Technical inquiries:

ICEST technical support, tel.: +359 2 965 3145, fax: +359 2 868 5343, e-mail: icest@tu-sofia.bg

2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)

Sozopol, Bulgaria, June 16-18, 2021

Technical University of Sofia,
Faculty of Telecommunications,
Bulgaria

University of Niš,
Faculty of Electronic Engineering,
Serbia

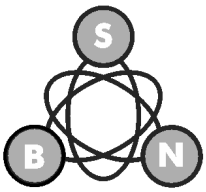
University St. Kliment Ohridski,
Faculty of Technical Sciences, Bitola,
North Macedonia

Proceedings of Papers

ISBN: 978-1-6654-2886-6
Part Number: CFP21UWE-CDR

Technical Co-Sponsors:
IEEE Bulgaria Section
IEEE Serbia and Montenegro Section
IEEE North Macedonia Section

2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)



ICEST 2021

Proceedings of Papers

Bulgaria, Sozopol, June 16 - 18, 2021

2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)

Bulgaria, Sozopol, June 16 - 18, 2021

Proceedings of Papers

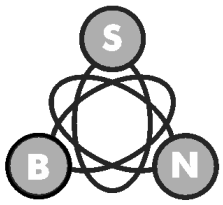
Editors: Assoc. Prof. Dr. Kalin L. Dimitrov
Prof. Dr. Nebojša S. Dončov
Prof. Dr. Mitko Kostov

Technical Support: Assoc. Prof. Dr. Ivo R. Draganov

Published by: Institute of Electrical and Electronics Engineers (IEEE)
Faculty of Telecommunications, Technical University of Sofia, Bulgaria

IEEE Catalog Number: CFP21UWE-CDR
ISBN: 978-1-6654-2886-6 (IEEE)

2021 56th International Scientific Conference on Information, Communication and Energy Systems and Technologies (ICEST)



organized by

Technical University of Sofia
Faculty of Telecommunications
Bulgaria

University of Niš
Faculty of Electronic Engineering
Serbia

University "St. Kliment Ohridski", Bitola
Faculty of Technical Sciences
North Macedonia

Technical co-sponsors:

- **IEEE Bulgarian Section**
- **Serbia and Montenegro IEEE Section**
- **IEEE Republic of North Macedonia Section**

TECHNICAL PROGRAM COMMITTEE

Chair:

Kalin Dimitrov	Technical University of Sofia, Bulgaria

Vice-chairs:

Nebojša Dočov	University of Niš, Serbia
Mitko Kostov	University St.Kliment Ohridski, Bitola, North Macedonia

Honorary Chairs:

Rumen Arnaudov	Technical University of Sofia, Bulgaria
Bratislav Milovanović	Singidunum University, Niš, Serbia
Cvetko Mitrovski	St. Kliment Ohridski University, Bitola, North Macedonia

Local Coordinators:

Ilia Iliev	Dean of the Faculty of Telecommunications, Technical University of Sofia, Bulgaria
Dragan Mančić	Dean of the Faculty of Electronic Engineering, University of Niš, Serbia
Stojanche Nusev	Dean of the Faculty of Technical Sciences, St. Kliment Ohridski University, Bitola, North Macedonia

Members:

