

# Effect of 5G Network on Development of Digitally Dependent Industries

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**Abstract** - Information and communication technologies (ICT) are an indispensable and decisive factor in developing society and the economy. Due to the greater spread of the telecommunications network and more affordable services, these technologies have become more accessible to a larger population. In the past five years, almost all business sectors have made a certain degree of transformation of their business, bringing new digital implications. Simultaneously, all sectors, especially the service ones, are showing readiness for the digital society's challenges. Industries that are predominantly dependent on the digital aspects of doing business are continually looking for faster ways to deliver services with as little cost and downtime as possible. Objective limitations in achieving these efforts emerge in the form of Internet connectivity. The emergence of the 5G network opens up new opportunities to expand and improve existing business models and the emergence of new ones. The aim of this paper is to look at the opportunities that the 5G network brings to digitally dependent industries. The paper will use available data from relevant publishers and publications that provide an overview of forecasts within individual industries related to improvements in supply, productivity, and potential shortcomings. The paper can serve the scientific community as a conceptual design and predictor of the development of individual parts of industries that should be monitored and analyzed through the prism of various commercial applications in the coming period.

**Keywords** - 5G; digital business; Industry 4.0; digital economy

## I. INTRODUCTION

As we are daily being amazed by the progress provided by technology leaps, we are experiencing only a fraction of what technology has to offer. 5G is often closely associated with fast economic growth. However, the road to a fully commercial application has been developing for five years since the EU vision announcement on 5G. Trends show that in the coming period, the demand for fast and ultra-fast broadband Internet will increase thanks to the accelerated digitalization of all sectors and the parallel development of sophisticated platforms in the business environment. Broadband Internet represents a fundamental precondition for the realization of a broader range of digital activities. Appropriate internet connection directly affects progress in digital business development, e-commerce, connecting with public sector services, digital literacy, and adoption of various digital skills that consequently affect the development of the entire digital society. According to the

OECD [1], there are more than 95% of businesses with access to a broadband internet connection - including fixed and mobile in the EU28. These indicators unequivocally confirm that the Internet has become a necessary factor in effective businesses.

Digital Europe is a program for 2021 to 2027 that includes investments in five critical digital sectors: high-performance computing, artificial intelligence, cybersecurity and trust, advanced digital skills, and ensuring the widespread use and implementation of digital technologies in all parts of the economy and society. The guidelines in this program are aimed at all EU members to achieve balanced growth and development. They should therefore be continuously implemented and included in local and regional development plans.

Theoretically, 5G offers estimated speeds of up to 10 Gb / s, which is about 100 times faster than existing 4G networks. Remote work will be much easier to achieve, including work from home, remote control of machines, remote patient monitoring, and diagnostics. An important feature of 5G networks is connecting many devices to send information to users, communicate with each other and manage specific processes - machine-to-machine (M2M) and the Internet of Things (IoT). Smart cities will distribute energy smarter and more efficiently. 5G will also be used in critical applications requiring very high reliability and low or almost zero signal latency, including precise machine control in industry, remote patient monitoring, diagnostics, and intelligent transport systems [2].

Although 5G still has a lengthy implementation process ahead, 4G network covers almost the entire European population, which is a good indicator on the demand side, so the transition to a faster and more reliable broadband connection is expected. In some cases where countries already have telecommunication infrastructure, it can be expected to develop network capabilities and better performance further, but not for all countries to that degree. When considering the worldwide population, there is still almost 40% of people or 3.2 billion that are still not connected [3]. The importance of digital connectivity is defined as a social right in the EU as one of the pillars for achieving a fairer Europe and strengthening its social dimension [4]. Even though the connectivity divide among some parts of the world is likely to persist or even grow, specific action plans are designed to tackle these problems and have a more inclusive approach.

