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**INDUSTRY 4.0.
 CHALLENGE OR OPPORTUNITY FOR GOVERNMENTS?***

VAHE BAYADYAN

Technical University of Munich (TUM)

Master in Management

B.Sc. of Engineering

Munich, Germany

bayadvahe@gmail.com

TATEVIK HOVHANNISYAN

Technical University of Munich (TUM)

MA in Economics

Munich, Germany

tatevik.hovhannisyanyan@tum.de

The aim of this article is to discuss the challenges governments face in the new digital era and underline the activities states should take to not only regulate the industries but also to encourage innovations. The Fourth Industrial Revolution caused rapid changes in all the aspects of our lives. Due to the digital transformation and active implementation of the latest disruptive technologies (e.g. Internet of Things (IoT), artificial intelligence (AI), blockchain etc.) in business operations, companies manage to reshape the traditional business models and provide advanced products and services which meet the increasing needs of the customers. Meanwhile, as governments try to keep pace with technological developments and employ effective regulatory frameworks for modern enterprises, our task is to reveal the paths that are available for doing so and to analyze those. The research method used in the paper is the detailed review of the corresponding literature and the data, provided by National statistical services of some countries. The article suggests that governments should actively promote innovations by creating and enhancing proper ecosystems and infrastructures.

Keywords: *digital era, Fourth Industrial Revolution, disruptive innovation, policymakers, regulatory framework, entrepreneurial state, development.*

Introduction: The rapid changes that the Fourth Industrial Revolution brought about are obvious nowadays. Started from the second half of the twentieth-century innovation keeps driving the economy and increasing living standards through more productive and enhanced technical solutions. Technologies like artificial intelligence, robotics, and virtual reality have revolutionized not only the lifestyle and consumer behavior of people but also disrupted the traditional business models paving a way for sharing economy, digital enterprises and cloud-based businesses. In the epoch of transformative scientific and technological progress,

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companies are not only introducing new products and services but also “reshaping industries, blurring geographical boundaries and challenging existing regulatory frameworks”⁸¹⁰. Moreover, considering the huge economic gains digitalization delivers to companies, it can be predicted that enterprises, which are incapable to adopt up-to-date technologies in their daily activities, will not survive in the age of so-called “digital Darwinism”, where innovations and customer demands are developing much faster than a company can react. Up-to-date information technologies assure not only higher productivity and growth, but also provide a basis for more stable growth, especially in terms of reducing transaction and logistic costs and optimizing the entire supply chain⁸¹¹.

The phenomena of the Fourth Industrial Revolution, which is also referred to as Industry 4.0, and its consequences are widely discussed both in academic literature and during various forums of local and international level. The concept of Industry 4.0 originates from Germany. “Industrie 4.0” was a national strategic initiative from the German government through the Ministry of Education and Research and the Ministry for Economic Affairs and Energy aimed at driving digital manufacturing forward by increasing digitization and the interconnection of products, value chains and business models⁸¹². As a part of the German High Tech 2020 Strategy launched in 2011, “Industrie 4.0” suggested that the government will support research, the networking of industry partners and standardization and will secure and develop Germany’s leading position in industrial manufacturing. Obviously, this is one but not the only example of how governments try to respond to the new developments in the economy resulted from the implementation of modern technologies in different industries.

Nowadays, the concept of Industry 4.0 is used to characterize current technological developments and emerging innovations based on big data, information systems, digital products and many others. Industry 4.0 is characterized by a ‘fusion’ of technologies that destroys the boundaries between the physical, digital and biological spheres⁸¹³.

What should be the role of the governments in this fast-growing digital era? How should the governments respond to the Fourth Industrial Revolution? Should the governments regulate every industry more actively or they should care more about promoting innovations and implementing the latest technologies in the national economies? *The answers to these questions address not only the concerns of the governments as policymakers but also the expectations of citizens and entrepreneurs in terms of decreasing the level of existing uncertainty about the state role.* Traditionally, state’s actions as a regulator are considered to be mainly connected with customer welfare protection, particularly, protection from externalities, unfair competition, asymmetric information and other so-called “market failures”⁸¹⁴.