Agata Manolova	Technical University of Sofia, Bulgaria
Biljana Stošić	University of Niš, Serbia
Boyanka Nikolova	Technical University of Sofia, Bulgaria
Brian Barsky	University of California, Berkeley, USA
Chrysostomos Stylios	Technological Education Institute of Epiros, Greece
Đani Juričić	Jožef Stefan Institute, Slovenia
D.D. Rasolomampionona	Warsaw University of Technology, Poland
Dimitar Taskovski	Ss. Cyril and Methodius University Skopje, North Macedonia
Dimiter Alexandrov	Lakehead University, Canada
Dragan Denić	University of Niš, Serbia
Dragan Stojanović	University of Niš, Serbia
Dušanka Bošković	University of Sarajevo, Bosnia and Herzegovina
Eduard Ivanjko	University of Zagreb, Croatia
Evelin Krmac	University of Ljubljana, Slovenia
Evelina Pencheva	Technical University of Sofia, Bulgaria
Fernando Alvarez	University of Extremadura, Spain
Filiz Güneş	Yildiz Technical University, Turkey
Ismail Altas	Karadeniz Technical University, Turkey
Ivan Corbev	Ss. Cyril and Methodius University Skopje, North Macedonia
J.A.R.P. de Carvalho	University Beira Interior, Portugal
Jair Minoro Abe	Paulista University, Brazil
Jan Machac	Czech Technical University, Prague, Czech Republic
Jugoslav Joković	University of Niš, Serbia
Karel Raz	University of West Bohemia, Czech Republic
Kazumi Nakamatsu	University of Hyogo, Japan
Ljupčo Trpezanovski	St. Kliment Ohridski University Bitola, North Macedonia

Mariofanna Milanova	University of Arkansas at Little Rock, USA
Metodija Atanasovski	St. Kliment Ohridski University Bitola, North Macedonia
Mikolaj Bartłomiejczyk	Gdańsk University of Technology, Poland
Mikolaj Leszczuk	AGH University of Science and Technology, Poland
Nikola Donato	University of Messina, Italy
Pece Mitrevski	St. Kliment Ohridski University Bitola, North Macedonia
Pero Latkoski	Ss. Cyril and Methodius University Skopje, North Macedonia
Petar Popovski	Aalborg University, Denmark
Peter Planinšič	University of Maribor, Slovenia
Slavko Rupčić	University of Osijek, Croatia
Stanimir Valtchev	New University of Lisbon, Portugal
Stefan Stancescu	Polytechnic University of Bucharest, Romania
Stevo Bozinovski	South Carolina State University, USA
Szilvia Nagy	University of Gyor, Hungary
Urban Burnik	University of Ljubljana, Slovenia
Uwe Siart	Technical University of Munich, Germany
Vincenzo Piuri	University of Milan, Italy
Wojciech Krzysztofik	Wroclaw University of Technology, Poland
Wojtek Bock	University of Ottawa, Canada
Zdenka Babić	University of Banja Luka, Bosnia and Herzegovina
Zoran Jovanović	University of Niš, Serbia
Zoran Stanković	University of Niš, Serbia

CONFERENCE ORGANIZING COMMITTEE

Chairs:

K. Dimitrov	Technical University of Sofia, Bulgaria
N. Dončov	University of Niš, Serbia
M. Kostov	St. Kliment Ohridski University, Bitola, North Macedonia

Local Coordinators:

I. Iliev	Technical University of Sofia, Bulgaria
D. Mančić	University of Niš, Serbia
S. Nusev	St. Kliment Ohridski University, Bitola, North Macedonia

Technical Editor:

I. Draganov	Technical University of Sofia, Bulgaria

Secretary:

K. Stoyanova	Technical University of Sofia, Bulgaria

Members:

L. Laskov	Technical University of Sofia, Bulgaria
S. Antonov	Technical University of Sofia, Bulgaria
N. Hristova	Technical University of Sofia, Bulgaria
D. Kireva-Mihova	Technical University of Sofia, Bulgaria
T. Brusev	Technical University of Sofia, Bulgaria
V. Shterev	Technical University of Sofia, Bulgaria

