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Digital New Deal: Researching V4's Strategies for Society 4.0

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Content

1. Introduction

Kryštof Kruliš

The new concept of a future 4.0 factory was presented at the Hannover trade fair for the first time already in 2011. It promised a new way of production that will be flexible, effective and ready to mass produce individualized products with lower demand for a human labour force. Japan may be currently ahead of Germany and US firms are considered to approach 4.0 technologies in the most complex way.[1] For the central European region it will most probably be Germany, as the biggest purchaser of regional exports, who will set the pace for adoption of new industrial technologies.

The economic convergence of V4 countries to the EU average (per capita GDP and by added value) is still an endeavour for many decades. During those future decades the economic and social environment will be strongly influenced by new technologies, including the Internet of Things, automatization and robotization, Artificial Intelligence and Machine Learning, autonomous cars and drones, blockchain and various new ways of using the internet in everyday life and for economic transactions. The concept of 4.0 already escaped its industrial bounds and is now used to cover all technological advances that will influence not only the manufacturing sector, but also provision of services, logistics and spending free time. All this will bring substantial economic and social changes also to the central European region. Growth patterns that have been employed recently in our region may not be available in the near future.

The opening research paper of the project Digital New Deal for V4 consists of four country reports with SWOT analyses identifying Strengths, Weaknesses, Opportunities and Threats for Hungary, Poland, the Slovak Republic and the Czech Republic in regards to their transformation to Industry/Society 4.0. Each country report includes a descriptive country report on 1) what the official strategies in this field are (e.g. are there sectoral or horizontal strategies of government/individual ministries, how are these structured?), 2) who is in charge (which official body is responsible for this matter, are there working groups with participation of other stakeholders?) and 3) identify the main stakeholders who comment on this matter in the media and the main ideas they stress (politicians, government officials, think-tankers/scholars, representatives of industry, labour unions or consumer organizations). The exact extent of the subject matter depends on the specific discourse in each country as different countries tend to stress different aspects. Based on this data the reports also include a one-page SWOT matrix in bullet points.

This research paper offers an initial mapping of approaches adopted by V4 countries in preparation for the arrival of the 4.0 era. In later phases it will be used to develop a questionnaire for interviews with the main stakeholders in each country and formulation of the final policy paper summarising perspectives of leading stakeholders on the possible impact of 4.0 technologies on the economy, society and the overall political and strategic positions that may develop in our region in future decades.

[1] National Initiative Industry 4.0, available at: http://www.businessinfo.cz/app/content/files/dokumenty/narodni-iniciativa-prumysl-40.pdf, p. 41.

2. Hungary

Maté Hajba

2.1 Introduction

In Hungary, the digital economy represents about 20% of the Gross Value Added (GVA) of the economy, and it employs 15% of all employees.[2] The ICT sector accounts for 12% of the country's GDP.[3] It is therefore important for the country's economy, to have plans, which will keep up with the technological progress. This paper will examine what these plans are, what strategies and programmes exist, and provides a SWOT analysis to assess the general situation of Hungary with regards to digitalization.

Hungary's main goals with regards to digitalization and industry 4.0 are set forth in the National Infocommunication Strategy 2014-2020. Most of the other strategies and programmes are in harmony with this and complement this strategy. The ambitious project, along with the Digital Success Programme aims to digitalize the state, the economy, grant most people access to the internet, and develop digital competencies.

The different strategies and programmes are listed below, although many of them intertwine, complement one another and are in cooperation and in accordance:

- National Infocommunication Strategy
- Digital success programme
    - Digital child protection
    - Digital export development
    - Digital education
    - Digital startup
    - DJP2.0
- The Superfast Internet Programme
- Digital Hungary
    - Superfast internet
    - Digital community and economy
    - E-government (administration)
    - Digital competencies
- Public Services and Public Administration Development Operational Programme
- NAV 2.0
- Industry 4.0
- Instant payment, FinTech

[2] According to the Digital Startup Strategy of Hungary, published in 2016, available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/strategies.

[3] According to the National Infocommunication Strategy 2014-2020, published in 2014, available at: https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiko-iE_NjYAhUJElAKHWmVDOoQFggoMAA&url=http%3A%2F%2Fwww.kormany.hu%2Fdownload%2F5%2Fff%2F70000%2FNIS_EN_clear.pdf&usg=AOvVaw3Y2D4uVoOCNlJJDHvPlk1E.

2.2 Strategies

2.2.1 NATIONAL INFOCOMMUNICATION STRATEGY 2014-2020[4]

Introduction

Hungary's main agenda to modernize its infrastructure, economy, and to introduce its citizens to the digital age, is outlined in **the National Infocommunications Strategy 2014-2020 (NIS).** This document expresses the importance of the infocommunications sector, which accounts for 12% of Hungary's GDP, and the country has a larger number of employees in this sector than the majority of OECD countries. However the population as well as the business sector don't fully utilize the possibilities of ICT tools.

As the document states: "The purpose of this strategy is to give a comprehensive overview of the current situation of the Hungarian information society and the ICT market, to define the ideal target situation and to identify professional trends and development targets in infocommunications for the same period as the 2014-2020 planning cycle."

The strategy is in accordance with EU, and national strategies. "The main responsibility for the implementation of the strategy lies with **the Infocommunications State Secretariat of the Ministry of National Development** (MND) jointly with **the Ministry of Public Administration and Justice** (Deputy State Secretary in charge of E-administration). Within the pillar 'Infrastructure' **the National Media and Infocommunications Authority (NMIA)** is responsible for the implementation of the regulatory measures."

Outline

The NIS outlines the following 4 vertical pillars, and 3 horizontal pillars.

The vertical pillars are the following: **Digital infrastructure** with a dominant role of the state owned MVMNet, which should be responsible for the electronic communication infrastructure development both in the backbone and backhaul segments. Development of smart meters and smart grids is also envisaged in the field of energetics. **Digital competences** address various aspects of digital literacy and utilization in most parts of the society, including those lagging behind durably (e-inclusion). The **Digital economy** with incentives to development of ICT and related R&D. Finally, the **Digital state** pillar focuses on electronic services in public administration and in health, education, libraries, cultural heritage related services, as well as ensuring the security of those services.

Three further horizontal factors have also been identified in terms of context of the vertical pillars. They include **E-inclusion** supporting citizens missing from the digital ecosystem so that they can still benefit from it as much as possible; **Research-development and Innovation** activity in the ICT sector and other sectors using ICT instruments and applications; and **Security** stressing maximum protection of critical information systems and the user data contained therein.

[4] The National Infocommunication Strategy 2014-2020, available at: https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiko-iE_NjYAhUJElAKHWmVDOoQFggoMAA&url=http%3A%2F%2Fwww.kormany.hu%2Fdownload%2F5%2Fff%2F70000%2FNIS_EN_clear.pdf&usg=AOvVaw3Y2D4uVoOCNlJJDHvPlk1E.

Implementation

It is still early to judge the success of the NIS. In 2017, the government accepted the monitoring report of NIS for 2016[5], which compares datasets from 2013, 2014, and 2015. According to the report, in total there are 71 measures and actions, and 60 measures and actions are currently being implemented. For indicators the monitor also relies on the EU's Digital Economy and Society Index, the most recent, 2017 edition of which shows that Hungary is 21st in the EU, with a score of 0.46. The EU average is 0.52. In 2016 Hungary's score was 0.43, while the EU average was 0.49. However in 2016, Hungary was 20th. So **all in all Hungary managed to improve, but not as well as other countries.**[6]

According to the monitor, Hungary is doing well with regards to digital infrastructure, but is lagging behind in digital competencies. Hungary's largest handicap is in Integration of Digital Technologies, and Digital Public Services. In the areas of Connectivity, and Use of the Internet, Hungary is above the EU average.

2.2.2 DIGITAL SUCCESS PROGRAMME

In accordance with the National Infocommunication Strategy, and EU strategies, and in order to complement them, Hungary has launched **the Digital Success Programme (DSP)**. Its legal background was set in 2015, and by 2016, following a national consultation, **four strategies** had been published under the programme: The Digital Startup Strategy of Hungary, The Digital Education Strategy of Hungary, The Digital Export Development Strategy of Hungary, and The Digital Child Protection Strategy of Hungary.

The Digital Startup Strategy (DSS) claims a preference for a flexible regulatory environment and aims to support the whole ecosystem of Hungarian startups. For this, two horizontal instruments are employed: a) The Action Plan aiming to put the measures of the strategy into operation, break them down by persons in charge and deadlines and b) The Startup Hungary Centre for Methodology and Coordination that is responsible for breaking down the measures of the strategy into action plans and coordinating implementation.

As the strategy was published in 2016 December, it is too early to assess how successfully it is being implemented. Hungary has launched an organization (Startup Hungary Koordinációs és Módszertani Központ),[7] tasked with coordinating, monitoring, and implementing startup programmes, in accordance with the DSS. The strategy outlined the importance of a favourable economic environment for digital startups, with a favourable tax code. As per the Digital Success Programme, the VAT on internet usage has reduced to 5%, effective from January 1, 2018.[8]

The Digital Education Strategy (DES)[9] aims to integrate digital solutions into education, both from the side of teachers and students. Digital networks, and digital devices should be used by both parties, and digitalization should play a part in teaching. Upcoming generations should need digital skills in the job market.

[5] Nemzeti Infokommunikációs Stratégia 2016, available at: http://www.kormany.hu/download/d/22/21000/NIS_monitoring_v%C3%A9gleges.pdf.
[6] Digital Economy and Society Index 2017, available at: https://ec.europa.eu/digital-single-market/en/scoreboard/hungary.
[7] The website of the organization available at: https://djnkft.hu/startup-hungary-koordinacios-es-modszertani-kozpont/.
[8] The Digital Success Programme, available at: http://www.kormany.hu/hu/miniszterelnoki-kabinetiroda/digitalis-jolet-program/hirek/ot-szazalekra-csokken-az-internethasznalat-afaja-jovo-evtol.
[9] The Digital Education Strategy, available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/strategies.

DES is constructed alongside the following pillars: Public education, Vocational education, Higher education, and Adult learning. It utilizes Monitoring of the learning path and stresses Accessibility for persons with disabilities in education and training and the safe use of digital platforms.