## II. INDICATORS FOR DIGITAL COMPETITIVENESS

Since 2015, the European Commission has been monitoring Member States' digital competitiveness through the Digital Economy and Society Index (DESI) report. In DESI reports by Member State, quantitative evidence of indicators within the five categories of the index is combined with insights into individual countries' policies and best practices. There is a slight disparity in connectivity indicators between member states, but overall numbers are encouraging. (Fig. 1)

	EU	
	DESI 2018	DESI 2020
<b>1a1 Overall fixed broadband take-up</b>	<b>75%</b>	<b>78%</b>
% households	2017	2019
<b>1a2 At least 100 Mbps fixed broadband take-up</b>	<b>15%</b>	<b>26%</b>
% households	2017	2019
<b>1b1 Fast broadband (NGA) coverage</b>	<b>79%</b>	<b>86%</b>
% households	2017	2019
<b>1b2 Fixed Very High Capacity Network (VHCN) coverage</b>	<b>26%</b>	<b>44%</b>
% households	2017	2019
<b>1c1 4G coverage</b>	<b>91%</b>	<b>96%</b>
% households (average of operators)	2017	2019
<b>1c2 Mobile broadband take-up</b>	<b>90</b>	<b>100</b>
Subscriptions per 100 people	2017	2019
<b>1c3 5G readiness</b>	<b>NA</b>	<b>21%</b>
Assigned spectrum as a % of total harmonised 5G spectrum		2020
<b>1d1 Broadband price index</b>	<b>NA</b>	<b>64</b>
Score (0 to 100)		2019

Figure 1: **Connectivity indicators in DESI**  
Source: DESI 2020., European commission

Depending on how successfully and quickly an individual country is digitally transformed, it reveals and how competitively it will take advantage of the possibilities of 5G technology. Some authors argue that the existing DESI index results from prevailing trends and efforts, and it is not expected to increase at the same rate as before. However, instead, it will be an opportunity to utilize and maximize its potential. Countries that can quickly react to a growing demand for innovative solutions will eminently impact their macroeconomic prospects.

Development implications for digitally dependent industries are closely linked to the increase in data transfer capabilities. The first industries to experience these benefits are manufacturing, telecommunications, tech companies, and media and entertainment publishers, as they will enable faster adoption among a broader audience. Further development will include all other business from healthcare and tourism to the full range of service providers. This new service offering implies a transition from a 'horizontal' service delivery model, where services are provided separately from the demands of customers to a 'vertical' delivery model, where the services offered are customized to particular segments of individuals or businesses [5].

## III. INDUSTRIES MOST LIKELY TO BENEFIT FROM 5G

There is an ongoing discussion on what industries will benefit the most from 5G network. It comes down to their readiness to embrace and adapt to the new possibilities it offers. Many reports and studies confirm that some industries are more ready than others to embrace the revolution that 5G brings to businesses and the economy

at large. The emphasis on this list is on vertical industries that already have a maturity in technology adoption.

### A. Manufacturing

5G technology brings changes in production primarily by optimizing various production operations that become more efficient, safer, and more flexible. Such shifts contribute to the expansion of smart factories' concept that, with the help of automation, augmented reality, and artificial intelligence, extend modern enterprises' boundaries. Furthermore, the factory of the future relies on the ability to operate and provide advanced predictive maintenance for the equipment and control supply chain equipment remotely. Machines perform predictive and preventative maintenance using dozens of sensors to give an accurate, real-time representation of a machine [6]. Enhancements are also evident in the area of equipment monitoring and machine-to-machine communication. Real-time communications within enterprise aimed at monitoring assets distributed in broader geographical areas across the value chain. Augmented reality supports such tasks as education and training in otherwise expensive settings, providing real-life simulations in the design, maintenance, and repair domain [7].

### B. Automotive industry

Four fundamental innovations in the auto industry driven by the rapid flow of information will impact safety, comfort, efficiency, and change within the demographics. Although great strides have been made in driving safety, there is still significant interest within the automotive industry in emphasizing safety. Primarily in protecting vulnerable groups in traffic such as children and cyclists through the integration of technologies for timely response and identification of potential hazards. The comfort category is also greatly influenced by technological advances. Helping drivers during repetitive driving actions raises the level of enjoyment and reliability during day trips. Efficiency is reflected in better planning of travel routes with as few delays as possible, saving fuel and energy and positively impacting the environment. Traditional models of purchasing and costs associated with owning a vehicle are changing, opening up opportunities for the emergence of new business models that will better meet the current needs of modern living [8]. Perhaps the auto industry's most disruptive technology will be the introduction of autonomous vehicles, which is an extension of already implemented but not perfected assisted driving. This new paradigm will have a positive impact on all before mentioned innovations.