K. Stoyanova	Technical University of Sofia, Bulgaria
M. Stoyanova	Technical University of Sofia, Bulgaria
A. Atanasković	University of Niš, Serbia
T. Dimitrijević	University of Niš, Serbia
J. Joković	University of Niš, Serbia
D. Mančić	University of Niš, Serbia
N. Maleš-Ilić	University of Niš, Serbia
Z. Marinković	University of Niš, Serbia
V. Marković	University of Niš, Serbia
M. Milijić	University of Niš, Serbia
O. Pronić-Rančić	University of Niš, Serbia
B. Veselić	University of Niš, Serbia
L. Stoimenov	University of Niš, Serbia
J. Milošević	University of Niš, Serbia
Z. Stanković	University of Niš, Serbia
M. Atanasovski	St. Kliment Ohridski University, Bitola, North Macedonia
B. Arapinoski	St. Kliment Ohridski University, Bitola, North Macedonia
G. Janevska	St. Kliment Ohridski University, Bitola, North Macedonia
V. Dancevska	St. Kliment Ohridski University, Bitola, North Macedonia
N. Mojsovska	St. Kliment Ohridski University, Bitola, North Macedonia
J. Pargovski	St. Kliment Ohridski University, Bitola, North Macedonia
M. Spirovski	St. Kliment Ohridski University, Bitola, North Macedonia
I. Andreevski	St. Kliment Ohridski University, Bitola, North Macedonia
D. Koltovska	St. Kliment Ohridski University, Bitola, North Macedonia

CONFERENCE SECRETARIAT

Address:
ICEST 2021 Conference
Technical University of Sofia
Faculty of Telecommunications
8 Kliment Ohridski Blvd.
1756 Sofia, Bulgaria
phone: +359 2 965 2272
e-mail: icest@tu-sofia.bg

CONFERENCE INTERNET SITE

For further information, please visit the Conference Internet Site: **http://www.icestconf.org**

TABLE OF CONTENTS

COMPUTER SYSTEMS, INTERNET TECHNOLOGIES, DIGITAL SIGNAL AND IMAGE PROCESSING I

Regular papers:

COMPUTER SYSTEMS, INTERNET TECHNOLOGIES, DIGITAL SIGNAL AND IMAGE PROCESSING II

Posters:

DIGITAL SIGNAL AND IMAGE PROCESSING III

Regular papers:

INFORMATICS, COMPUTER SCIENCE, ELECTRONICS, CONTROL SYSTEMS, DIGITAL SIGNAL AND IMAGE PROCESSING IV

Posters:

ANTENNAS I AND CONTROL SYSTEMS

Regular papers:

RADIO COMMUNICATIONS, MICROWAVES, ANTENNAS II

Posters:

ENGINEERING EDUCATION, ENERGY SYSTEMS AND EFFICIENCY I

Regular papers:

ENGINEERING EDUCATION, ENERGY SYSTEMS AND EFFICIENCY II

Posters:

The Impact of Industry 4.0 on Education and Future Jobs

Filip Anackovski[1], Mitko Kostov[1], Roberto Pasic[1], Ivo Kuzmanov[1]

Abstract – **The subject of this paper is the analysis of the Impact of Industry 4.0 on Education and Future Jobs. The purpose of this paper is to explore the impacts of recent trends and characteristics related to digital transformation in the field of Education and Future Jobs, namely, to further understand how such a digital transformation will transform the modern living and working. Some jobs will not exist, other jobs going to be developed, and new jobs that do not exist these days will become usual. What is known is that in the future will be required new skills to master.**

Keywords – **Industry 4.0, 4th Industrial Revolution, Education, Future, Jobs**

I. Introduction

In the past few years, Industry 4.0 has become one of the most discussed concepts and has aroused great welcome in the academic and industrial sectors [1]. Industry 4.0 will have huge influence on the Education and Future Jobs.

The Industrial Revolution brought about a comprehensive transformation of economic and social organization [2].

Increasing innovation led to higher levels of motivation and education, which led to several groundbreaking inventions that are still in use today [3].

Engineers have always tried to solve problems related to the operation of machines and machines maintenance. Their main target is to increase production quality and efficiency, and in same time to reduce the production cost. In general, to improve processes in the organization of production and other related entities.

Intelligence is the most important factor for future development and progress. Intelligent manufacturing has participated in industrial practice to some extent, but it is expected to play an important role in the near future. It is also expected to affect global manufacturing operations to any degree, thereby making the company flexible enough to react quickly to production changes. A very important modern concept related to advanced and intelligent production is the concept of Industry 4.0 [4].