This article aims to identify the main challenges states face in the Fourth Industrial Revolution era and discusses the actions governments take to both overcome those challenges and deliver value to society and economy. The article explores the economic theories about the role of the governments to show how the views on this topic fluctuated over time due to historical alterations. With the purpose of making policy recommendations for emerging countries, the article examines the policy papers and best practices of the leading economies and highlights the directions governments can follow for more effective performance. Apparently,

⁸¹⁰ **Broekaert K, Espinel V.A.** (2018) How can policy keep pace with the fourth industrial revolution? Retrieved from <https://www.weforum.org/agenda/2018/02/can-policy-keep-pace-with-fourth-industrial-revolution/>.

⁸¹¹ **Stiglitz, J. E., Orszag, P. R., & Orszag, J. M.** (2000). Role of government in a digital age.

⁸¹² **Klitou, D., Conrads, J., Rasmussen, M., Probst, L., & Pedersen, B.** (2017). „Germany: Industrie 4.0”. Digital Transformation Monitor, Germany.

⁸¹³ **Schwab, K.** (2018). The Global Competitiveness report 2018. Geneva: World Economic Forum.

⁸¹⁴ **Koopman, C., Mitchell, M., & Thierer, A.** (2014). The sharing economy and consumer protection regulation: The case for policy change. *J. Bus. Entrepreneurship & L.*, 8, 529.

state's role is not limited with investments in the digital sector, but also encompasses alignment of the investment activities with new development strategies and policies, new skillset and institutions ⁸¹⁵. Finally, the article suggests that while the Fourth Industrial Revolution is a challenge for states, governments should actively promote and encourage innovations and digital transformation by creating and enhancing proper ecosystems and infrastructures. *Aimed at addressing several crucial questions about the state role in Industry 4.0, this study is important and relevant both for policymakers and market players.*

Research Method:

While this article intends to explore the theoretical views on the role of the government as a policymaker and to examine the changes in the academic literature over time, the literature review is the main method of the article. Main sources of the literature are leading journals in the field of innovation and economic science and various scientific papers. Since the historical shreds of evidence had a significant influence on the question of whether the state should intervene in the economy or not, historical and case study methods are also employed in the research. These methods are also used to present the main challenges for governments in the modern world and show how states encounter them. Particularly, the latest reports of high-level international organizations (World Bank, World Economic Forum, United Nations, European Union etc.) and policy papers of several leading countries are studied to identify the key steps governments take to respond to the current rearrangement in the economy. The methodology of the research comprises descriptive and comparative methods as well. The data and the statistics, however, are not collected by the authors but are taken from reliable sources, such as reputable international databases and state statistics.

Theoretical Background:

Before identifying the main challenges governments face in the new digital era and exploring the ways they confront them, it is important to discuss the role of the government as a policymaker and quickly highlight the main theoretical approaches on this topic. This chapter will provide a short theoretical background for this research and will illustrate how the views on government's role have been influenced by historical developments, including wars and crises. Economic and financial crises in the last two centuries were turning points not only in terms of rearrangements in the world economy but also from the perspective of the changes in economic policies led by states. Considering the origin of theoretical approaches to the government's role, particularly the role it plays in innovation regulation and/or encouragement, we conditionally differentiate *traditional* and *modern* theories.

Traditional theories and the government's limited role in innovation promotion:

As Stiglitz⁸¹⁶ argues, some nations managed to take advantage of the active state policy, including establishments of colonies. However, the state's active interventions were not the only precondition of promotion, since countries with relatively passive governments prospered as well.

⁸¹⁵ **Hanna, N.** (2018). A role for the state in the digital age. *Journal of Innovation and Entrepreneurship*, 7(5), 86–103.

⁸¹⁶ **Stiglitz, J. E.** (1988). Economic organization, information, and development. *Handbook of development economics*, 1, 93–160.

To address this paradox and discuss the questions of wealth creation and distribution, outstanding British scholar Adam Smith⁸¹⁷ propounded the notion of ‘invisible hand’ arguing that markets can be regulated without state interventions. Smith believed that, in a capitalist society, people are motivated and inspired to maximize their profit or value and the government's role should be limited by ensuring fair competition and trust. “By directing that industry in such a manner as its produce may be of greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention”. With this theory, Smith discussed the phenomena of the self-interested individual, who should live without taking into consideration possible influences of negative externalities and without worrying about ‘benevolence’⁸¹⁸. *Though Smith suggested a limited role for the government as a regulator, he still advocated state’s responsibility to deliver such basic public goods to the nation as education, healthcare, defense and to maintain other infrastructures.*

Recognizing the unavoidable conflicts between private and state interest is crucial while discussing Smith’s Laissez-faire approach since privatization was a key in his theory. The contrast between private sector’s wish to minimize costs for production resources and state’s aim to get a maximum return can be eliminated through creating highly competitive and efficient markets⁸¹⁹. Here the government has a role to play.