### C. Marketing, media, and entertainment

The main changes will be visible in the way the media and its consumers interact. For example, virtual reality-based applications are projected to generate more than \$ 140 million in the period 2021 to 2028 [9], making it an entirely new and relevant channel of communication. So far, successful advertising models will be complementary to an even more engaging experience. A large share of media content will come in the form of video, an already data-intensive media element. The gaming industry will

experience a major revolution with the integration of AR and VR technology. The new media experience will be expanded with an immersive experience of consuming content via 4K / 8K displays, voice control, and 4D experience. In addition to the previously mentioned advances in advertising, marketing can expect to introduce new key performance indicators of individual activities through technologies such as biometrics and eye-tracking.

#### D. Healthcare

5G technology in healthcare will be of particular importance, especially to communities where healthcare service is not widely available. Improvements like access to health data and life-saving assistance via mobile devices. 5G will also enable a fuller use of wearable technology, which has now primarily become healthcare equipment. Furthermore, assistance during real-time operations and medical staff training will strengthen existing collaborations that will no longer depend on geographical distance.

#### IV. RISE IN NEW TECHNOLOGY DEVELOPMENT

All mentioned industry advances are enabled by new technology developments fueled by 5G that could be summed up in five global trends [10]: IoT, Data privacy, Cloud computing, AI, and machine learning, bridging the digital divide. The Internet of Things has only been partially implemented due to the low bandwidth of Internet connectivity with the available infrastructure. As the number of connected devices or IoT increases, more data will be generated, and for that to be feasible, we need next-generation connectivity. Staggering 41.6 billion IoT devices will be generating 79.4 zettabytes of data in 2025 [11]. The devices will increase their capabilities and generate large amounts of metadata that will be useful in reducing the time of consumer adoption of innovations. Consequently, such innovations also introduce the need for better regulation of privacy issues. Telecommunications providers will play a significant role in the development and implementation of these regulations.

Some of the main terms and regulations to which users are sensitive are the transparent communication of the provided service, the possibility to manage preferred features, and clearly stated instances where consent is needed for further use of sensitive data. Cloud computing is not a market novelty, but it is taking on a new use-value with 5G connectivity. Namely, the greater need for data storage and the possibility of access to this data opens the door to the development of new pricing models from which telecommunications entities and tech companies will feel the most benefits. AI and machine-learning are the latest buzzwords associated with the dawn of 5G revolution. Basically, it enables algorithms to be more efficient and faster at the same time. Faster speeds will reduce capital expenditure, optimize network performance and new revenue streams, and improve customer service and enhance customer experience [12].

Along with the introduction of the 5G network, some shortcomings appear in the form of deepening the digital divide. Incomplete or partial 5G signal coverage suggests a further widening of the digital divide, but this time not between the poor and the rich but those living in rural and those living in urban areas. However, it seems reasonable to invest in the 5G network in places with the highest usability. However, negative influences can lead to additional stratification in society. In this case, local initiatives and governments' support and activity in further stimulating and finding solutions to these serious issues is necessary.

#### V. OVERVIEW OF USERS, COUNTRIES AND INDUSTRY READINESS FOR 5G

How industries respond to the upcoming 5G era is best illustrated by an overview of several reports shown below. However, before we see how individual countries and industries prepare, one should look at user search habits to better understand people's interests and preparation for 5G-related issues. Access to data provided by the Google trends tool can help us better understand these trends. The data available through this service show the emergence of interest in searching for the term 5G among users only in 2018 (Fig 2).

Data available over Google trends service is not indicative in the sense that it shows users specific interest in topics concerning 5G. In contrast, they have shown raised concern about health risks linked to the introduction of 5G network. As 5G becomes more commercially present, it is expected that interest among users and their inquiries will grow. For the EU, inCITES Consulting has developed a methodology for assessing European countries' readiness to implement and adopt 5G technology. As expected, according to the proposed index, the best-ranked countries are from Western Europe: Finland, Switzerland, Germany, Denmark, and Sweden. These countries have consistent results in the following categories: infrastructure and technology, regulations, innovation, human capital, country profile, and demand. In southern European countries, the variability of results occurs.