In line with the objectives set forth in DES, a centre (Digitális Pedagógiai Módszertani Központ)[10] was set up to make recommendations with regards to the implementation of the strategy, as well as to help implement the measures. The centre implemented a project called Digital Model School (Digitális Mintaiskola), with the participation of 13 educational institutions throughout Hungary. Some recommendations have already been published with regards to technological requirements, and the institutional background.

The Digital Export Development Strategy (DEDS)[11] "defines a comprehensive governmental package of measures designed to improve the export capacities of SMEs engaged in IT services." It aims to increase the export of digital products, as that would enhance Hungary's economy. It also has an aim to improve digitalization knowledge in Hungary and contribute to Hungary's becoming the beneficiary of the digitalization trend. It should start with a Country report identifying the target markets, proceed with an Inventory of Domestic Solutions and in a third stage create an Interdepartmental Committee for Digital Export Development (IC DEP) to define the main objectives.

In order to realize the goals of the DEDS and as outlined in the strategy, the **Interdepartmental Committee for Digital Export Development** (Digitális Exportfejlesztési Tárcaközi Bizottság),[12] led by the Ministry of Foreign Affairs and Trade, has been established. The committee has assisted in organizing an ICT-focused training event[13] as outlined by the strategy, organized by the Hungarian National Trading House[14].

The Digital Child Protection Strategy (DCPS)[15] was drafted following a public consultation on digital projects, InernetKon. The aim of the strategy is to help facilitate the conscious use of the internet for children, improve digital culture and digital society, as well as to provide a regulatory framework to protect them from threats. "The strategy has therefore been drawn up primarily in order to ensure that children are protected from dangerous and harmful online content and methods and to prepare children, parents and teachers for a conscious and productive use of the Internet." While the primary focus is on children it affects everyone in society, and therefore the strategy calls on all organizations to cooperate in its implementation.

The strategy is based on three objectives: Awareness-raising and media education which in certain cases is established as a compulsory part of the syllabus, Protection and safety that makes available the legal and technical conditions required for the safe use of the Internet, and Applying sanctions and providing help with regular monitoring and assessment structures capable of evaluating the actual weight and impact of problems.

The government has accepted the strategy and has passed a resolution, which outlined needs for improved training, cooperation among service providers

[10] The website of the organization available at: https://dpmk.hu/digitalis-pedagogiai-modszertani-kozpont/.
[11] The Digital Export Development Strategy, available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/strategies.
[12] More on the committee available at: https://djnkft.hu/digitalis-exportfejlesztesi-tarcakozi-bizottsag/.
[13] More on the event available at: http://www.kereskedohaz.hu/hu/esemenyek/ikt-exportakademia.
[14] The website of the organization in English: http://www.kereskedohaz.hu/en.
[15] The Digital Child Protection Strategy, available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/strategies.

and the state to protect children, and that there should be a record of international best practices on the matter.[16]

The Prime Minister has appointed a Commissioner, who is responsible for the Digital Success Programme, however certain measures fall under the responsibility of various Ministries. The Commissioner is responsible for coordinating all the works. Recently the government outlined plans for the expansion of the programme, in DSP 2.0.

Basic Digital Success Package[17]

Hungary has created the Basic Digital Success Package under the Digital Success Programme. The aim of it is to provide internet access to 200-250 thousand people, who are not connected. The package offers 15% more favourable conditions than the best conditions offered by internet service providers beforehand. 11 service providers have joined the programme so far.[18]

Other projects under DSP

Some of the other programmes in accordance with DSP and NIS include:

The Superfast Internet Programme aims to fulfil the objective of the NIS, of a minimum of 30 Mbit/s as a result of large scale network developments, by the end of 2018.[19]

The **Digital Hungary Nyíregyháza Sub-programme**[20] is a pilot project, launched in 2015 for the **Digital Hungary** programme, which aims to bring together the strategies.[21] Its 4 pillars are:

- Superfast Internet
- Digital community and economy
- E-public services
- Digital competencies

[16] Outlined in the government resolution 1488/2016. (IX. 2.), available in Hungarian at: https://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=A16H1488.KOR&timeshift=fffffff4&txtreferer=00000001.TXT.

[17] The Cabinet Office of the Prime Minister "The Basic Digital Success Package will be available from this summer", available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/news/the-basic-digital-success-package-will-be-available-from-this-summer.

[18] Digital Wellbeing Basic Package (Digitális Jólét Alapcsomag), available at: https://djnkft.hu/digitalis-jolet-alapcsomag/.

[19] The Cabinet Office of the Prime Minister "The Superfast Internet Program (SIP)", available at: http://www.kormany.hu/en/cabinet-office-of-the-prime-minister/hu/digital-success-programme/the-suparfast-internet-program-sip.

[20] Digital Hungary (Digitális Magyarország Nyíregyháza alprogram), available at: http://digitalismagyarorszag.kormany.hu/digitalis-magyarorszag-nyiregyhaza-alprogram.

[21] Digital Hungary (Digitális Magyarország), available at: http://digitalismagyarorszag.kormany.hu/digitalis-magyarorszag.

2.2.3 DIGITAL SUCCESS PROGRAMME 2.0

The Digital Success Programme 2.0 (DSP 2.0), passed in July 2017 outlines programmes that build on and expand the DSP for 2017-2018. It consists of the following topics:

Digital infrastructure: includes tasks regarding the implementation of the Superfast Internet Programme, or the introduction of a 5G network.

Digital competencies: includes measures such as the Basic Digital Success Software Package (to enable broad access to softwares), the sustainable development of digital competencies and a Digital Labourforce Programme.

Digital economy: Includes the development of a Digital Agricultural Strategy, a Digital Sport Strategy, a Digital Healthcare Industry Development Strategy, the support of SMEs in the region, and programmes regarding the sharing economy.

Digital state: Includes programmes about e-government the digitalization of public collections, and the development of a National Data Policy.

Horizontal topics include cyber-defence, Smart Cities, a unified digital ecosystem in the Carpathian basin and research of the effects of digitization on society.

The Hungarian government has already made available a summary of the draft of the Digital Agricultural Strategy[22] within the framework of the digital success programme. The strategy is in line with Hungary's concept for the food industry between 2017-2050.[23] The document outlines proposed answers to the challenge of Agriculture 4.0, and as a solution plans to introduce more IT solutions and digitalization in agriculture, as well as introducing a sharing economy and other electronic commerce innovations, among other things.

2.2.4 OTHER PROJECTS

There are other projects and programmes, ongoing or in development beside the aforementioned ones, which often complement the previously outlined strategies. These are:

- Public Services and Public Administration Development Operational Programme
- NAV 2.0
- Industry 4.0
- MNB programmes (Instant payment, fintech)

[22] Digital Agricultural Strategy (Magyarország Digitális Agrár Stratégiájának tervezete).
[23] Magyarország Élelmiszergazdasági Koncepciója 2017-2050, available at: http://www.kormany.hu/hu/foldmuvelesugyi-miniszterium/hirek/elelmiszergazdasagi-program-2017-2050.

Public Services and Public Administration Development Operational Programme 2014-2020[24]

The Public Services and Public Administration Development Operational Programme 2014-2020 outlines all programmes with regards to public service and administration. Among many other things it also concerns **digital state and e-government.** The pillars for these are in harmony with NIS, and they are the following:

- Developments harmonizing databases
- Improvement of the interoperability of IT systems
- The modernization of registries
- IT support and the development of internal processes
- Providing conditions for secure operation

The implementation of many measures with regards to the digital state predates the Programme, but it is a long process and constant improvements are needed. The steps already taken include the e-signature. "Hungary was among the first countries to implement the 1999/93/EC Directive on electronic signatures in 2001."[25] And the platform of e-government called client gate, the fully online services of which include: services for employers and employees, personal annual tax declaration and company tax declaration, VAT declaration, company registration (via an attorney-at-law), statistical data provision, customs declaration, e-Procurement, and permissions related to environment protection.[26]

NAV 2.0

NAV 2.0[27] (NAV is the Hungarian acronym for the National Tax and Customs Administration of Hungary), is a concept, first unveiled to the press in 2017, which will modernize NAV in the upcoming 5 years, by introducing real-time, paperless services, halving the time spent of tax administration. NAV 2.0 would also help improve taxation in Hungary. With this programme the government proposes to create one of the most competitive tax administrations in the EU.

Industry 4.0

"The Industry 4.0 National Technology Platform was established under the leadership of the Institute for Computer Science and Control (SZTAKI), **Hungarian Academy of Sciences**, with the participation of research institutions, companies, universities and professional organizations which have premises in Hungary, and with the full support and commitment of the Government of Hungary, and specifically that of the Ministry of National Economy."[28]

[24] Közigazgatás- és Közszolgáltatás-fejlesztési Stratégia 2014-2020, available at: https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjczLr3_NjYAhUGLlAKHS2aBt8QFggoMAA&url=http%3A%2F%2Fwww.kormany.hu%2Fdownload%2F8%2F42%2F40000%2FK%25C3%25B6zigazgat%25C3%25A1s_feljeszt%25C3%25A9si_strat%25C3%25A9gia_.pdf&usg=AOvVaw057R3uHhdW1YmvtKhnoSPQ.

[25] Point of Single Contact " eGovernment in Hungary", available at: http://eugo.gov.hu/key-facts-about-hungary/egovernment-hungary.

[26] Ibid.

[27] State Secretariat for Parliament and Taxes "A NAV 2.0 a jövő adóhivatala", available at: http://www.kormany.hu/hu/nemzetgazdasagi-miniszterium/parlamenti-allamtitkarsag/hirek/a-nav-2-0-a-jovo-adohivatala.

[28] National Technology Platform "About us", available at: https://www.i4oplatform.hu/en.

Currently the Platform has **7 Work Groups**:

- Strategic Planning
- Employment, Education and Training
- Production and Logistics
- ICT Technologies (safety, reference architectures, standards)
- Industry 4.0 Cyber-Physical Pilot Systems
- Innovation and Business Model
- Legal Framework.

The platform was established by companies and organizations, from key sectors outlined in the Irinyi Plan, The Directions of Innovative Industrial Development in Hungary.[29] The plan dedicates a chapter to the ICT sector, which summarizes and quotes the NIS. Several large companies and key market players are members of the Industry 4.0 platform.