While discussing Smith’s writings Mazzucato⁸²⁰ mentions that though Smith's arguments were more convincing than the ones suggested by simple libertarian economists, Smith still believes in the magic power of capitalism to guarantee effective production and fair distribution without any enforcement by the governments. As a contradiction, Mazzucato refers to another economic historian Karl Polanyi who managed to show that market self-regulation is a mythical concept since the free and open markets are originally created by government efforts.

Apparently, the huge influence of technology on the economy and society raised the necessity to develop new growth models and *include technology as an endogenous parameter*. In the following section, we will introduce the relatively modern economic approaches which are *innovation-based* and also provide a better understanding of government’s role in *promoting economic growth through innovations*.

Modern theories and government’s active participation in technological progress:

The role of innovations was underestimated for a long time. Views on this topic dramatically changed after Austrian economist Schumpeter introduced his Capitalism, Socialism and Democracy masterwork in 1943. Schumpeter proposed his famous “creative destruction” concept which suggested that technological transformation is a social process and placed companies and entrepreneurs at the core position in the growth process⁸²¹. Schumpeter argued that perfect competition is a myth; if the main principle of completely free markets holds, diverse products and innovative methods of manufacturing would barely be introduced, and new markers would hardly appear, hence, economic advancement might be inconceivable. While innovations were fundamental in Schumpeter’s research, he discussed that in capitalist system, people who create new values are rewarded with ‘short-term monopoly profits’, such as additional

⁸¹⁷ **Smith, A.** (1976). An inquiry into the nature and causes of the wealth of nations (ed. RH Campbell, AS Skinner, and WB Todd).

⁸¹⁸ **Wang, L., Malhotra, D., & Murnighan, J. K.** (2011). Economics education and greed. Academy of Management Learning & Education, 10(4), 643-660.

⁸¹⁹ **Sappington, D. E., & Stiglitz, J. E.** (1987). Privatization, information and incentives. Journal of policy analysis and management, 6(4), 567-585.

⁸²⁰ **Mazzucato, M.** (2011). The entrepreneurial state. Soundings, 49(49), 131-142.

⁸²¹ **Aghion, P., & Akcigit, U.** (2015, October). Innovation and growth: the Schumpeterian perspective. In COEURE workshop.

funds and extended networks, and suggested that states should encourage such innovative enterprises by granting provisional monopolies over benefits of creative work, including intellectual property⁸²².

Generally, the role of the state in the innovation process became central at the beginning of the 21st century when studies started to concentrate on how government can facilitate the process of bringing new lab-based ideas into the market through providing funds and establishing proper infrastructures. But the concepts of 'creative' or 'entrepreneurial' state suggest that government's role should not be limited by fixing or facilitating. The state should also establish an effective 'debate' and interaction between public and private entities and enhance the innovative capacities of the country.

As mentioned above, Mazzucato's study was based on adding the attribute of state proactivity on the fully functioning national innovation system. The framework on national innovation systems appeared in the literature at the end of the 1980s by several academics such as Freeman⁸²³ and Lundvall⁸²⁴. It suggests that innovation is the final and the most desired result of research, and the system of research is a part of a more complex system which includes government, university and industry. Hence, the scholars discussed the interactions between the mentioned entities and models of collaboration between them. Based on the document analysis, Godin argues⁸²⁵ however, that the notion of national innovation systems appeared much earlier in the literature of the Organization for Economic Co-operation and Development (OECD) where the systematic approach was added to the concept of knowledge-based economy. Freeman takes a historical insight into the huge differences between the ways countries enhanced their national economies through introducing and defusing innovative products and methods. Freeman notices that the United States and Germany were the most successful countries in terms of implementing institutional innovations and utilizing them for the expansion of national systems. Freeman greatly contributed to the theory of national innovation systems by highlighting the importance of sophisticated national innovation systems for the success of the state in the era of globalization. Lundvall enlarges⁸²⁶ the discussions about national innovation systems while arguing system models in various countries and concludes that "the most successful countries had a strong state that promoted general education before the beginning of, or at very early stages of the industrialization process". Hence, Lundvall shapes the model of interaction between the three main entity of the national innovation system.

