DIGITALIZATION AND REGIONAL COMPETITIVENESS: A BRIEF SUMMARY

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INTRODUCTION
This manuscript acts solely as a brief and concise summary on the research carried out during the ÚNKP-17-3 New National Excellence Program of the Ministry of Human Capacities in a clear and transparent manuscript format. During my Scholarship the main focus of my research topic revolved around regional competitiveness and various aspects of digitalization, as the latter is a phenomenon which becomes more and more embedded in our everyday lives and is capable of changing society and the economy.

From day to day, we learn more about digitalization, and through research, we are able to chart and identify the challenges and core advantages that can come with digitalization on a broader scale in the short and long run as well.

What is certain that digitalization is a popular buzzword and a key driver of research, a main focus of professionals of several industries and policymakers alike. Our world is in a transitional phase as we are more and more connected globally with each other. People are able to connect with people and smart devices, and vica versa. We also experience a change in mapping consumer behavior as behavioral economics gain significance and also there is a change in how we handle and analyze enormous amounts of data in the world of Big Data (Zuti 2018a, Hollingworth – Barker 2017, Kovács 2017a, Kovács 2017b, Yoon 2017, Magruk 2016, Manyika et al. 2016, Özköse et al. 2015, Brynjolfsson–McAfee 2012).

As our social and economic environments undergo a transitional phase, the mindset related to the structure of society and economy needs to adapt as well to the new conditions (Zuti 2018a, Schwab 2017, Leonhard 2016).

DIGITALIZATION AND COMPETITIVENESS
Through the debate of professionals and academics on the boundaries related to competitiveness, we can differentiate two main points of view (Huggins et al 2014a, Huggins et al 2014b). As the first group views it, competitiveness can be only recognized in the case of enterprises and on a microeconomic level. This means they disagree with the fact that competitiveness can be defined in case of territorial units (Lengyel 2010, Polenske 2004, Dicken 2003, Krugman 1998, Krugman 1994). As the second group views it, competitiveness can be defined in case of territorial units as well, which means competitiveness is a valid definition on a micro- and macroeconomic level as well (Lengyel 2010, Porter 2008, Dahlman 2007, Lengyel–Rechnitzer 2004, Chesire 2003, Martin 2003, Camagni 2002, Malecki 2002, Markusen 1996, Porter 1996).

In this manuscript, the latter view is accepted.
Apparently, competition and rivalry have been part of the history of humankind in a direct or indirect way. Based on Lengyel (2010, p. 100) and Batey and Friedrich (2000, p. 4) we can differentiate several forms of the mentioned rivalry. There is a level of rivalry among living organisms (for food, a place to live and for the sake of biological reproduction). We can also see this rivalry among social groups (e.g. communities, political parties, religions), whose goal is to gain authority, power or influence. Rivalry can be identified also among economic units, which compete with each other in order of acquiring a certain degree of economic benefits. The latter example is the only one where we can we can interpret competition as a definition from a purely economic perspective (Lengyel 2010).

The standard definition of competitiveness is widely known (EC 1999, p. 75): “competitiveness is defined as the ability of a region to generate, while being exposed to external competition, relatively high income and employment levels. In other words, for a region to be competitive, it is important to ensure both quality and quantity of jobs”.

The definition builds on income and employment levels, however in an era of digitalization, a proper mixture of exogenous and endogenous elements together enhance the competitiveness of economies and regions (Camagni 2009, Capello 2009).

An important milestone has been achieved recently in the case of digitalization and competitiveness, as the IMD (2017) created a definition and a framework of digital competitiveness. Digital competitiveness can be described as follows (IMD 2017, p. 19): “digital competitiveness is defined as the capacity of an economy to adopt and explore digital technologies leading to the transformation in government practices, business models and society in general. In this way, firms increase the opportunities to strengthen future value creation”.