Industry 4.0 – should increase manufacturing flexibility, together with mass customization, improved productivity and better quality. On that way, will enables companies to meet the challenges of producing more individualized products with higher quality and faster production times. Intelligent manufacturing has an important role in Industry 4.0. With converting of typical resources into intelligent objects, they can feel and act within intelligent environment [5].

In this paper, the history of the Industrial Revolutions is described, with a focus on the features and components of the Fourth Industrial Revolution and its impact on Education and Future Jobs.

[1]Filip Anackovski, Mitko Kostov, Roberto Pasic and Ivo Kuzmanov are with the St. Kliment Ohridski University, Faculty of Technical Sciences – Bitola, Makedonska Falanga 33, Bitola 7000, Republic of Macedonia, E-mail: filip.anackovski@gmail.com

II. Industrial Revolutions

The Industrial Revolution began in Great Britain and quickly spread cross whole world. The Industrial Revolution was a period of major industrialization and innovation which happened during the late 1700s and early 1800s [6].

Over the years, the company has achieved higher productivity through the use of steam engines, electricity, and the transition from analog technology to digital technology. However, the impact of the Fourth Industrial Revolution is broader, not only affecting production, but also indirect sectors, especially engineering processes. This means that the potential for productivity growth lies especially in improving brain function and decision-making processes. Cooperation at all levels can help expedite this process.

The first industrial revolution was after the original industrialization period. It started from the end of the 18th century to the beginning of the 19th century. The biggest change comes from the mechanized form of the industry. Mechanization is the reason why agriculture began to be replaced by industry as the pillar of social economy [7]. The steam engine, like the locomotive, enabled an enormous increase in transportation efficiency. In 1784 the first mechanical weaving loom was put into operation.

Second revolution marked the use of electricity for new mass production and new types of production organization (Fordism, Taylorism). This is followed by the development of the chemical industry. In 1870, the first conveyor belt was installed in the Cincinnati slaughterhouse [8].

The development and application of electronics and the IT sector have opened up new possibilities for production management and automation. The third revolution initiated the rise of electronics, telecommunications and of course computers. With these new technologies, the third industrial revolution enable to have space expeditions, research, and biotechnology. In 1969, the first control program with the help of programmable logic circuits (PLC), Modicon 084 was realized.

In this revolution, smart factory machines and Plants are largely self-organizing, supply chains are self-synchronizing, and raw materials (working parts) for machines, which they make themselves in the real world, provide information about production. Experts call such an industry a stock exchange where machines offer their services. These are the new, so-

978-1-6654-2886-6/21/$31.00 ©2021 IEEE

called Smart Factories. This revolution has already begun, and proof of this are the existing technologies as its prerequisite: Internet, IIoT (data connection for industrial systems), simulation software, TIA (Totally Integrated Automation) portal for fast engineering. Fig. 1 shows visual history of the industrial revolutions.

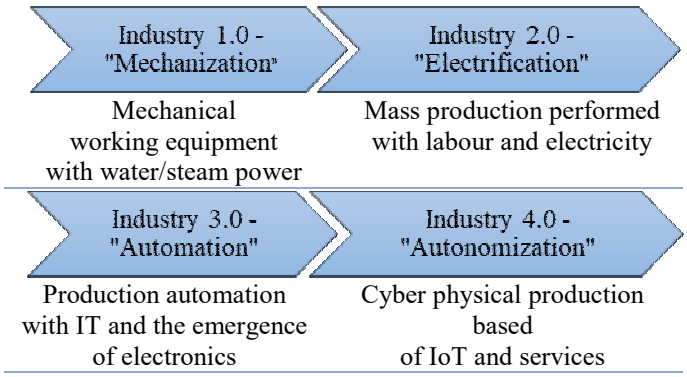


Fig. 1. Industrial Revolutions History

III. INDUSTRY 4.0

Industry 4.0 is defined as "the name of the current trends in automation and data exchange in manufacturing technology, including cyber-physical systems, the Internet of Things, cloud computing and cognitive computing, and the creation of smart factories" [9].