This section discussed the most influential economic theories which were introduced in various historical periods and provided understanding on approaches of state's role in the innovation promotion.

Key Findings and Discussion:

The previous sections provided a theoretical background on state role in the economy in terms of participating in innovation and technical enhancement of the country. Most of the discussed theories were developed before the invention of such major technologies like artificial intelligence, cloud computing, big data etc. Thus, those studies did not address the actual challenges for the governments in this very period of the Fourth Industrial Revolution.

⁸²² Nakamura, L. (2000). Economics and the new economy: The invisible hand meets creative destruction. *Business review*, 2000, 15-30.

⁸²³ Freeman, C. (1987). Information technology and change in techno-economic paradigm. *Technical change and full employment*, 49-69.

⁸²⁴ Lundvall, B. A. (1992). *National innovation system: towards a theory of innovation and interactive learning*. Pinter, London.

⁸²⁵ Godin, B. (2009). National innovation system: The system approach in historical perspective. *Science, Technology, & Human Values*, 34(4), 476-501.

⁸²⁶ Lundvall, B. Å. (2016). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. *The Learning Economy and the Economics of Hope*, 85.

However, most of the time, scholars agreed that government should create appropriate policies and regulatory framework aimed at facilitating the business initiatives of the private sector. Moreover, the recent assumptions also suggested that states themselves should take initiatives and allocate more funds for R&D and technical enrichment of the economy.

This section will take a deeper look into the current challenges and threats for the governments in the digital age and will explore and compare the main features of the innovation policies in various countries. It is important to underline the main points developing countries can learn from the experiences of the leading nations, which apparently have more expertise in innovation policy creation and execution.

Identifying major challenges for governments:

In order to show the entire spectrum of major challenges for the states in the era of digital transformations, we will conditionally classify the existing challenges into two main categories—*technology-related challenges* and *resource-related challenges*.

Technology related challenges:

As mentioned earlier, different organizations and research institutes have various approaches to defining the list of frontier technologies of the Industry 4.0. Nevertheless, there is a range of technologies which are intensively adopted by businesses and actively discussed by experts and society. Moreover, it sometimes takes time to understand the concept of those disruptive technologies and their application areas. These technologies open new opportunities both for the government and enterprises, but also challenge the existing regulatory frameworks and give rise to new problems to be addressed. Here are discussed the major technology-related challenges for the governments.

Cloud computing and data security. Cloud computing is a technology which provides a range of shared computing resources and services, such as applications, computing, storage, networking, development, distribution platforms and business operations⁸²⁷. Clouds are used by individuals and governments as well, and Worldwide Semi-annual Public Cloud Services Spending Guide 2018 developed by International Data Corporation suggests that the United States invests 97 billion USD on public cloud services accounting for more than 60% of worldwide spending. The UK and Germany are following with 7,9 billion USD and 7,4 billion USD spending respectively.

The wide usage of cloud services, however, gives rise to such problems as *personal data security, company data protection, sensitive data vulnerability, the reliability of the service provider, and the threat of cyber-attacks*. The survey by Deloitte among 1,600 C-level executives across 19 countries found out that 24% of companies consider ‘increasing threat of cyber risk’ as one the major factors impacting on their organization over the next 5 years⁸²⁸. According to research done by the US government, “22 of 24 major federal agencies reported that they were either concerned or very concerned about the potential information security risks associated with cloud computing”⁸²⁹. Obviously, the government should take actions to encounter these challenges and guarantee the data protection not only for citizens and private sector but also for public agencies, because the vulnerability of state data can affect on the national security of the country and society. Such actions include creating strict data protection policies on both national and international level.

Artificial intelligence and machine learning. Artificial intelligence (AI) is a branch of computer science which has a huge potential to fundamentally revolutionize such sectors as

⁸²⁷ Hurwitz, J. S., Nugent, A., Halper, F., & Kaufman, M. (2013). Big data for dummies. John Wiley & Sons.

⁸²⁸ Deloitte Touche Tohmatsu (Firm). (2018). The Fourth Industrial Revolution is here: are you ready?