Instant payment, fintech

Instant payment

The Hungarian central bank, Magyar Nemzeti Bank (MNB) outlined its plans in 2016, to introduce instant payment services.

"The introduction of instant payment services in Hungary has three fundamental objectives:

- To introduce an electronic payment service that vies with the speed, continuous availability and simplicity of cash payments, thereby creating an electronic payment alternative in an ever widening range of payment situations.
- To support innovation in the payments market.
- To prevent the creation of non-interoperable payment solutions.

In accordance with the foregoing, the MNB formulated basic requirements related to instant payment services, which should be met to ensure that the new infrastructure supports the attainment of the aforementioned objectives to the greatest possible degree:

- continuous (24*7*365) operation;
- execution of the entire payment cycle in a matter of seconds;
- feedback on the result of the transaction;
- immediate and unrestricted usability of the amount credited to the payee;
- competition-neutral access to the basic system;
- use of secondary identifiers;
- interoperability of the payment solutions;
- possibility to create additional services."[30]

[29] Irinyi Plan, available at: https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwjEk7mv_djYAhWSZlAKHblAAN8QFggvMAE&url=http%3A%2F%2Fwww.kormany.hu%2Fdownload%2Fb%2Ffb%2F31000%2FIRINYI%2520Plan.pdf&usg=AOvVaw1-svOLYzwUEu9DhpCv54Ov.

[30] Hungarian National Bank "Operational model of the instant payment service in Hungary", available at: https://www.mnb.hu/en/payments/instantpayments.

The implementation of the service is planned for July 1, 2019.[31]

FinTech

The Hungarian central bank has also launched a consultation[32] on proposed regulations regarding FinTech, such as the introduction of an Innovation Hub, and a Regulatory Sandbox. The consultation was closed on January 20, 2018.

2.3 Remarks on SWOT Analysis

Many of the aforementioned strategies include a SWOT analysis of the given area. The following SWOT analysis takes those into consideration. The analysis includes and factors in all of the digitalization strategies and programmes and focuses on the digital prospect of Hungary rather than on specific sectors or strategies.

The strengths include an attractive environment for startups, high broadband coverage, and a strong ICT sector (12% of the GDP).[33] However digital illiteracy is still high (according to DES, "more than one third of the population aged 15 or older are digitally illiterate", Budapest exercises a brain drain on the rest of the country, widening the gap between regions, and according to the Digital Economy and Society Index 2017, "the business sector is not exploiting the opportunities offered by digital technology as much as other countries do", which are weaknesses. Opportunities can be found in the government's intention, expressed in the strategies, to decrease the administrative burden on entreprises, the constant developments, harmonizations, and integrations of e-government, and the vast amount of best practices, which the strategies recognize and aim to pay attention to. On the other hand, there were 73, 713 job vacancies in 2017 Q3, and the number shows a growing trend.[34] According to the Digital Education Strategy with regards to ICT tools in education "the rate of usage of available tools is low; in other cases teachers refuse to use those technologies in the classroom because of outdated equipment or the lack of tools". According to 2014 statistics "over 95 % of all public investments in Hungary are co-financed by the EU",[35] and the country's heavy reliance on EU funds,[36] as well as the labour shortage[37] and outdated technologies pose a threat to digitalization and modernization.

[31] Hungarian National Bank "Jogszabály tervezet", available at: https://www.mnb.hu/penzforgalom/azonnalifizetes/jogszabaly-tervezet.
[32] Hungarian National Bank "Innováció és Stabilitás", available at: https://www.mnb.hu/letoltes/konzultacios-dokumentum.pdf.
[33] As stated in the National Infocommunications Strategy 2014-2020, available at: https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiko-iE_NjYAhUJElAKHWmVDOoQFggoMAA&url=http%3A%2F%2Fwww.kormany.hu%2Fdownload%2F5%2Fff%2F70000%2FNIS_EN_clear.pdf&usg=AOvVaw3Y2D4uVoOCNlJJDHvPlk1E.
[34] Hungarian Central Statistical Office "Üres álláshelyek száma és aránya", available at: http://www.ksh.hu/docs/hun/xstadat/xstadat_evkozi/e_qli027c.html?down=58.
[35] European Commission "Hungary", available at: http://ec.europa.eu/budget/mycountry/HU/index_en.cfm.
[36] European Union "Hungary", available at: https://europa.eu/european-union/about-eu/countries/member-countries/hungary_en.
[37] Hungarian Central Statistical Office "Üres álláshelyek száma és aránya", available at: http://www.ksh.hu/docs/hun/xstadat/xstadat_evkozi/e_qli027c.html?down=284.

2.4 Hungary (SWOT)

STRENGTHS (present)	OPPORTUNITIES (future)
▪ Nearly 100% basic broadband coverage ▪ Low costs make Budapest an ideal startup location ▪ The ICT sector accounts for a considerable portion of the GDP ▪ The use of internet among Hungarians is close to the EU average	▪ Administrative burdens of the enterprises will be reduced ▪ Constant improvements on e-government ▪ Growing number of international best practices ▪ Mobile and smart devices are spreading
WEAKNESSES (present)	**THREATS (future)**
▪ High digital illiteracy ▪ Large gap between regions of Hungary in terms of digitalization and attitudes ▪ ICT involvement of companies is still low	▪ Labour shortage ▪ Outdated technologies in education ▪ Heavy reliance on EU funds

3. Poland

Marcin Frenkel
Translated by Olga Łabendowicz

3.1 Introduction

The title of this paper raises a question: what exactly is Industry 4.0? It is believed that this term was used for the first time at the Hannover Messe 2011 during a presentation devoted to the future of industry. The speeches delivered were a result of the research conducted a year earlier by the German government, whose main objective was to identify and analyze the key (or even groundbreaking) changes that have had a strategic influence on the economy of the Federal Republic of Germany (FRG). In 2013, these joint efforts (under the supervision of Professor Henning Kagermann) of representatives of business and science resulted in the publication of Strategic Initiative INDUSTRIE 4.0.[38]

In the next few years following the publication of the report, the presence in the media of the idea of Industrie 4.0 started to be ever greater – partly under its English name, Industry 4.0, and in Poland as Przemysł 4.0. The number occurring in the term is a reference to the concept of the fourth industrial revolution, which is commonly employed in literature devoted to this topic, and which served as the basis for Przemysł 4.0. Until recently, when describing the history of civilization, three stages of socio-economic development (industrial revolutions) were traditionally listed. According to Professor Wojciech Paprocki of the Warsaw School of Economics (SGH), each and every revolution marked the introduction of some technical innovation that significantly changed the way in which people function in the world and which, at the same time, increased the effectiveness of human actions[39] in a stepwise manner.[40]

Currently, we are observing the emergence of the fourth industrial revolution linked to omnipresent digitalization, which influences communication not only between humans—machines, but also between machines (without the human component). According to Professor Jana Pieriegud, this phenomenon is strictly related to such terms as the Internet of Things, the Internet of Everything, cloud computing, Big Data and its analytics, automation and robotization, as well as multi-channel and whole-channel distribution of products.[41] All these elements lead to the most extensive automation of processes that are not only related to production – but also to society, e.g. by almost full automation of production that exceeds the boundaries of a factory and thus involves suppliers and subcontractors, tracking the life of products (from their production to disposal), as well as the relatively

[38] A. Solwaty "Czwarta rewolucja przemysłowa i Przemysł 4.0 – Co oznaczają te pojęcia?", "Control Engineering Polska", 31.10.2016, http://www.controlengineering.pl/menu-gorne/artykul/article/czwarta-rewolucja-przemyslowa-i-przemysl-40-co-oznaczaja-te-pojecia/. The report provides an overview of the recent past of an industry that was revolutionized by the wider application of advanced IT technologies. The document featured not only a list of recommendations for actions that would protect the German economy from marginalization – which might have been the result of the forthcoming technological revolution – but also offered a set of practical steps on how to utilize the upcoming wave to strengthen the position of Germany in the global arena.

[39] W. Paprocki "Koncepcja Przemysł 4.0 i jej zastosowanie w warunkach gospodarki cyfrowej", p 40.

[40] The first of these revolutions occurred at the end of the 18th century and was related to utilizing steam and the mechanization of production. The second revolution began in the last three decades of the 19th century with the development of electricity, the invention of the telegraph, production lines, and mass production. The next stage, marked at the turn of the 1960s and the 1970s, was related to the popularization of electronics and automated production – thus constituting the third industrial revolution.

[41] Jana Pieregud "Cyfryzacja gospodarki i społeczeństwa – wymiar globalny, europejski i krajowy", p 11.

inexpensive customization of a wide range of products that not so long ago were the outcome of standardized mass production.[42]

The key difference between the third and fourth industrial revolutions may be relatively well explained by taking a look at the concept of how automated factories operate. Until now, robots on the production line have been controlled externally by a program that dictates the next tasks in relation to the product being created and which is completely passive in the process. Meanwhile, in the near future, a chip installed within the product at the initial stage of its creation will control its successive operations as a part of the production process, but also after it has been finished – by reporting the need for new parts or stimulating self-repair.

The key component that allows for **effective self-cooperation between the machines is an ultrafast 5G Internet connection** (with three hundred times greater speed of transferring data than today). As explains Dr Michał Boni (Civic Platform), the former Polish Minister of Administration and Digitization, "thanks to contemporary technology, around a thousand electronic devices may easily communicate with each other within one square kilometer. In 5G, that would be possible for a million devices". This, according to the politician, signals the beginning of the age of the Internet of Things, which allows devices to communicate with each other directly.[43]

3.2 Digital Revolution in Official Documents

The aforementioned Dr Boni is one of the key agents in the report published in 2009 titled **Poland 2030. Development Challenges**. It was the first governmental analysis of its kind in Poland that aimed to identify the place Poland would hold after 20 years of transformation in key areas (e.g. infrastructure, knowledge-based economy, labour force participation, social capital), to pinpoint the potential challenges and dilemmas, as well as to determine what path of civilizational development the country should take in the next two decades. The document did not, of course, discuss the theme of Industry 4.0 directly. Yet, it did mention the issue of digital development, increasing productivity and innovativeness of the Polish economy.[44]

Another significant governmental document devoted to innovativeness of the economy as well as dealing with the digitization of state administration is the so-called **Action Plan for Responsible Development of Poland**, also referred to in Poland as "Morawiecki's Plan" after the name of the initiator of the study, the then Minister of Economic Development and Finance, and currently the Prime Minister of the Republic of Poland. Published in 2016, the document identified **five so-called development traps** that Poland has fallen into, including the **middle income trap** and the **average product trap.**[45] One of the proposed solutions was a gradual departure from an economy based on cheap labour performing relatively simple tasks towards an economy based on innovations and advanced technology that would enable the creation of more profitable workplaces. The production of products based on specialized knowledge would avoid having to participate in a damaging price race on the world markets.