Table 1 represents the framework that has been created by IMD related to digital competitiveness (IMD 2017, p. 21).

| Knowledge | Talent | Training and education | Scientific concentration |
|-----------|--------|------------------------|-------------------------|
| Educational assessments, International experience, Foreign highly-skilled personnel, Management of cities, Digital/Technological skills, Net flow of international students. | Employee training, Total public expenditure on education, Pupil-teacher ratio in tertiary education, Graduates in Sciences, Women with degrees. | Total expenditure on R&D (%), Total R&D personnel per capita, Female researchers, Scientific and technical employment, High-tech patent grants. |

| Technology | Capital | Technological framework |
|------------|---------|-------------------------|
| Starting a business, Enforcing contracts, Immigration laws, Technological regulation, Scientific research legislation, Intellectual property rights. | IT & media stock market capitalization, Funding for technological development, Banking and financial services, Investment risk, Venture capital, Investment in telecommunications, | Communications technology, Mobile broadband subscribers, Wireless broadband, Internet users, Internet bandwidth speed, High-tech exports (%). |

| Future readiness | Business agility | IT integration |
|------------------|------------------|---------------|
| E-Participation, Internet retailing, Tablet possession, Smartphone possession, Attitudes toward globalization. | Opportunities and threats, Innovative firms, Agility of companies, Use of big data services, Knowledge transfer, | E-Government, Public-private partnerships, Cyber security, Software piracy. |

Source: own construction based on IMD (2017, p. 21)
The definition builds upon traditional (e. g. productivity, income) and new elements as well (e. g. the state of gender equality, internationalisation, etc.) (Zuti 2018b). The structure of digital competitiveness incorporates three main components (knowledge, technology and future readiness) and nine sub-components (talent, training and education, scientific concentration, regulatory framework, capital, technological framework, adaptive attitudes, business agility, IT integration) (IMD 2017, p. 21).

**THE FOURTH INDUSTRIAL REVOLUTION**

In retrospect, we can summarize that the first industrial revolution commenced around the end of the 18th century, when steam machines were introduced. The use of these machines started to spread widely. The second industrial revolution occurred at the beginning of the 20th century. At this time, electricity-powered solutions enabled the creation of the assembly line and the concept of mass production. The third industrial revolution eventuated around the 1970’s, when IT technologies and automation started to get utilized by industries (Hwang 2016, Kagermann et al. 2013).

The phenomenon that we know as the fourth industrial revolution is mainly catalyzed by digitalization and it affects the fundamental structures of society and economy directly (Schmidt et al. 2015, Dujin et al. 2014). Based on the anticipations of Kovács (2017a, p. 825), the fourth industrial revolution will generate the greatest impact regarding the following technology sectors: Big Data analysis, autonomous machines, robotics, simulations, integration of horizontal and vertical systems, Internet of Things, cyber security, cloud computing, additive manufacturing and augmented reality.

There are a number of definitions from several groups of authors on the fourth industrial revolution.

Based on Pfohl et al. (2015, p. 37): “Industry 4.0 is the sum of all disruptive innovations derived and implemented in a value chain to address the trends of digitalization, autonomization, transparency, mobility, modularization, network-collaboration and socializing of products and processes”.

Based on the research of Schuh et al. (2017, p. 10) the fourth industrial revolution is: “real-time, high data volume, multilateral communication and interconnectedness between cyber-physical systems and people”.

Based on the definition of Smit et al. (2016, p. 20): “Industry 4.0 describes the organisation of production processes based on technology and devices autonomously communicating with each other along the value chain: a model of the ‘smart’ factory of the future where computer-driven systems monitor physical processes, create a virtual copy of the physical world and make decentralised decisions based on self-organisation mechanisms”.

The big picture behind the definitions is that a world is being born where there is a constant communication among people, smart devices and machines.

**DIGITALIZATION AND MOBILITY**

Digitalization itself can reinvent the industry of mobility and also how we think of cities and plan their structure. As digitalization acts also as a driver for improving urban mobility, the topic is also well-researched nowadays (Zuti 2018b). As a result, the whole automotive industry experiences change and is impacted by new results from one day to another. The main aim of the renewal of mobility can be summarized by two key concepts.

The first is the accessibility concept of Litman (2017, p. 6) which is described as: “the ease of reaching goods, services, activities and destinations, which together are called opportunities. It can be defined as the potential for interaction and exchange”.