⁸²⁹ Additional Guidance Needed to Address Cloud Computing Concerns GAO-12-130T. Oct 6, 2011.

healthcare, customer services, agriculture and manufacturing. Many experts discuss how governments can benefit from AI implementation and address the existing administrative and functional problems, such as controlling immense amount of diverse data (qualitative, quantitative, in different languages), ineffective resource allocation, lack of experts and uncertain decisions (for example, AI can introduce predictions based on historical data)⁸³⁰. Despite the noticeable opportunities, AI offers, it also has a potential to worsen issues around privacy and ethics, because most of the time it is unclear how this tool works, what type of algorithm runs behind it, what factors it relies on while making decisions and whether the input data is interpreted properly or not. Therefore, these challenges should be accepted and addressed properly. While appreciating the gains AI can provide, the UK government, for example, highlights the role of the state to manage and mitigate the risks which may arise while implying AI in public and private sectors. Particularly, the experts mention state's role in recognizing the perspectives of individual freedoms, privacy and consent concepts while applying machine learning tools on ever-increasing amounts of personal data and adapting appropriate mechanisms to ensure accountability for decisions made by artificial intelligence⁸³¹. AI becomes another field of competition between leading economies. China's AI market, for example, was worth around 3,55 billion USD in 2017 and China is planning to become the front-runner in AI by 2030 beating the US which owns 13,9 % share of world AI talents⁸³².

Blockchain and cryptocurrencies. Although blockchain and cryptocurrencies are usually discussed together and even sometimes confused, cryptocurrency is just one system based on blockchain technology – one of the frontier technologies of Industry 4.0. Blockchain contains a set of scientific fields such as cryptography, mathematics, algorithm, economic model and other and solves the traditional problem of the synchronization of distributed databases⁸³³. Blockchain grants people a higher level of autonomy and as such challenges the state power to control and regulate. A recent report by British Standards Institution (BSI) highlights the following major challenges related to blockchain technologies – “lack of clarity on the terminology and perceived immaturity of the technology, perceived risks in early adoption and likely disruption to existing industry practices, insufficient evidence on business gains and wider economic impact, *uncertainty around regulation*, maintaining security and privacy of data” etc.⁸³⁴

In fact, blockchain is more an opportunity for the state than a threat. Cryptocurrencies, however, can be more harmful to the state due to their *ability to facilitate illicit and criminal behavior*. Interestingly, International Monetary Fund offers governments to consider offering their own cryptocurrencies and prevent these systems becoming havens for fraudsters and money launderers⁸³⁵. Governments, however, do not hurry to regulate cryptocurrencies or offer new ones for a set of reasons; first, the fluctuations in cryptocurrency market suggests that these technologies are not mainstream and mature enough to disrupt industries yet, and secondly, as payment tools, regulation of cryptocurrencies should be considered in the context of maintaining

⁸³⁰ Mehr, H., Ash, H., & Fellow, D. (2017). Artificial intelligence for citizen services and government. Ash Cent. Democr. Gov. Innov. Harvard Kennedy Sch., no. August, 1-12.

⁸³¹ Hancock, M. (2015). Artificial intelligence: opportunities and implications for the future of decision making. Governemnt Office for Science.

⁸³² Lucas, L. (2018, November 15). China's artificial intelligence ambitions hit hurdles. Retrieved from <https://www.ft.com/content/8620933a-e0c5-11e8-a6e5-792428919cee>.

⁸³³ Lin, I. C., & Liao, T. C. (2017). A Survey of Blockchain Security Issues and Challenges. *IJ Network Security*, 19(5), 653-659.

⁸³⁴ Deshpande, A., Stewart, K., Lepetit, L., & Gunashekar, S. (2017). Distributed Ledger Technologies/Blockchain: Challenges, opportunities and the prospects for standards. Overview report The British Standards Institution (BSI).

⁸³⁵ Inman, P. (2018, November 14). IMF says governments could set up their own cryptocurrencies. Retrieved from <https://www.theguardian.com/business/2018/nov/14/imf-says-governments-could-set-up-their-own-cryptocurrencies>.

stable national financial markets and reliable international settlements. Considering the main features of cryptocurrencies – anonymity and decentralization - Marian concludes⁸³⁶ that it is *possible to design such regulatory instruments which target only the negative aspects of cryptocurrencies while allowing positive traits to prosper.*

Renewable energy. Considering different views on climate change drivers, (See <https://climate.nasa.gov/scientific-consensus/>), human activities and economic development itself lead to climate change. Moreover, millennium problems as deforestation, heavy consumption of national resources and air pollution keep challenging governments and societies. It is important to notice, that energy production based on renewable sources, including sunlight, wind and geothermal heat was widespread even before the current stage of the industrial revolution, however, Industry 4.0 introduces new methods of renewable energy manufacturing and offers more sustainable and efficient solutions. Such technologies include smart grids, Virtual Power Plants and sensor monitoring aimed at controlling and optimizing electricity usage in factories and enterprises⁸³⁷.