[42] J. Szczepanik "Gospodarka 4.0 a społeczeństwo zintegrowane", Racjonalista.pl, 2.05.2017, available at: http://www.racjonalista.pl/kk.php/s,10112.
[43] R. Siewiorek, M. Boni, "Jeśli nie zdążymy z budową sieci, staniemy się krajem furmanek w świecie hyperloopa", Wyborcza.pl, 18.11.2017, available at: http://wyborcza.pl/magazyn/7,124059,22660274,michal-boni-technologia-5g-bedzie-nowym-murem-berlinskim.html.
[44] Polska 2030, available at: www.polska2030.pl.
[45] ISAP, available at: http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WMP20170000260.

3.3 State Institutions and Digitization

Apart from the two aforementioned documents, the actions of the current **Ministry of Digitization** should be considered as a clear example of governmental engagement in the process of digital revolution – manifested especially by its last Head,[46] Anna Strężyńska, and former Secretary of State and Governmental Plenipotentiary for Digital Single Market, Krzysztof Szubert. Contrary to other members of the government, Minister Strężyńska avoided ideological manifestos, did not shy away from public consultations, and most importantly focused on **a systematic implementation of small projects aimed at digitization of the country and its cybersecurity** (e.g. by launching the **National Cybersecurity Center**, NCC, or by legalizing the operations of the so-called **ethical hackers** – the individuals who in good faith look for weaknesses in the IT systems of state institutions and enterprises).[47] It is also worth mentioning the document titled Polska Agenda Cyfrowa. Sprawozdanie z działalności Ministerstwa Cyfryzacji w latach 2015-2017 (**Polish Digital Agenda. An Activity Report of the Ministry of Digital Affairs for the Years 2015-2017**), which provides a detailed overview of the actions undertaken by the Ministry in the area of country-wide digitization, especially when it comes to public institutions.[48]

Moreover, another unit for protecting public institutions is constituted by **the Ministry of National Defence**, headed then by Antonii Macierewicz (replaced by Mariusz Błaszczak in January 2018). Ultimately, this unit is to consist of around a thousand cybersecurity specialists. However, IT specialists remain sceptical of this initiative mainly due to issues related to the recruitment process – for high profile specialists working in the private sector, both the salary and organizational culture fall short of their expectations.[49]

3.4 Digital Revolution in the Media

Currently, the topic of Industry 4.0 and Society 4.0 is becoming more and more present in the media and expert discussions in Poland. Articles and interviews devoted to this matter occur in national daily newspapers, weekly magazines, and expert journals devoted to new technologies. In the past few months, panel discussions devoted to the digital revolution were present during the Economic Forum in Krynica, the Freedom Games in Lodz, as well as during the conferences organized in Warsaw by the Civic Institute or the Stefan Batory Foundation. In the aftermath of the election victory of the Law and Justice party in Poland (in 2015), of Donald Trump in the US and of the supporters of Brexit (in 2016), **fake news** and the process of its dissemination in social media have gained a prominent place in the discussions – especially in liberal circles. On the other hand, **the theme of accelerating the innovativeness of the Polish economy** became a significant topic within the ruling party.

[46] Since January 2018 there is a vacancy on this position. The Ministry of Digitalization is temporarily directed by the vice-minister.
[47] Ministry of Digitalization "Programy i projekty", available at: https://www.gov.pl/cyfryzacja/programy-i-projekty.
[48] Ministry of Digitization "Polska Agenda Cyfrowa. Sprawozdanie z działalności Ministerstwa Cyfryzacji w latach 2015-2017".
[49] J. Wątor "Eksperci o cyberarmii Macierewicza: To bardzo trudne do realizacji", Wyborcza.pl, 12.10.2017, available at: http://wyborcza.pl/7,156282,22499477,eksperci-o-cyberarmii-macierewicza-to-bardzo-trudne-do-realizacji.html.

In the context of the knowledge economy, the retro-reform of education endorsed by Minister Anna Zalewska raises the biggest concerns. Critics accuse it of promoting obsolete teaching methods – focusing mostly on memorization, history, limiting the space for individual selection of themes of interest (both by teachers and students), as well as unwillingness to teach critical thinking.[50] The concerns related to the consequences of the education system "reform" were pointedly summarized by Dominika Wielowieyska, a journalist of Gazeta Wyborcza daily, when she wrote: "I fear that by reversing all education system reforms, the Law and Justice party is leading us towards a backwards-thinking society that is lazy and afraid. A society that is incapable of competing with other European countries (...). It seems that we will shelter our children. We will not be very flexible but rather closed-minded, reluctant to take on new challenges".[51]

Another problem is an anti-immigration campaign lead by the ruling party and the public media (controlled by the Law and Justice). This social atmosphere has resulted in an increasing number of racist crimes[52] and raising aversion to foreigners. All this is accompanied by an unquestioning perspective on Polish history and the affirmation of national characteristics in the form of a cult of ourism (naszyzm; the conviction that what is Polish is better than anything else).[53] As Widold Gadomski, a Polish feature writer, points out, "it's hard to imagine that innovativeness and creativity could exist in a society that is distrustful towards the world, one that is immersed in its martyrological history, fearing punishment for taking risk. Governmental propaganda persuades people that staying in the Polish Bible belt, far from the madding crowd of the world, is the best life there is. In such a backwater there is very little innovation". These sentiments correspond with **low social capital and "feudal relations"**. This refers to events deeply rooted in Polish history, and which currently appear to be further reinforced by the factors described in the further part of the paper. For many years, sociologists have been warning about the fact that the distrust commonly felt in Polish society and the cult of falsely understood individualism constitute one of the barriers to further economic development of Poland – also in terms of Society 4.0. This, in a number of institutions and companies, is paired with so-called feudal relations, which are defined by Andrzej Leder, a Polish philosopher of culture, as a mental structure, a set of attitudes and habits, transfers of social energy, reactions, and impulses that are characteristic of hierarchical relations. This phenomenon emerged in the times of the manorialist economy (especially in the 16th-18th centuries), and despite the political and social transformations that came later (especially strongly in the 20th century), they still remain vibrant in certain social circles – however, these may often be subconscious. The division of society into "masters" and "peasants" lies at the heart of feudal relations. The former group is usually in possession of greater material and cultural capital, while at the same time remains constantly uncertain of their own value and social standing. This uncertainty is taken out on the second group, which is often taken advantage of. Notably, this is not an agreement with fixed and clear dividing

[50] K. Biedrzycki "Deforma edukacji. Nowa podstawa programowa do polskiego cofnie szkołę do połowy XX wieku", Oko.press, 7.12.2016, available at: https://oko.press/podstawa-programowa-polskiego-cofnie-szkole/.

[51] D. Wielowieyska "Reforma dla lękliwych, czyli pisowski model edukacji", Wyborcza.pl, 30.06.2016, available at: http://wyborcza.pl/1,75968,20325399,reforma-dla-lekliwych-czyli-pisowski-model-edukacji.html.

[52] P. Kośmiński "Prokuratura Krajowa przyznaje: Rośnie liczba przestępstw z nienawiści", Wyborcza.pl, 24.04.2017, available at: http://wyborcza.pl/7,75398,21679222,prokuratura-krajowa-przyznaje-rosnie-liczba-przestepstw-z-nienawisci.html; see also the official report of the Attorney General's Office: https://pk.gov.pl/wp-content/uploads/2017/12/8ffee219b2f4dd5638750800 8eee13a5.pdf.

[53] L. Jażdżewski "Naszyzm łączy Polaków. Alkoholik zwiał z odwyku", Polityka, 23.08.2016, available at: https://www.polityka.pl/tygodnikpolityka/kraj/1672580,1,naszyzm-laczy-polakow.read.

lines. It is commonly reflected in various social groups and situations, whenever a relation of co-dependence occurs and when one party has an advantage over the other one. For example, a "feudal relation" may be in place between a doctor and a patient, but it may also exist between the supervisor of the said doctor and the doctor him/herself, and further up in the hospital staff hierarchy. The fact that such an agreement is usually unspoken (yet, passed from one generation to the next) is characteristic of this phenomenon.

3.6 Remarks on SWOT Analysis

Let us move now to a SWOT analysis of the position of Poland on the threshold of transformation towards Industry/Society 4.0 Among the country's **Strengths** we shall list at least the following three factors:

a. **The presence of well-educated, creative high-tech experts** (IT specialists, computer programmers, etc.); these are mainly the graduates of Polish technical universities.[54] Unfortunately, the supply is lower than the demand of the labour market (which shall be discussed in a greater detail in the Weaknesses section); this demand is a result of the good condition of IT companies[55] (both Polish and foreign) that operate in the Polish market and which, in practice, often operate on a global scale.
b. **Being aware of the challenges** that lie ahead for the Polish economy and society – at least among some of the decision-makers (including Anna Strężyńska in the government, Michał Boni and Rafał Trzaskowski in the opposition).
c. In a wider context, we shall point to some sort of **entrepreneurship that has historically developed in the Polish society and the society's flexibility** in adjusting to changes. In the past, this feature enabled Poles to adapt to highly unfavourable circumstances when all systemic solutions had failed. Also now, in light of the digital revolution, this might be a somewhat positive outlook on the situation.