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The second concept revolves around a mindset change from individual ownership of mobility products to thinking about mobility as a service (MaaS) all in all (Foulser 2017, Goodall et al 2017). Foulser (2017, p. 8) identifies three groups as main stakeholders in the MaaS paradigm, these are the following:

- **Customers:** They are central elements of transport systems and their core driver is identified as high-level user experience.
- **Mobility services providers and operators:** They are the companies or authorities who operate and maintain services. Companies mainly put emphasis on their financial returns.
- **Authorities:** They are actors who are empowered to intervene in the transportation system through legal action and possess regulatory supervision rights. Authorities focus on the establishment and maintenance of cost-efficient, widely accessible mobility solutions.

Mobility is a crucial element of societies and economies, as it enables access to resources or to destinations (Piccinini et al. 2016). The main goals of new urban mobility are well-described by Benevolo, Damieri and D’Auria (2016, p. 15-16):

- The reduction of air pollution and emitted contaminants;
- The reduction of traffic congestions;
- The reduction of noise pollution;
- The reduction of transfer costs;
- The increase in the physical safety of people;
- The improvement of travel speed.

Besides the above advantages that can be realized based on the expectations and assumptions, it is at least equally important to address the potential challenges that revolve around mobility solutions enabled by digitalization. These challenges can be risks related to the operation of the vehicle, health, cybersecurity, climate, economy, trust and fundamental morals and ethics of society (CGPS 2017, Clements–Kockelman 2017, Fleetwood 2017, Holstein 2017, Bonnefon et al. 2016, Corwin et al. 2016, Schreurs–Steuwer 2016, Trappl 2016, Winkle 2016, Yan et al. 2016, Blyth et al. 2015, Barcham 2014, Schoettle–Sivak 2014, Yeomans 2014).

**Digitalization and Higher Education**

In today’s world, we can identify a demographical shift, namely the appearance of Generation Z in higher education and the labor market. We call them “digital natives”, as technological solutions and smart devices were easily accessible for them even from a very young age (Prensky 2001).

The significance of soft skills like adaptivity or critical thinking becomes inevitable besides the hard skills and the knowledge that individuals possess in order to succeed. This is because automatization and robotization are becoming more common in numerous industries, hence there is also a social shift present (Leonhard 2016, WEF 2016, Kampylis – Punie – Devine 2015, Kortuem et al 2013, Chris – Binhui 2011, Lai 2011). The core idea that Toffler (1990) presented is crucial: we need to be able to learn, unlearn and relearn in a fast-paced environment.

Universities need to adapt to the changing status quo as well. They need to become institutions that promote innovative thinking, efficient communication among students and teachers via an interactive, inclusive environment by also capitalizing on the opportunities presented by technology (WEF 2017, French – Shim 2016, Gros – López 2016, WEF 2016, Kortuem et al 2013, Chris – Binhui 2011, Zuti 2018c).

Technological solutions to boost cooperation and efficiency are already present in certain environments. Synchronous Online Teaching (SOT) can be compared to a video conference with a study purpose: Students can connect to the class from anywhere around the
The sibling of this teaching mode is Asynchronous Online Teaching (AOT), which means that students can continue their study progress independently from other students, without geographical or time constraints (Zuti 2018c, Murphy et al. 2011, Powell – Patrick 2006). These solutions of self-development can add positive impact to the concept of lifelong learning ambitions (Zuti 2018c, Hrastinski 2008).

Blended learning solutions can be described as a method that utilizes the advantages of online and traditional teaching methods. With this mixture of methods, the personal contact and positive impact of ICT technologies and the quick and easy accessibility of curriculum can be realized (Zuti 2018c, Cher Ping – Tianchong 2017, Owston et al. 2013, Castle 2010, Collopy – Arnold 2009, Dziuban et al. 2006, Carman 2005).

Massive Open Online Courses (MOOC) are popular alternatives that align with the changing needs of students. These changing needs include quality and cost-efficient education without any geographical or time-related boundaries. The planning of these types of courses revolves around active participation and creating a discussion regarding real life cases and the improvement of critical thinking is also a crucial factor (Zuti 2018c, Jewitt 2017, Patru – Venkatamaram 2016).