What are the challenges for governments? Generally, the first major challenge in case of any new technology is to realize and accept the technology as a challenge and take actions to eliminate its possible negative influences or benefit from its implications. From the aspect of renewable energy technologies, it is crucial for the governments to estimate their technical and human capacity required for applying renewable energy techniques in manufacturing. UNIDO proposed⁸³⁸ two main activities for governments to take - transforming and leapfrogging; the first one should be aimed at “retrofitting existing industrialized systems with Industry 4.0 technologies” for more sustainable production, and the second one is addressed to emerging countries and underlines the importance of learning from the practice of developed countries and immediately enhance the full potential of digitization instead of taking the traditional development pathways.

Resource-related challenges:

Disruptive technologies challenge not on regulatory frameworks but also require massive investments in R&D. As presented in the theoretical part, some scholars argue that governments should take hands off and let the market decide the most profitable investment sectors. However, in the current world, innovation becomes a crucial precondition of promotion and global competitiveness, because “it is no longer possible to rely solely on efficiency and cost-cutting for economic success: innovation, flexibility and adaptation to change are becoming the key ingredients”⁸³⁹. According to Global Innovation Index 2018, R&D is highly focused in high-income and a very few middle-income economies, and, excluding China, in middle-income economies R&D intensity progressed only slightly comprising 0,6% in 2016 compared to 0,5% in 2000. The same report shows that the countries with greatest R&D expenditures (US, China, UK, Switzerland, Israel) produce the greatest share of innovation outputs globally (around 90 %) and have the highest patent density (around 2 million patent application in 2017). Overall, world leading manufacturing economies invest in average 2,4% of the GDP into R&D (Japan – 3,49%, USA – 2,79%, Germany – 2,88%, China – 2,1%, UK – 1,7%) (See more on OECD website <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>). According to another reputable

⁸³⁶ **Marian, O. Y.** (2014). Conceptual framework for the regulation of cryptocurrencies. University of Chicago Law Review Dialogue, 82, 53.

⁸³⁷ **Shabanzadeh, M., Sheikh-El-Eslami, M. K., & Haghifam, M. R.** (2017). An interactive cooperation model for neighboring virtual power plants. Applied energy, 200, 273-289.

⁸³⁸ **UNIDO** (2017). Accelerating clean energy through Industry 4.0: manufacturing the next revolution. Nagasawa, T., Pillay, C., Beier, G., Fritzsche, K., Pougel, F., Takama, T., The, K., Bobashev, I. A report of the United Nations Industrial Development Organization, Vienna, Austria.

⁸³⁹ **Schwab, K.** (2018). The Global Competitiveness report 2018. Geneva: World Economic Forum.

ranking – Global Competitiveness Index 2018⁸⁴⁰ (the latest report was dedicated to Industry 4.0), the world average score on Innovation capability pillar is 36 out of 100 which is the lowest score across 12 pillars⁷, moreover, ‘Innovation Capability’ is the weakest pillar for 77 countries out of 140 studies once. Overall, only four countries show excellent results in innovations - Germany, the United States, Switzerland and Taiwan (China). The examination of the report suggests that the biggest drawbacks for emerging countries in terms of embracing innovations include a lack of diverse workforce, low level of international co-investments and R&D expenditures as well as ineffective multi-stakeholder collaboration. The mentioned problems we consider resource - related challenges for the states since those problems exist because of the scarcity of some type of resource (skillful human resources or sufficient capital funds).

Fourth Industrial Revolution and Innovation Policy:

While Industry 4.0 is challenging the state, it also offers great opportunities for improvements, and leveraging those prospects can bring radical advancements in the economy. The current digital era requires the government's active participation in the structural transformations in the economy through adapting state development strategies to sustainable, innovation-oriented and inclusive policies. Lack of adequate policy papers is one of the drawbacks international experts usually mention while discussing innovation promotion practice of the emerging and even in some developed countries. In this context, it is important to explore the best experience of the leading innovative countries and make policy recommendation for the developing economies.