The following aspects (partly linked to the abovementioned advantages) shall be listed as **Weaknesses**:

a. The mentioned **limited high-tech experts resource on the market** (in practice: shortage thereof);[56] companies often deal with this problem by

[54] Poland has 18 technical universities (recognized and supervised by the Ministry of Science and Higher Education). The average number of students in these schools is ca. 300,000 yearly which for instance in the year 2012 gave 77,155 graduates. Sources available at: http://www.nauka.gov.pl/uczelnie-publiczne/wykaz-uczelni-publicznych-nadzorowanych-przez-ministra-wlasciwego-ds-szkolnictwa-wyzszego-publiczne-uczelnie-akademickie.html., http://www.otouczelnie.pl/artykul/1127/Politechniki-i-uczelnie-techniczne, http://stat.gov.pl/cps/rde/xbcr/gus/E_szkoly_wyzsze_2012.pdf.

[55] According to "ITwiz Best 100" report – a ranking of 100 biggest IT companies in the Polish market – first five positions were occupied by: ABC Data (distributor of IT hardware and consumer electronics), ACTION (distributor and manufacturer of IT hardware, consumer electronics and home appliances, office products and consumables), Lenovo Technology B.V. (designer, developer, manufacturer and seller of computers, smartphones, workstations, servers and IT management software), AB (distributor of IT and consumer electronics), HP Inc. (developer of computers, printers and related supplies) and DELL EMC Polska (seller of data storage, information security, virtualization, analytics and cloud computing). Source available at: https://itwiz.pl/najwieksze-polskie-firmy-roku-2016-wyniki-raportu-itwiz-best100/.

[56] The situation partially results from the mass emigration after joining Poland to the EU. According to the Statistics Poland in the years 2004-2013 over 1,400,000 Poles left the country. The total number of Poles living abroad in 2013 was assessed at 2,196,000 (including 1,789,000 in the EU);

hiring people with no professional education who become apprentices and learn everything they should already know working for a given company. The concerns that the three "reforms" recently introduced by the government (**repealing compulsory education for six-year-olds, lowering the retirement age, and education system retro-reform**) widely discussed in the media and by experts may further deepen the problematic shortage of a qualified workforce.

b. The **low social capital and** the feeling of **isolationist social attitude** of some kind, stimulated by the ruling party and reinforced by the media that support it. Taking into account internal politics, it promotes in the society the attitude of animosity and distrust directed both at other states (presenting the open Western society as morally corrupt) and other social groups within the country (dividing Polish society into "the better" and "worse sort"). It seems, it is reflected directly in the efficiency of the economic system also in terms of its innovativeness and transformation towards Economy 4.0. "Feudal relations" – as pointed out by Professor Leder – hamper social communication, transfer of knowledge, the process of coordinating activities, and mutual understanding. A significant part of social energy is being wasted on this paper chase, in which one party always does its utmost to prove that it is "master-like", while, at the same time, the other party tries to avoid being humiliated, or possibly even to take revenge on the "masters".[57]

c. A low level of innovativeness and digitization of the economy. Experts in this area always struggle to recall significant innovations that Poland has recently offered the world. The companies that shape the global economy (such as Google, Apple, or Facebook) were established far away from here. As observed by experts, there are many reasons for that – some of which are discussed later in this paper – among the usually listed are poor cooperation between business and science (conducted research is usually detached from what enterprises really need) and an unfavourable taxation system (most start-ups – not only in Poland – are not able to survive the first year of operation, while those that do, do not generate profit). Moreover, as pointed out by the former Polish Minister of Economy Jacek Piechota, **when trying to entice foreign investment into Poland, politicians are under pressure from the society to bring investments that would create as many work places as possible,**[58] **whereas the issue of innovativeness is being almost completely neglected.**[59] Of course, this situation, in turn, influences the structure of the industry of a given service sector. As a result, the level of informatization of the Polish economy is lower by a half than the EU average. As emphasized by economists Marta Götz and Jarosław Gracel, many Polish companies are stuck at the level of the third industrial revolution. **One of the factors that discourage entrepreneurs from investing in robotization are the still low costs of human labour.**[60]

https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5471/2/7/1/informacja_o_rozmiarach_i_kierunkach_emigracji_z_polski_w_latach_2004-2013.pdf.

[57] A. Leder "Relacja folwarczna", Krytykapolityczna.pl, 24.12.2016, available at: http://krytykapolityczna.pl/kraj/leder-relacja-folwarczna/.

[58] The unemployment rate (by age: from 15 to 74 years) in Poland was reduced more than by half in the last ten years: from 13.9% in 2006 to 6.2% in 2016, source available at: http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tepsr_wc170&language=en. The general unemployment rate in Poland in January 2018 was 4.5%, http://ec.europa.eu/eurostat/statistics-explained/index.php/Unemployment_statistics.

[59] B. Mayer "Przemysł 4.0 nie dla nas?", My Company Polska, 6.07.2017, available at: https://mycompanypolska.pl/artykul/709/know-what-przemysl-nie-dla-nas.

[60] M. Götz, J. Gracel "Przemysł czwartej generacji (Industry 4.0) – wyzwania dla badań w kontekście międzynarodowym" Kwartalnik Naukowy Uczelni Vistula, no 1(51), 2017.

d. **An unstable legal situation, low quality of the passed laws, and the limited separation of powers. In December 2017**, the ruling Law and Justice party introduced new legal acts which de facto altered the political system in Poland. They did this at great speed (often during parliamentary sessions held at night) with no public consultations, nor merit-based debates with the opposition and non-partisan experts. In fact, most of the introduced laws are considered unconstitutional. As a result of these actions, the political independence of the prosecutor's office and the Constitutional Tribunal have been destroyed. Currently, the party is working on taking over control of the judiciary, which poses a threat to a number of civic matters, including property law. Both business and municipalities have reacted to this uncertain situation with a clear decrease in investment[61] (which is currently at a level similar to that of 1996).[62] It is also safe to assume that this cautiousness and the existing concerns will also affect the high-tech sector.

e. **Restricted access to the capital crucial to high-tech investment**. As a result of the damages inflicted on Poland in the Second World War as well as during the forty five years of authoritarian socialism, the country's own financial resources are limited. The modernization of the economy towards the fourth industrial revolution is therefore to a large extent dependent on foreign funds. And here, again, the issue of trust of investors in the stability of the legal and political system plays an important role.

When it comes to **Opportunities**, which a shift to the level of Economy 4.0 may give Poland, we can list:

a. **Reducing the civilizational distance** between Poland and Western Europe, and the United States. By its stepwise increase in productivity of the economy, the digital revolution will most likely enable a greater pace of overcoming the developmental backwardness of states of the former Soviet bloc than if it was to be based on traditional methods. It is equally important that the knowledge economy nullifies the past developmental limitations resulting from the peripheral geographical location (the distance to main trade routes) or the lack of mineral resources. Entering the "digital revolution" will most likely enable such countries as Poland to avoid certain interim solutions or some developmental culs-de-sac, which highly developed countries have gone through. This brings to mind an analogy to online banking, which on the brink of the 21st century was introduced in Poland almost from scratch as a complete and new solution, instead of modifying and updating the already existing (and often imperfect) systems, as was the case in the US and Western Europe. When talking about reducing the civilizational distance we mean not only hard economic indicators, but also the overall improvement of the quality of life in Polish society – for example by the means of Medicine 4.0, or reduced pollution of the natural environment.

[61] The current (2017) investment rate in the Polish economy is below 18% of GDP while the average rate for the last twenty years was 20.7% (the highest rate was in 1999 – 24,3%). Source available at: W. Gadomski "Inwestycje i wzrost gospodarczy – wcale nie taka prosta zależność", Obserwatorfinansowy.pl, 13.11.2017, available at: https://www.obserwatorfinansowy.pl/tematyka/makroekonomia/inwestycje-i-wzrost-gospodarczy-wcale-nie-taka-prosta-zaleznosc/ , "mBank: stopa inwestycji najniższa od 1996 r.", Bankier.pl, 27.07.2017, available at: https://www.bankier.pl/wiadomosc/mBank-stopa-inwestycji-najnizsza-od-1996-r-7534751.html.

[62] D. Szymański "Plan Morawieckiego na razie tylko na papierze. Polska z najgorszym wynikiem od 1996 r.", Business Insider Polska, 1.08.2017, available at: https://businessinsider.com.pl/finanse/makroekonomia/polska-z-najnizsza-stopa-inwestycji-od-1996-r/6h6r1tb.

b. **A stronger position in the group of democratic countries.** A kind of transnationality, international cooperation, openness to new ideas and other points of view are characteristic of the knowledge economy. Moreover, a significant part of Economy 4.0 flagship projects requires considerable investment, which at times is greater than state resources. This is where foreign capital and EU funds come in handy – which, in turn, strengthen the integration of Poland with other European states, or even with the world economy. The importance of this phenomenon is not only economic in nature, but shall also be considered in terms of state security. Strong economic links to allies strengthen their motivation to protect the partner from external threats (but also internal – vide, the actions taken by the Venice Commission, the European Parliament, and the European Commission with regards to violating the rule of law in Poland) should such a need arise.

Among the major **Threats** that may follow the advent of Economy 4.0, we shall list three key issues:

a. **The increase of unemployment among the less qualified**. Until now, the model of the Polish economy was based chiefly on a cheap workforce, which – when juxtaposed with the geographical proximity and good communication infrastructure connecting Poland with the heart of Europe – made the country a desirable location for investment. As a result, a number of assembly plants and outsourcing centers offering relatively simple services were created in the country. Experts commonly believe that in the near future the demand for employees performing simple and repetitive tasks will gradually decrease in light of the further development of automatization. Lowering labour costs (thus cutting salaries or, related to this by the level of contributions, social insurance) will most likely be the key instrument in competing with robots.
b. **The return to the periphery**. If Poland fails to join in the world-wide digital revolution (e.g. by increasing participation in the economy of knowledge-based companies – and not companies based on a cheap workforce), we risk amplifying the civilizational distance between Poland and Western Europe, and the US. With the decrease in the pace of economic development, the resources for healthcare, infrastructure, security, and nature protection will decrease as well. The unmet expectations of next generations that enter the labour market will be met with social anxiety and questioning the point of Euro-Atlantic integration. In the worst-case scenario, all existing economic ties will be broken – especially with FRG (the main trade partner of Poland and at the same time a country that is the leader of the fourth industrial revolution). As a result of the deepening technological backwardness, our attractiveness in terms of European trade may suffer. We should also bear in mind that the advanced process of robotization makes enterprises independent of human labour costs. A risk arises that industrial plants that were built in Poland by foreign investors may be relocated to their motherlands (after reaching a certain level of automatization, the costs of labour become less important in the overall economic perspective).
c. **Increase in citizens' surveillance.** The development of digital technologies drastically increases the possibility of surveilling the society by both the authorities and corporations. Technical infrastructure that protects people from, e.g., the terrorist threat, may well be employed to keep track of the opposition or journalists who criticize the government. This threat is even more disturbing viewed in the light of the dismantling of the independent judiciary, which should be a neutral guardian of the rule

of law and civil liberties. Another example of a possible risk is a situation in which medical records generated by advanced applications monitoring patients' health fall into the wrong hands (of, for instance, insurance companies).