Industry 4.0 can be understood as a combination of production technology, process technology, and information technology (IT). The concept of Industry 4.0 is a term introduced, which actually refers to the "Fourth Industrial Revolution" that first appeared in the German-speaking region in 2011, named "Industry 4.0". Today, the subject of Industry 4.0 has aroused great interest in the field of industrial engineering. One of the basic characteristics of Industry 4.0 is the transition from the concept of automated manufacturing to the concept of intelligent manufacturing, which includes the integration of organization, equipment, personnel, and products, as well as the collaboration between them and the ability to communicate in real time.

Industrial Internet of Things (IIoT) and Cyber-Physical Systems (CPS) are the two key technologies that will provide Industry 4.0 to deliver: high level of automation and digitalization, artificial intelligence, to enhance the possibility to manipulate and evaluate large amounts of information and exchange data within a networked system [4].

The benefits that Industry 4.0 can bring to industry – and therefore to customers – include: better resource efficiency, faster production, better quality control and greater product and component traceability and most important lower costs [10].

IIoT allows multiple devices (simple as a single sensor or complex as a machine tool) to exchange data using Internet and Ethernet-Based Technologies. Manufacturers should consider the current levels of factory automation and network architecture that exist in the factory today. Adopting the principles of Industry 4.0 and smart manufacturing may require high levels of investment, due to requires of high levels of automation and network infrastructure, so the road to digitalization will not be cheap.

Table I compares the advantages and disadvantages of Industry 4.0.

TABLE I
INDUSTRY 4.0 ADVANTAGES AND DISADVANTAGES

Advantages	**Disadvantages**
Automation of repetitive tasks	"Fear" of new technology/too much transparency
Utilization of e-workflows	Many of the current machinery and stations in stores are not compatible with digitalization
Production detail data (e.g., current manufactured pieces.)	Accurate definition/design of data structure
Available in real time → Ability to make quick decisions	Incompatibility issues between different databases/systems

Industry 4.0 target is to implement a smart factory based on a Computer Physical System (CPS – Cyber Physical System). CPS collects and analyzes information about equipment and people in the real world and help to control it based on the results of the analysis. This concept provide possibility to improve the efficiency and system optimization. In manufacturing plants, the practice of using sensors to collect information and use it to monitor and control production facilities has been implemented. In the future, the improvement of sensor networks and analyzes will result in factories becoming intelligent and autonomous, i.e., smart factories.

In a smart factory, all the equipment is networked. Analyze the data they collect and use the results as a basis for the coordination and control of equipment and personnel to achieve the following purposes:

1. Maximizes production quality
2. Minimize the costs

While all existing Supply Chain Management (SCM) systems are advanced to enable the above, it is expected that industrial operations (operations management) will use AI (artificial intelligence) technology to provide particularly important innovations [11].

Intelligent manufacturing or also called smart manufacturing is a broad manufacturing concept that can optimize production and product transactions by making full use of advanced information technology and manufacturing. It is considered as a new production model based on intelligent science and technology, which greatly upgrades the design, production, management and integration of the entire life cycle of typical products. Through the use of various smart sensors, adaptive decision models, advanced materials, smart devices and data analysis, the entire product life cycle can be

simplified. Production efficiency, product quality and service levels will be improved. A manufacturing company's ability to cope with global market dynamics and fluctuations can enhance its competitiveness.

In the era of Industry 4.0, Intelligent Manufacturing System – IMS uses Service-Oriented Architecture (SOA) over the Internet to provide collaborative, customizable, flexible, and configurable service to end users, enabling a highly integrated human-machine manufacturing system.

The high integration of human-machine collaboration aims to establish an ecosystem of various product elements contained in IMS, so that organization, management and technical levels can be seamlessly combined.