The Bring Your Own Device (BYOD) concept focuses on the fact that for solely study purposes, the use of smart or portable devices like laptops, tablets or smartphones is permitted in the classroom, hence adding value to the study experience (Zuti 2018c, Burns-Sardone 2014, Afreen 2014).

**DIGITALIZATION AND GOVERNMENTS**

The renewal of the public sector also seems to be inevitable in the current social and economic transition catalyzed by digitalization. An experimental definition for the digital government can be phrased as follows: “Digital government refers to the production of and access of data, services and content, sourced and distributed across the digital ecosystem, to create public value” (Kloes et al. 2015, p. 5).

The governments of the future should be established in a way that is advantageous both for the civil and business sectors, as highlighted by the European Commission (Zuti 2018d, EC 2016). There is a strong focus on accelerating the digital transformation of the governments throughout Europe. The European Commission also highlights 7 foundational principles when planning and designing the digital government (EC 2016, p. 4):

- **Digital by default:** The services provided by public institutions should aim to promote their service delivery from a digital perspective.
- **Only once principle:** Data should be collected once from citizens and economic actors once and should use them aligned with data protection regulations.
- **Inclusiveness and accessibility:** The design of services should aim toward inclusivity and should be able to satisfy different needs.
- **Openness and transparency:** Control and access related to stored data and information should be enabled to the respective citizens and businesses.
- **Cross-border by default:** Digital public services should be uniform within the Digital Single Market.
- **Interoperability by default:** All services should work smoothly throughout the Digital Single Market.
- **Trustworthiness and Security:** Personal and business data protection, appropriate security arrangements should be core foundations of all services provided.

As highlighted by the European Commission (EC 2016, p. 1): “The digital transformation of government is a key element to the success of the Single Market”.

Electronic copy available at: https://ssrn.com/abstract=3205442
POLICY IMPLICATIONS RELATED TO DIGITALIZATION

The most recent and most important regulation change related to the digital world is the go-live of GDPR. On 25 May 2018, the regulation replaced the former Data Protection Directive (Directive 95/46/EC) (Zuti 2018b, EC 2018). The GDPR can be understood as a framework aiming towards decreasing risk related to data management and acts as a legal tool on how data should be handled in the European Union (Zuti 2018b, Room et al. 2018). From the perspective of the individual this will mean more control over personal and private data. From the perspective of companies, it will act as a guide consisting of transparent and clear rules related to the secure and handling of personal data.

The communication of GDPR includes the eleven key points of the framework, which can be identified as follows (EC 2018, p. 2-4):

- A harmonized legal framework leading to a uniform application of rules to the benefit of the EU digital single market.
- A level-playing field for all companies operating in the EU market.
- The principles of data protection by design and by default.
- Stronger individuals’ rights
- More control over personal data for individuals
- Stronger protection against data breaches
- The Regulation gives all data protection authorities the power to impose fines on controllers and processors
- More flexibility for controllers and processors processing personal data due to unambiguous provisions on responsibility (the accountability principle)
- More clarity on the obligations of processors and the responsibility of controllers when selecting a processor
- A modern governance system to ensure that the rules are enforced more consistently and strongly
- The protection of the personal data guaranteed by the Regulation travels with the data outside the EU ensuring a high level of protection.

The operation and maintenance of the framework will be the task of the European Data Protection Board, and this institution will act as a central entity for data protection of Europe. A report based on the experiences and key takeaways of the introduction of GDPR will be published in 2020. The framework then will be reevaluated if necessary (Zuti 2018b, EC 2018).

CONCLUSIONS

Every day we can learn something new that is related to digitalization and how this phenomenon may change our lives, our society and economy in the long run. There is a huge territory unknown to us that needs to be explored via research and real-life experience. We are aware of the fact that we can create a world where technology can be a facilitator of everyday life, however we must also be precautious, proactive and seek a life where our physical and virtual presence is in balance. The key point is to understand that we need to create and build the open and multidisciplinary discussion among various stakeholders, e. g. professionals, the academia, the civil sector or policymakers, etc. Digitalization is a complex phenomenon and the changes that are brought require a high level of attention and research.

In this manuscript, I briefly summarized the 6 topics that were in focus during my research on digitalization and regional competitiveness.
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