3.7 Final Remarks

In terms of the transformation towards Economy 4.0, Poland's indisputable strength lies in well-educated personnel – characterized by entrepreneurial spirit and flexibility towards new challenges. Unfortunately, currently, the supply on the labour market of this kind of employee is insufficient (so the country's potential is not fully used).[63] Other factors that may torpedo the process of introducing the fourth industrial revolution in Poland include isolationist social attitudes, an unstable legal situation, and related to all this, the low level of innovativeness of the economy (which is the foundation of further digital development), among others.

Should, however, the discussed transformation be successful, Poland has a chance for a groundbreaking reduction of the civilizational distance that exists between Poland and Western Europe, and the United States. This would lead to a significant improvement in the quality of life of Polish citizens – not only in terms of being financially well-off. A side-effect of some kind – yet, a positive one – of multiplying economic and scientific links with the Euro-Atlantic world would be the stronger position of Poland in the group of democratic countries.

Therefore, should the fourth industrial revolution in Poland fail (or its achievements be not fully taken advantage of), a number of complex consequences (not to mention the increase of unemployment among the less qualified) such as breaking the current network of international links, and in turn political and economic marginalization of the country on the global scale, may follow.

[63] According to Krzysztof Jonak, EMEA Territory Billings Accounts Director in Intel, the IT sector of Polish economy lacks even 50,000 employees. The main reason is an intensive development of R&D centers and ongoing digitalization of companies, for sources see: "Deficyt pracowników w IT szacuje się na ok. 50 tys. osób. Brakuje ich m.in. w obszarze cyberbezpieczeństwa", Biznes.newseria.pl, 11.01.2017, available at: https://biznes.newseria.pl/news/deficyt-pracownikow-w-it,p132363070.

3.8 Poland (SWOT)

STRENGTHS (present)	OPPORTUNITIES (future)
▪ **Well-educated personnel** on the labour market ▪ **awareness of the challenges** among (some) decision-makers ▪ **entrepreneurial spirit and flexibility** (of the majority) of the society	▪ **Decreasing the civilizational distance** between Poland and Western Europe, and the US (including an increase in wealth, further infrastructure development, better health and nature protection) ▪ **a stronger position in the group of democratic countries** (by multiplying economic and scientific interactions and relations)
WEAKNESSES (present)	**THREATS (future)**
▪ **Limited resources of employees** prepared for work in the Industry 4.0 sector – likely to be reinforced in the future by other "reforms" introduced by the current government ▪ **isolationist social attitude, low social capital, and feudal relations** ▪ **low level of innovativeness and digitization of the economy** ▪ **legal situation** (lack of stability, low quality of the existing law, limited separation of powers) ▪ **inhibited access to capital**	▪ **Increase of unemployment** among the less qualified ▪ **return to the periphery** of the Western world (in case digital transformation fails) ▪ **increase in citizens' surveillance** ▪ **investors pulling out** of Polish markets (relocating branches to motherlands)

4. Slovakia

Martin Reguli

4.1 Introduction

Slovakia has been since the early 2000s viewed as **a stronghold of the automotive industry**. With the announced coming of the Jaguar company in 2018, there are four large manufacturing producers in Slovakia that are driving the industrial employment in the country. If one adds to that the present electronic manufacturers, like Samsung, with the total share of industry at the 39.45 % of the GDP, it should be readily assumed that the industrial policy of Slovakia would be dominated by discussions regarding the ever-closer, even imminent era of digitalization (also known as Industry 4.0). However, sadly this has not yet been the case. **Despite the great scale of the potential losses that Slovakia could face by not paying enough attention to this new trend, Slovakia has only moved slowly to embrace any form of official activity towards the agenda for Industry 4.0.** While there has been the adoption of a Strategy of Smart Industry in 2016, there has been very little done in terms of legislative preparation for the future direction of the industry. This research paper focuses on the current situation in Slovakia regarding strategies, administration and path forward with respect to changes in industrial policy and the changes necessary for the successful adoption of digitalization practices. This is related to not just technology adoption, but also the necessary changes to the Labour code that would have to be implemented to the current legislation.

4.2 The Strategy for Smart Industry and other forms of preparation for Digitalization

The Slovak Strategy of Smart Industry (2016) has identified as one of the key problems in the development of Industry 4.0, the need for the creation of more efficient mechanisms of financial support for the new areas of technological development. This is one of the necessary preconditions for the lift-off of the implementation of digitalization and the improvement of the position of science in the Slovak manufacturing industry. One of the key components in the weakness of Slovak financing of technological development is a weak utilization of European structural and investment funds. A better utilization of these resources would be in accordance with the Research and Innovation Strategy for Smart Specialization of the Slovak Republic, which was published in 2013 and is needed in the implementation of Industry 4.0 and the digitalization of small and medium enterprises (SMEs).

These failings have resulted in a situation, where Slovakia currently lacks, in comparison with Western Europe, legal preparedness for the new challenges in the form of labour relations and working conditions. **Slovakia lacks any form of activity in terms of regulations set-up regarding industrial, technological and scientific progress and their implementation in working processes and in particular the functioning of SMEs.** With the current short-term expectations, Slovakia needs to better set up the framework conditions of support for the Slovak IoT (Internet of Things) environment. It is necessary to specify the individual public sector areas, where changes in legislation and regulations can be made to comply with the changing forms of entrepreneurship and employment. Regulatory burdens are currently a very frequent pain point in attempts to implement new Start-up and entrepreneurial projects in the Slovak market. New regulatory mechanisms should be prepared in accordance with the future form of digitalization aiming to lower the administrative burdens and support international cooperation.

Slovakia also lacks the correct set-up of the network of relevant actors and all interest groups that should be invited to any discussion on the future form of the regulatory environment. These groups should include representatives of the main employers in each of the respective regions, representatives of the universities and employees' organizations, which will be affected by changes in the industrial structure. The main focus should be directed towards knowledge formation regarding the functioning of the regional economic and infrastructure systems and the connection of actors who are involved in them.[64] [65]

Another key area, where **Slovakia needs to focus is the support of public dialogue in the first phase of the preparation of the new regulatory environment**. This dialogue needs to be the foundation of the preparation of the basic regulatory and administrative framework of the Smart industries environment. The result should be the creation of new norms and standards regarding digitalization. One of the main means of support for this set-up would be the establishment of an evaluation of the most efficient regulatory approach and possible alternative forms of bureaucratic oversight. The best way would be to form **a Digital Impact Assessment on the basis of the Regulatory Impact Assessment.** This should help the set-up of regulatory principles of the digital economy towards standardization. The absence of this approach is also criticized in the Strategy of Smart industry for Slovakia. Lacking this approach, there is insufficient access to and use of public data in real time, which would give the public administration the information needed for the digitalization and creation of efficient electronic public services. The new legislation must focus on the support of innovative solutions in the form of protection of intellectual property, in the spirit of the needs of smart industries and new sectors in the digital era.[66]

The government needs to prepare new legislation for the simplification of access to different sources of finances at the Slovak and European level to support innovation and research on the part of SMEs. One of the main reasons, why Slovak companies invest too little in research and development, is a weak financial condition, which still does has not recovered to pre-crisis levels. Despite the fact that a decade has passed already since the start of the crisis, the Slovak economy has improved only gradually and the improvement has often been limited to specific sectors of the economy. Positive examples can be seen in the automotive industry or machine manufacturing. In comparison, the production of the IT, electronic and the optical equipment sectors have been doing worse even in the last couple of years.[67] [68] This situation results in the fact that Slovak companies have little capacity to invest in new innovations in the form of long-term tied assets, which have a long time frame needed to cover the costs and bring reliable rates of profit. Also given the low level of penetration of digitalized technology in the Slovak market, **there is still uncertainty about which platform and standards will be applied** in terms of the standardized solutions. Given the lower level of indebtedness

[64] Fifeková, E. a Nemcová, E. "Priemysel 4.0 a jeho implikácie pre priemyselnú politiku EÚ - Industry 4.0 and its Implications for EU industrial Policy", Prognostické Práce, Volume 8, No. 1, 2016, available at: http://www.prog.sav.sk/fileadmin/pusav/download_files/prognosticke_prace/2016/Priemysel.4.0.a.jeho.implikacie.pre.priemyselnu.politiku.pdf.

[65] Úrad vlády Slovenskej republiky "Koncepcia inteligentného priemyslu pre Slovensko – návrh", Rokovania vlády Slovenskej republiky, UV-30478/2016, available at: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26016.

[66] Office of the Government "Koncepcia inteligentného priemyslu pre Slovensko – návrh", Rokovania vlády Slovenskej republiky, UV-30478/2016, available at: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26016.

[67] SITA "Analýza priemyslu v SR: Úspech vo výzve Priemysel 4.0 vyžaduje investície", Webnoviny.sk, 27 April 2017, available at: https://www.webnoviny.sk/analyza-priemyslu-v-sr-uspech-vo-vyzve-priemysel-4-0-vyzaduje-investicie/.