At the beginning of the second decade of the 21st century, in response to the challenges of Industry 4.0, governments started to adopt innovation policies and utilize state resources for improved productivity and more competitive national economy. The examination of innovation policies developed by different countries shows that while the long-term goals are usually common among countries, states offer different methods in policy implementation, resource allocation and partnership with the industry. China, as a country with one of the most innovative economy globally, has developed the National Medium- and Long-Term Program for Science and Technology Development (2006–2020) which targets the rapid extension of R&D expenditures (at least 2,5% of GDP), raising the R&D contribution to economic progress to at least 60 %, reducing dependence on external technology to below 30 percent and ranking among the world's top five nations in patents and citations. Australian approach to the innovation policy is concentrated on standardization issues, particularly, Australian government aims to actively advocate on consolidation of national standards on the international level since it will promote Industry 4.0 through facilitating the networking and cooperation between various industries inside and outside of the country's borders.⁸⁴¹

Overall, from Industry 4.0 perspective, European Commission aims to spread such values as competition, coherence and cohesion among member countries and the adoption of this task force laid the ground for active policymaking actions on the national level.⁸⁴²

Since EU can be a paradigm for many emerging countries, it is important to mention the main drawbacks of the EU innovation policy. Recently, European Parliament did a research to find out the major gaps in the European innovation policy on the union and national levels and, according to the study, innovation policies on the national level should be more country- specific (considering the level of development, resources, vision etc.) and should focus more on the labor

⁸⁴⁰ The same.

⁸⁴¹ **Aljukic, A.** (March 2017). Industry 4.0: An Australian Perspective. Recommendations Report to Australian Government – Department of Industry, Innovation and Science.

⁸⁴² **Buhr, D. and Stehnen, T.** (12/2018). Industry 4.0 and European Innovation Policy - Big plans, small steps. Friedrich-Ebert-Stiftung.

skillset enhancement because current transformations in the job market suggest embracing new capabilities and learning new ways of doing business⁸⁴³.

Conclusions:

The Fourth Industrial Revolution already has its irreversible impact on all the aspect of our lives. The fundamental changes we witness on the world level are disrupting even the most traditional industries of the economy challenging the existing regulatory frameworks of the policymakers. Competition does not look the same anymore. Thus, states are forced to review their approaches on the regulation and promotion issues and acknowledge their decisive role in the technological enhancement of the economy.

The research showed that theoretical approaches on the government's role as a 'promoter' has considerably fluctuated over time. Moreover, only after the rapid pace of innovations academics started to mention government's 'creative', 'entrepreneurial' and 'agile' role in the country and advocate for the need of innovation policy design and execution.

Paper discussed the major frontier technologies of Industry 4.0 to identify the most complex challenges they may engender for the states. Though the nature and the application areas of the lasted disruptive technologies are slightly diverse, the major problems, they may provoke, usually overlap. Such problems/challenges include data protection and privacy issues, uncertainty of the market future, ethical concerns and the multinational nature of some technologies. Furthermore, especially the emerging countries lack of appropriate financial and human resources to respond to rapid innovations accordingly, which might increase the technological chasm between them and the innovation leaders. Therefore, the governments of the developing states should not hesitate to analyze the opportunities Industry 4.0 offers and take determined steps towards modernizing and digitalizing the industries. Undoubtedly, active cooperation with the private sector is vital to leverage the benefits of the current digital age and deliver value to the society.

Finally, paper reflected on the innovation strategy creation practice in the most innovative states and described the main features of the policy papers. In fact, most of the states link the innovation with the productivity growth and aim to transform industries for improved competitiveness. Obviously, very important notice is given for enhancing the capacities of the labor considering possible alterations in the job market.

The paper concludes that while the Fourth Industrial Revolution is a challenge for the states, governments should actively foster innovations and digitalization through enhancing sustainable ecosystems and supportive infrastructures as well as through enforcing relevant legal instruments for the modern advanced technologies.

⁸⁴³ Industry 4.0. (2016) **Policy Department A: Economic and Scientific Policy**. European Parliament.