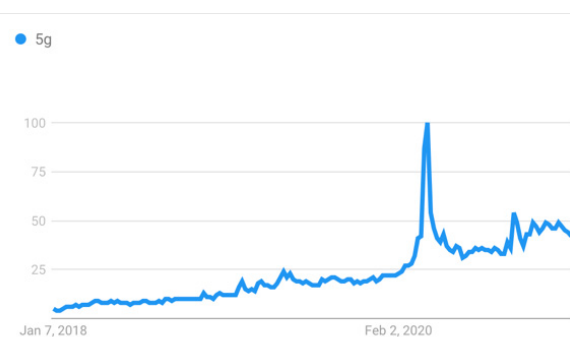


Figure 2: Interest over time: 5G query  
Source: Google trends

The higher search rate that appears in 2019 is mostly in direct correlation with the terms related to consumer electronics and their planned launch dates for 5G capable smartphones. Peak interest among users is recorded in the first half of April in 2020. Unfortunately, this could be linked to false claims about certain 5G health risks and the worldwide covid-19 pandemic in that period. Google trends category overview shows the most interest in the auto and vehicle section where there is a steady query interest from 2018 till today (Fig 3).

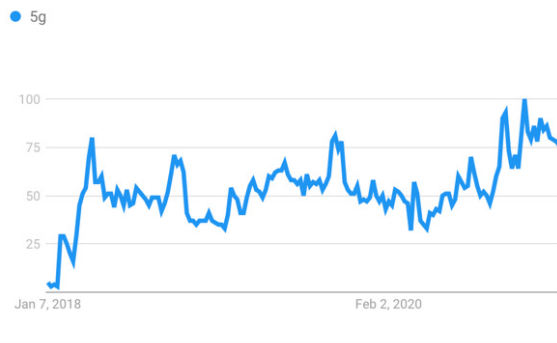


Figure 3: Interest over time: 5G query (auto and vehicle category)  
Source: Google trends

While in some categories they achieve good results, in others they lag. In this analysis, Eastern European countries lag the most with weaknesses in the Regulation and Policy and Innovation Landscape. Similar, but with slightly worse indicators, are the Balkan countries. Countries that have traditionally been pioneers in technology development and adoption lead the 5G race in Europe [13].

Industries, on the other, recognize opportunities behind the 5G introduction. Some have a more passive role, while others have already made some significant investments in that area. For instance, Bell Labs Consulting [14] has released a research report showing that 86% of decision-makers have some strategy for 5G, but only 15% are currently investing in its implementation. Also, the fact that 57% of organizations plan to invest within the next five years suggests that they are still gathering information and evidence to help them decide how they can use the potential of 5G best. Another telecommunication provider, Ericsson, has released the report based on its research on the industry impact of 5G [15].

Key findings show that since the survey was conducted in recent years, interest in this technology has increased in all industries. Companies see the most significant advantages in taking the position of innovators within a certain industry, which will consequently have a favorable effect on their efficiency and cost reduction. Of course, barriers in the form of transition to new systems dependent on rapid connectivity and security, in general, have also been identified. On average, industries most likely to use 5G to create new consumer offerings are energy/utilities, financial services, and agriculture. On average, the healthcare, retail, and car industries stand out

the most for creating consumer value. In contrast, the car industry, healthcare, retail, and agriculture expect the most increase in business optimization.

## VI. CONCLUSION

The paper deals with the effects of the introduction of the 5G network on digitally dependent industries, countries and consumers. A constructive discussion was made to examine all participants' initial adaptation levels in the digital transformation of an economy that knows no boundaries. An indispensable part of this picture is undoubtedly the current status of countries in implementing the introduction of 5G infrastructure and adapting users to the new opportunities it offers. The review confirms the value and benefits of rapid connectivity and its impact on all social and economic spheres. Giant technological leaps like this necessarily leave behind barriers as well. Given that the paper examines the possibilities of this exciting and disruptive new technology, recommendations for further research could go in the direction of establishing new business models that will make even better use of the improved capacities of services, products, and concepts. Furthermore, it would be opportune to explore and anticipate the emergence of a wide range of innovative services for businesses and individuals as these demands arrive with an everchanging digital environment. For companies to remain relevant, they face a mix of challenges in risk acceptance and significant transformations that often represent a departure from the current business philosophy. However, companies are not the only ones put to the adjustment test. Although the introduction of 5G connectivity is seen as another step towards greater inclusion, most studies warn that there is an objective risk of widening the digital divide. Adaptation at the country level is expected to occur depending on the demand for this type of service, the readiness for the economy's digital transformation, and the governments' ability to implement appropriate policies.

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