[68] Office of the Government "Koncepcia inteligentného priemyslu pre Slovensko – návrh", Rokovania vlády Slovenskej republiky, UV-30478/2016, available at: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26016.

of Slovak industrial companies, there is still an opportunity to use bank loans to finance such investments. However, with the possibility of the increased costs of servicing such debts, there is a need for companies to focus on production with a higher added value. While this may decrease their competitiveness from the short-term perspective, in the long run this can increase their share of the newly created value in the companies' sales, resulting in higher return on the investment to Industry 4.0.[69]

4.3 Weak support of the research priorities and the development of the education

One more specific area, where the Slovak government has space for considerable improvement is the education system. It is imperative for Slovakia and the Ministry of Education in particular to increase its active involvement in high-tech industry, where there are considerable demands for improved quality of research and development. There is expected to be considerable demand for high-skilled employees. This creates a direct need for **a reform of the education system at all levels**, from primary to life-long learning. The current part of the discussion on the part of the Ministry of Education is how to best support the creation of applied interdisciplinary study curricula, which would enable students to gain the **qualifications for a wide range of career applications**. Responsibility should also be borne by corporations to integrate these new education programs into their production processes. This **cooperation between the education and the production sector** should lead to an exchange of personnel and know-how between companies and education providers. The expected result is the improvement of theoretical and practical knowledge, professional and technical skills of graduating students and the faculty staff. Due to the expected severe shortage of high-skilled employees in the very near future the public sector needs to support **the retraining of the current labour force** through more effective use of training centers to assure the full use of the potential of the Slovak workforce.[70]

The next aspect, where there is a need for cooperation between the various stakeholders in terms of preparation for the digital economy, is in the development of the concept of lifelong education. Slovak enterprises are still only weakly interested in improving the qualifications of their own employees and in the preparation of training for the unemployed, namely those who are difficult to get back into the labour market. Slovakia lacks a national debate for the support of the correct identification of new opportunities for the development of education system. Slovakia needs leadership and support in the implementation of smart industry and technologies. It is necessary to undertake thorough and specialized analyses for the correct evaluation of the current or future needs of industry and companies. Vocational education could be the solution that would bring Slovak universities closer to Slovak businesses mainly in the manufacturing sector in the form of the creation of inter-sectoral partnerships. Smart industry will require

[69] SITA "Analýza priemyslu v SR: Úspech vo výzve Priemysel 4.0 vyžaduje investície", Webnoviny.sk, 27 April 2017, available at: https://www.webnoviny.sk/analyza-priemyslu-v-sr-uspech-vo-vyzve-priemysel-4-0-vyzaduje-investicie/.

[70] Ministry of Education "Duálny systém odborného vzdelávania je výhodný aj pre automobilový priemysel", Ministerstvo školstvo, vedy, výskumu a športu, 20 April 2016, Available at: https://www.minedu.sk/dualny-system-odborneho-vzdelavania-je-vyhodny-aj-pre-automobilovy-priemysel/.

the establishment of exchange programs connecting professionals in trade and industry with the respective schools and educational programs.[71] [72]

The main weakness of the Slovak labour force with respect to digitalization and preparation for the introduction of Industry 4.0 is **the low level of IT skills among the general workforce**. Numerous representatives of the business sector in combination with academic staff have demanded an increase in the financing of IT study fields. Slovakia is unable today to graduate enough specialists in the area of information and communication technologies, to be able to function as the necessary base for the digital transformation of Slovakia. Without specific support there would be a growing threat to the further development of the Slovak economy in multiple sectors resulting in the backsliding of Slovakia in comparison with other economies of the European Union in multiple industries. According to the World Economic Forum's report in 2016, in the digital era, only those countries will succeed that manage to create flexible forms of employment and considerably increase IT abilities as a part of their education programs. The weakness of Slovakia has been underlined by the claims of **the IT Association of Slovakia**, which says that the government continuously ignores the situation of its education system. This system is in a catastrophic condition and together with the unfavourable demographic trend it could cause Slovakia to lose its place in European and international supply chains. This would mean that Slovakia would find itself in the periphery of the European economic area.[73]

4.4 Insufficient levels of physical and digital infrastructure

The development of new solutions in the digital economy requires also the development of infrastructure, which in Slovakia is in much worse shape than in the countries of Western Europe. Slovakia needs to boost **the quality of the physical (i.e. transport) as well as technological and IT infrastructure**. The main task in the infrastructure field is the technology infrastructure required to connect machinery to the IoT network, which is the basis for the introduction of digitalization. However, to achieve a greater level of penetration of Industry 4.0 to specific sectors of the economy, there will also need to be considerable investments in obsolete forms of urban and regional infrastructure. One of the most glaring areas, in which Slovakia loses when compared with other countries, is lacking development of its transport infrastructure. Another critical aspect is the area of infrastructure for the unleashing of the full potential of digitalization. Slovakia lacks preparedness of the physical infrastructure of roads for the implementation of sensors and other technologies of IoT networks. This can considerably slow down the speed of implementation of the technological opportunities and the availability of the benefits hidden in Industry 4.0 for urban planning. Related to the previously mentioned problems of insufficient capital available for investments into scientific and research priorities, there are similar obstacles to the improvement of **outdated infrastructure in the areas of education and health care**. These are other key areas of infrastructure, where Slovakia is at risk of losing out due to a lack of planning

[71] Office of the Government "Koncepcia inteligentného priemyslu pre Slovensko – návrh", Rokovania vlády Slovenskej republiky, UV-30478/2016, available at: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26016.

[72] Ministry of Education "Duálny systém odborného vzdelávania je výhodný aj pre automobilový priemysel", Ministerstvo školstvo, vedy, výskumu a športu, 20 April 2016, available at: https://www.minedu.sk/dualny-system-odborneho-vzdelavania-je-vyhodny-aj-pre-automobilovy-priemysel/.

[73] Budinský, G. "Keď sa nezmení prístup vlády vo vzdelávaní IT špecialistov, Slovensko sa z technologickej krajiny prepadne na montážnu dielňu", IT Asociácia Slovenska, 21 July 2017, available at: http://itas.sk/ked-sa-nezmeni-pristup-vlady-vo-vzdelavani-it-specialistov-slovensko-sa-z-technologickej-krajiny-prepadne-na-montaznu-dielnu/.

in terms of the quality of education and health care services it can deliver. The impact on business mentioned above is highly dependent on these areas.[74]

The negative impact of the low quality of infrastructure in Slovakia was pointed out by Slovak suppliers in the area of the automotive industry. Up to 12 percent of them have pointed out that the inadequate infrastructure poses a risk that could affect the growth of their company in Slovakia.[75] Besides the physical infrastructure there is a problem also associated with **the low rate of outsourcing of secure IT infrastructure and the services of data centers. Companies are very slow to get used to the new opportunities stemming from the available IT solutions**. Trust in the digitalization of operations and data servicing is only picking up slowly. This is caused by the fact that these systems would contain **confidential company information, and thus there would be a higher risk of damage, loss or abuse of such information on the part of the supplier**. Slovakia still lacks more extensive experience with the different uses of the existing and new prospective physical and digital infrastructure. Together with the lack of finances to invest in new IT solutions for their companies, a lack of trust and practical experience are acting as the main brake on the process of creation of a new infrastructure for small and medium enterprises.[76]

Finally, **Slovakia also has shortcomings in the area of development and deployment of renewable sources of energy, implementation of smart machinery and the optimization of the existing infrastructure.** The Slovak Strategy of Smart Industry for Slovakia deems necessary to bring innovations into Slovak industry. To achieve this it proposed a system of support for research innovations. It is necessary to create a transition framework connecting the existing measures with the new elements. The public administration itself needs to improve its preparedness for the implementation and inclusion of the digital infrastructure in its processes by increasing the skill set of its employees and updating the systems it uses. Slovakia therefore needs to bring its industry as well as its public services into a modern technological infrastructure, where it would be possible to prepare the country for the new digital factories and digital public administration. Digital infrastructure in the form of the connection of research and development in private and university areas as well as the digitalization of education are the key areas where Slovakia needs to make its main steps and public investments for the development of new opportunities.[77]

[74] Fifeková, E. a Nemcová, E. "Industry 4.0 and its Implications for EU industrial Policy", Prognostické Práce, Volume 8, No. 1, 2016, available at: http://www.prog.sav.sk/fileadmin/pusav/download_files/prognosticke_prace/2016/Priemysel.4.0.a.jeho.implikacie.pre.priemyselnu.politiku.pdf.

[75] Hörning, J., Mrnka, P. and Grošeková, J. "Prieskum dodávateľov automobilového priemyslu: Slovensko", 2016, PwC, available at: http://www.pwc.com/sk/sk/odvetvia/automobilovy-priemysel/assets/survey2016/prieskum-dodavatelov-automobiloveho-priemyslu-2016.pdf.

[76] Gérer, A. (2016) "Priemysel 4.0 sa neviaže len na veľké projekty", ATPJournal.sk, 24 August 2016, available at: http://www.atpjournal.sk/novetrendy/priemysel-4.0-saneviaze-lennavelke-projekty.html?page_id=23852.

[77] Office of the Government "Koncepcia inteligentného priemyslu pre Slovensko – návrh", Rokovania vlády Slovenskej republiky, UV-30478/2016, available at: http://www.rokovania.sk/Rokovanie.aspx/BodRokovaniaDetail?idMaterial=26016.