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*Մյուլխեյնի Տեխնիկական Համալսարան (մագիստրատուրա)
Տեխնիկական Գիտությունների Բակալավր
ք.Մյուլխեյն, Գերմանիա*

ՏԱԹԵՎԻԿ ՀՈՎՀԱՆՆԻՍՅԱՆ

*Մյուլխեյնի Տեխնիկական Համալսարան (մագիստրատուրա)
Տնտեսագիտական Գիտությունների Մագիստրոս
ք.Մյուլխեյն, Գերմանիա*

Հոդվածի նպատակն է քննարկել նոր թվային դարաշրջանում կառավարության առջև ծառացած խնդիրները և ընդգծել այն գործունեությունը, որը պետությունները պետք է ձեռնարկեն ոչ միայն արդյունաբերության կարգավորումը, այլև նորարարությունը խրախուսելու համար: Հորրորդ արդյունաբերական հեղափոխությունը հսկայական փոփոխություններ է առաջացրել մեր կյանքի բոլոր ոլորտներում: Շնորհիվ թվային վերափոխման և վերջին տեխնոլոգիաների ակտիվ ներդրման (օրինակ՝ բանացանց, արհեստական բանականություն (AI), կրիպտոարժույթներ և այլն) կազմակերպությունները կարողանում են փոխել ավանդական բիզնես մոդելները և ապահովել առաջադեմ ապրանքներ և ծառայություններ, որոնք համապատասխանում են հաճախորդների աճող պահանջներին: Ընդ որում, բանի որ կառավարությունները փորձում են ներդաշնակ քայլել տեխնոլոգիական նորարարություններին և օգտագործել արդյունավետ նորմատիվ-իրավական բազան ժամանակակից ձեռնարկությունների համար, հոդվածի խնդիրն է ուսումնասիրել այն տարբերակները որոնցով կառավարություններ կարող են անել սա և մանրամասնորեն քննարկել դրանք: Հոդվածում օգտագործված հետազոտական մեթոդը համապատասխան գրականության և երկրների ազգային վիճակագրական ծառայությունների տրամադրած տվյալների մանրամասն ուսումնասիրությունն է: Հոդվածում առաջարկվում է, որ կառավարությունները ակտիվորեն խրախուսեն նորարարությունները համապատասխան էկոհամակարգերի և ենթակառուցվածքների ստեղծման և ամրապնդման միջոցով:

Հիմնաբառեր՝ *թվային դարաշրջան, չորրորդ արդյունաբերական հեղափոխություն, կործանարար նորարարություն, քաղաքական օրակարգի մշակում, կարգավորիչ դաշտ, ինովատիվ պետություն, վարգացում:*

ИНДУСТРИЯ 4.0. ПРОБЛЕМА ИЛИ ВОЗМОЖНОСТЬ ДЛЯ ПРАВИТЕЛЬСТВ?

ВАГЕ БАЯДЯН

*Технический университет Мюнхена (магистратура)
бакалавр инженерии,
г.Мюнхен, Германия*

ТАТЕВИК ОВАННИСЯН

*Технический университет Мюнхена (Магистратура)
магистр экономических наук,
г.Мюнхен, Германия*

Цель этой статьи – обсудить проблемы, с которыми сталкиваются правительства в новую цифровую эру, и подчеркнуть деятельность, которую государства должны предпринять, чтобы не только регулировать отрасли, но и поощрять инновации. Четвертая промышленная революция вызвала быстрые изменения во всех аспектах нашей жизни. Благодаря цифровой трансформации и активному внедрению новейших прорывных технологий (например, Интернет вещей (IoT), искусственный интеллект (AI), блокчейн и др.) в бизнес-операциях компании удастся изменить традиционные бизнес-модели и предоставлять передовые продукты и услуги, которые отвечают растущим потребностям клиентов. Ввиду того, что правительства стараются идти в ногу с технологическими разработками и использовать эффективную нормативно-правовую базу для современных предприятий, наша задача заключается в том, чтобы выявить имеющиеся для этого пути и детально проанализировать их.

Метод, используемый в статье, представляет собой подробный обзор соответствующей литературы и данных, предоставленных Национальной статистической службой. В статье предлагается, чтобы правительства активно поощряли инновации путем создания и укрепления надлежащих экосистем и инфраструктур.

Ключевые слова: *цифровая эра, Четвертая промышленная революция, разрушительные инновации, выработка политического курса, нормативная база, инновативное государство, развитие.*