AI (Artificial Intelligence)-Artificial Intelligence plays a vital role in IMS by providing typical functions such as learning, reasoning, and action. By using AI technology, people's participation in IMS can be minimized. For example, materials and production components can be automatically organized, and production processes and production operations can be monitored and controlled in real time. As Industry 4.0 continues to be popular, it will eventually realize autonomous wake-up, intelligent interconnection, intelligent learning analysis and intelligent decision-making. For example, an intelligent scheduling system can allow tasks to be scheduled based on AI technology and troubleshooting procedures and can be used as an Internet-Enabled Services (Internet-Enabled Platform) to provide other users [5].

The systems for Augmented Reality providing different services, from sending maintenance instructions via mobile devices to selecting parts in a warehouse. Companies, in the future will use augmented reality systems much more mainly to improve the work procedures and will help employees with real-time information to improve decision-making.

For example, operators may receive maintenance instructions for changing of some particular spare part because they are looking at a real system that needs repair. These data can be displayed directly to the operator's vision using devices such as glasses for augmented reality.

Another possibility is virtual training. Siemens has developed Como's software that uses a realistic, 3D data-driven environment with augmented reality glasses to train emergency plant personnel. It is a virtual production operator training module. Operators can also change parameters and download operating data and maintenance instructions [12].

IV. The Impact of Education and Future Jobs

The world is entering the Fourth Industrial Revolution and smart technologies are leading to a series of changes in the economy, the labor market and our lives. Education is a way to prepare young people for the challenges of the new age. In addition to the classic technical knowledge in the field of information technology, 21st century jobs will require new knowledge and new skills. With digital literacy, the progress of individuals and societies will require creative, critical, and analytical thinking to solve challenges [13].

The development of the Fourth Industrial Revolution will transform the modern living and working. Some jobs will not exist, other jobs going to be developed, and new jobs that do not exist these days will become usual. What is known is that in the future will be required new skills to master.

A report from "The Future of Jobs" [14] indicates what skills would be needed in the future:

1. Solving complex problems
2. Critical thinking
3. Creativity
4. Managing people
5. Coordination
6. Emotional intelligence
7. Reasoning and decision making
8. Service orientation
9. Negotiations
10. Cognitive flexibility

Creativity will be among the first necessary skills. Workers will have to be more creative to benefit from the large number of changes that will occur. Robots can help us to be faster, but they cannot be as creative as humans.

Negotiation and flexibility are high on the list at the moment, but in the next years they will start to fall because the machines will make decisions for us.

Active listening will be deleted completely.

Emotional intelligence, which is not in the top 10 list of current skills, will be among the first in the future.

The nature of change will depend most on the industry itself. Some areas are already far ahead of others, mobile technology, artificial intelligence, 3D printing already have an impact on the way we work.

Change will not wait for businessmen, educators and governments should be proactive and educate people so that everyone can easily adapt and be part of the Fourth Industrial Revolution.

V. Conclusion

Industry 4.0 will dramatically change current environment. With interconnection of work cells, workstations throw sensors and IT systems going to be linked with the supply chain outside of a one company. These connected cyber-physical systems will use standard IP protocols to share information with each other and analyze the data to predict failures, configure themselves and adapt to changes.

Industry 4.0 will enable the collection and analysis of data, faster and more flexible, highly efficient processes and producing better quality finish goods with reduced costs.

The Fourth Industrial Revolution will have a strong impact and bring benefits in many areas by increasing productivity, revenue growth, employment, education and future professions, investment, sales, operations management, production flexibility – allowing shifting from mass production to mass customization [15].

In addition, there will be lower costs, faster production, better resource efficiency, avoidance of delays, greater quality control and greater traceability of products and components, and greater safety for workers. Also, this will have huge influence to change the economy, change the structure of the workforce, boost industry growth, which will dramatically change the competitiveness of companies and industrial zones [10]. Smart factories are mobile and adaptable, and can

support different production scenarios. They are also flexible and can handle different quantities of production and production technologies. In terms of manufacturing, Industry 4.0 usually involves applying sensors to devices, controls, and other digitally aware devices, then networking them, sharing data to drive changes in automated manufacturing, and providing executives with insights analysis, solutions and decision-making [16]. By using artificial intelligence data and IoT devices, companies can easily perform more product analysis to provide high-quality information.

