrankių kūrimą naudojant pažangias informacines technologijas ir novatoriškus išradimus, kad būtų galima susidoroti su naujosios eros globaliais šiuolaikinio amžiaus iššūkiais. Jei pokyčių tempas už įmonės ribų viršija pokyčių tempą įmonės viduje, jo pabaiga bus arti. „Pramonė 4.0“ technologijos padės aukštųjų technologijų gamintojų ir pramonės įmonių konkurencinių pranašumų pagrindą, skaitmenizuojant ir automatizuojant kiekvieną verslo dalį, taip pat gamybos procesą. Įmonės, siekdamos tapti konkurencingesnės pasaulinėje rinkoje, turėtų žinoti, pasiruošti ir įvertinti, kaip naujos skaitmeninės technologijos gali paveikti verslo vietą ir veiklą pasaulinėje vertės grandinėje. Tyrimo metodologijos požiūriu duomenys buvo surinkti iš tarptautinių institutų ir organizacijų ataskaitų. Duomenys apie naujausių technologijų įsisavinimą ir konkurenciją paslaugų srityje buvo apdorojami naudojant paprastą tiesinę regresinę analizę, siekiant parodyti, kiek šios technologijos atitinkamai prisideda prie paslaugų konkurencijos. Tyrimo apribojimas yra tas, kad „Pramonė 4.0“ praktiškai nėra gerai žinoma, ji tiriama akademinėje ir mokslinėje srityje, o moksliniai straipsniai labiau susiję su inžinerija ir gamyba.

Reikšminiai žodžiai: „Pramonė 4.0“, pažangios informacinės technologijos, verslas, automatizavimas, inovacijos, konkurencingumas, regresinė analizė.