The development of the Fourth Industrial Revolution will transform the modern living and working. Some jobs will not exist, other jobs going to be developed, and new jobs that do not exist these days will become usual. What is known is that in the future will be required new skills to master. The nature of change will depend most on the industry itself.

Change will not wait for us: businessmen, educators and governments should be proactive and educate people so that everyone can easily adapt and be part of the Fourth Industrial Revolution.

REFERENCES

[1] Buer, S.-V. (2018). *The link between Industry 4.0 and lean manufacturing: mapping current research and establishing a research agenda.* Taylor & Francis Online: https://www.tandfonline.com/doi/full/10.1080/00207543.2018.1442945?scroll=top&needAccess=true&

[2] The Editors of Encyclopaedia Britannica (2021). *Industrial Revolution Causes and Effects*. Britannica: https://www.britannica.com/summary/Industrial-Revolution-Causes-and-Effects

[3] JAMES CHEN (2021). *Industrial Revolution*. Investopedia: https://www.investopedia.com/terms/i/industrial-revolution.asp

[4] Karkalos, N. E. (2019). *Computational Methods for Application in Industry 4.0.*

[5] Zhong, R. Y. (2017). *Intelligent Manufacturing in the Context of Industry 4.0: A Review. Elsevier.*

[6] HISTORY.COM EDITORS (2021). *Industrial Revolution*. History:https://www.history.com/topics/industrial-revolution/industrial-revolution

[7] iED Team (2019). *The 4 Industrial Revolutions*. Institute of Entrepreneurship Development: https://ied.eu/project-updates/the-4-industrial-revolutions/

[8] Skenderovski, T. (2020). *Industrial revolutions*. Emitter - Macedonian magazine for popularization and application of science and technology: https://emiter.com.mk/vesti/12275/

[9] i-scoop (2021). *Industry 4.0: the fourth industrial revolution – guide to Industrie 4.0*. https://www.i-scoop.eu/industry-4-0/#:~:text=Industry%204.0%20has%20been%20defined,and%20creating%20the%20smart%20factory%E2%80%9D.

[10] Anackovski, F. (2020). *Impact of Industry 4.0 on achieving operational excellence in LEAN production: Real Time OEE Monitoring System.* TEMEL: https://0e86df64-11b2-4266-8f2d-193243648779.filesusr.com/ugd/29815f_abb69f67bf6340149d28af3f7c59369a.pdf

[11] Takayoshi, A. (2016). *Industrial Operations Supporting Industry 4.0.* NEC Technical Journal: https://www.nec.com/en/global/techrep/journal/g16/n01/160107.html

[12] Lorenz, M. (2015). *Industry 4.0: The Future of Productivity and Growth in Manufacturing Industries.* BCG: https://www.bcg.com/publications/2015/engineered_products_project_business_industry_4_future_productivity_growth_manufacturing_industries

[13] British Council (2020). *Skills for the "smart" future.* https://www.britishcouncil.mk/programmes/education/21st-century-schools/why/skills-for-future

[14] Agler, E. (2016). *The Future of Jobs*. World Economic Forum: https://www.weforum.org/reports/the-future-of-jobs

[15] Castellina, N. (2020). *Industry 4.0 and the Future of Productivity*. Supply and Demand Chain Executive: https://www.sdcexec.com/software-technology/article/21160015/infor-industry-40-and-the-future-of-productivity

[16] Howells, R. (2020). *How Industry 4.0 Boosts Productivity and Profitability in Intelligent Factories*. Forbes: https://www.forbes.com/sites/sap/2020/07/01/how-industry-40-boosts-productivity-and-profitability-in-intelligent-factories/?sh=36e6bb9f48ec