4.5 The Slovak Republic (SWOT)

STRENGTHS (present)	OPPORTUNITIES (future)
▪ **strong presence** of companies demanding a focus on upskilling of the workforce, mainly in the **automotive and manufacturing areas** ▪ development of the foundational document **Strategy for Smart Industry in Slovakia** with the outline of key principles to follow ▪ **high quality of specialized IT faculties** in Slovakia, even though the number of graduates is thus far insufficient ▪ stable government **with no negative populist rhetoric against the European Union or the business environment**	▪ **decreasing levels of unemployment push for the need to focus on improving skills for the unemployed** and tailor the graduates to the needs of employers ▪ presence of **strong technological players Google, IBM and other** companies familiar with providing Smart solutions ▪ improvements in the road and the railroad infrastructure could further Slovakia's potential as it finds itself in an important spot for the railroad trade route from China ▪ potential for improvement of the local and municipal authorities if they adopt the smart city initiatives
WEAKNESSES (present)	**THREATS (future)**
▪ **missing link between universities and employers** in terms of providing a feedback loop between the curricula and the needs of employers ▪ **lack of infrastructural preparedness** for the immediate deployment of many digitalized solutions ▪ **absence of platform uniting business leaders and public administration** to support the definition of agreed standards to use in the processes of deployment of the Internet of Things ▪ lacking financial resources of businesses to dedicate to the development of smart solutions ▪ **inactive approach** by the national as well as regional public administration in terms of legislation or executive action that would grasp the importance of this transformation and the risks associated with non-action	▪ chances of the main industry players **leaving the country due to lack of action on the part of the public authorities** ▪ negative demographic trends point in the direction of the need for substantial immigration to substitute for the low fertility rates – **in the next few years the numbers of graduates will not meet the needs of the new technological development** ▪ lacking attention to vocational education and **low focus on the language and IT oriented skills** of the general graduating population ▪ lack of attention to **the situation of the teaching staff**, whose low salaries resulted in minimal interest for this career path by students – this can cause teacher shortages in IT, physics and chemistry, but also a diminishing quality of other subjects as good graduates choose better paid professions

5. Czech Republic

Kryštof Kruliš

5.1 Introduction

The Czech Republic has entered the year 2018 as the country with the lowest unemployment rate in the European Union (EU). It is also a country with a large tradition of manufacturing sector and is frequently mentioned as a country with the highest share of the manufacturing sector in its GDP. According to the Czech Statistical Office the industrial sector in the Czech Republic traditionally represents a large share in the overall Gross Value Added (32.4% in 2014), employs over 1.5 million workers and is highly concentrated in sectors around automotive, metal construction and metal products.[78] The Czech Republic not only has three large car manufacturers (Škoda Auto, Hyundai and TPCA) but also a large ecosystem of suppliers for the automotive industry that are able to produce not only for Czech car plants but also for the EU internal market. The automotive industry has been a frontrunner in the introduction of the concepts of industry 4.0 and also Czech industry is penetrated with such modern technologies. There are however several industrial sectors and SMEs in particular, that await the introduction of these technologies. Also the automotive industry itself will undergo, with electric cars and autonomous driving systems, a significant change of its final product in the future, with a possible shift towards provision of mobility rather than selling of cars. This shows that the concept of 4.0 developed from the notion of a high-tech manufacturing plant of the future to a near future arrival of new technologies that will penetrate all layers of our life. The 4.0 technologies thus include digitalization, Internet of Things, Artificial Intelligence/Machine Learning, automatization and robotization, autonomous cars and blockchain. They have the potential to develop new concepts not only in industry but also in trade and services. They will influence the jobs we do, the cities we live in, the ways in which we travel and how we spend our free time. This paper maps strategies and institutions that has been developed in the Czech Republic to prepare for the 4.0 era and examines how has the 4.0 discourse has been developing among the relevant stakeholders. At the end it offers a SWOT analysis on the Czech position on the verge of the 4.0 era.

5.2 Official 4.0 Strategies in the Czech Republic

In 2015 the Ministry for Industry and Trade initiated the drawing up of the **National Initiative Industry 4.0** (Národní iniciativa Průmysl 4.0) by a group of authors around professor Vladimír Mařík, a director of the Czech Institute of Informatics, Robotics and Cybernetics at the Czech Technical University in Prague.[79] This document aimed at initiation of a wider debate about the arrival of the 4.0 era and the position of the Czech Republic. It also included an initial SWOT analysis dealing with this topic from the Czech perspective.

The area of cybersecurity has been identified as a potential weak spot in the operations of state after the adoption of new technologies. The main strategic document in this area is the **National strategy of cybersecurity of the Czech Republic 2015-2020** (Národní strategie kybernetické bezpečnosti České republiky 2015-2020),[80] approved by the government in February 2015 within the Czech

[78] Czech Statistic Office "Českému průmyslu se daří", September 2015, https://www.czso.cz/csu/czso/ceskemu-prumyslu-se-dari.

[79] National Initiative Industry 4.0, available at: http://www.businessinfo.cz/app/content/files/dokumenty/narodni-iniciativa-prumysl-40.pdf.

[80] National strategy of cybersecurity of the Czech Republic 2015-2020, available at: https://www.ccdcoe.org/sites/default/files/strategy/CZE_NCSS_cz.pdf.

national security framework. It mentions the Internet of Things as one of the features that will increase possible threats to cybersecurity in the future and also reflects on weak cybersecurity at SMEs, cloud and protection of big data, among other things, and calls for education, research and cooperation between public and private sectors in this area. In August 2017 a new **National Cyber and Information Security Agency** (Národní úřad pro kybernetickou a informační bezpečnost)[81] was created as the central body of state administration for cyber security.

The leading official strategy in the area of science is the **National policy of research, development and innovation for the years 2016-2020** (Národní politika výzkumu, vývoje a inovací na léta 2016-2020), approved by the government in February 2016.[82] It is the first science strategy that was developed in cooperation with the business sector. It strengthens applied research within its timeframe, and names key fields of research in the Czech Republic. It also envisages the development of new measures that would press for cooperation of researchers and the private sector, including a database of devices of research institutes that could be used also for research in the private sector and tries to find ways to involve SMEs in research.[83] This national policy also reflects current documents on research and innovation under the EU framework, in particular the European Research Area Roadmap 2015 – 2020,[84] a component of the Europe 2020 Strategy.

The most complex official document that deals with implementation of 4.0 technologies in the Czech Republic and explores possibilities for sustaining and enhancing competitiveness of the country as well as the transformative influence on the society, in the long term, is **Initiative Industry 4.0** (Iniciativa Průmysl 4.0).[85] It was approved by the government on 24 August 2016. This extensive study describes the current state, maps the existing supporting measures and identifies key challenges that are ahead of us. It thus provides detailed information for the government and social partners necessary for formulation and adoption of specific measures where necessary. The suggested measures in the area of research reflect the existing and above mentioned National policy of research, development and innovation for the years 2016-2020.

The perspective of substantive changes of our society due to implementation of new 4.0 technologies was inserted also to the current **National program of reforms in the Czech Republic 2017** (Národní program reforem České republiky 2017), approved by the government in April 2017,[86] which is updated on a yearly basis and serves also as an underlying document for assessments of national policies by the European Commission within the European Semester framework.

There are a number of reform strategies that are related to or even bear in their own title the label "4.0" and implement suggestions from the horizontal Initiative industry 4.0 in specific vertical dimensions.

In the area of employment there is an official strategy named **Action plan for Labour 4.0** of the Ministry of Labour and Social Affairs, with the last update from

[81] National Cyber and Information Security Agency website: https://www.govcert.cz/.
[82] National policy of research, development and innovation for years 2016-2020, available at: http://www.vyzkum.cz/FrontClanek.aspx?idsekce=682145.
[83] Introduction of the National policy of research, development and innovation for years 2016-2020, available at:
http://www.vyzkum.cz/FrontClanek.aspx?idsekce=682145.
[84] Council Conclusions on the European Research Area Roadmap 2015 – 2020, No. 8975/15, 19 May 2015, available at: http://data.consilium.europa.eu/doc/document/ST-8975-2015-INIT/en/pdf.
[85] Initiative Industry 4.0, available at:
https://www.mpo.cz/assets/dokumenty/53723/64358/658713/prilohaoo1.pdf.
[86] National program of reforms in the Czech Republic 2017, available at:
https://www.vlada.cz/cz/evropske-zalezitosti/aktualne/vlada-schvalila-narodni-program-reforem-cr--na-zaklade-ktereho-nam-evropska-komise-navrhne-nova-doporuceni-155605/.

January 2018,[87] which follows the outcomes of the sectoral study named Initiative Labour 4.0, with the last update from December 2016.[88] It is intertwined and mutually complementary with the **Action plan – Strategy of Digital Literacy of the Czech Republic 2015-2020** (Akční plán Strategie digitální gramotnosti ČR na období 2015 až 2020), from June 2015.[89]

Initial work on the National Initiative Industry 4.0 in 2016 involved representatives of employers but was criticized for omitting trade unions from the process.[90] It seems that this has been remedied in later phases. Trade Unions together with other social partners, representatives of the academic sphere and public administration form together an **Alliance Society 4.0**, a platform for coordination of all existing economic and social aspects that arise from the arrival of 4.0 technologies. It is also envisaged that the Alliance will enter into contact with similar bodies in other states in order to exchange best practices in adaptation to the 4.0 era and help in formation of positions of the Czech Republic within the institutions of the EU.[91]

Finally the **Action plan for Society 4.0** (Akční plan pro společnost 4.0),[92] approved by the government in September 2017, represents the multisectoral roof framework with priorities and a timetable for all initiatives connected to 4.0 technologies and their impact on society.

The system of 4.0 development strategies has proliferated rapidly since August 2016 when the horizontal Initiative Industry 4.0 was completed. Most of the relevant players, including relevant ministries (Ministry of Industry and Trade, Ministry of Labour and Social Affairs and Ministry of Education, etc.), developed their own vertical strategies that suggest specific measures envisaged in the horizontal Initiative Industry 4.0. The label "4.0" has become widespread and some may say even overused. The positive aspect of this is that individual sectors have at least started to think about their portfolios from a longer-term perspective and admitted that their existing approaches may need to be adjusted to the challenges arising from rapid technological development and the resulting societal shifts. In some cases this endeavour also revealed a need for intersectoral cooperation, e.g. between education and employment strategies, and may be positive if such actions are reflected not only in strategies but also in better cooperation between responsible institutions.

Formulation of strategies is, however, only a first phase. Strategies and action plans need to be implemented, executed and their outcomes properly assessed. The technological development may demand flexibility and reorientation on other priorities in the future. A threat to such a complex system that has grown in the last three years is that a new government may prefer to proceed in a different way, in procedure and/or in substance. This in fact happened after elections in 2017 and partially changed the institutional arrangement in state administration responsible for coordination of the 4.0 agenda (dissolution of the position of national coordinator of digital agenda, see below). Adjustability of the strategies and the institutional

[87] Action plan for Labour 4.0, available at: https://portal.mpsv.cz/sz/politikazamest/prace_4_0/akcni_plan_prace_4.0.pdf.
[88] Study Initiative Labour 4.0, available at: https://portal.mpsv.cz/sz/politikazamest/prace_4_0/studie_iniciativa_prace_4.0.pdf.
[89] Action plan – Strategy of Digital Literacy of the Czech Republic 2015-2020, available at: https://www.mpsv.cz/files/clanky/21499/Strategie_DG.pdf.
[90] Šulc Jaroslav "Makroekonomická reflexe agendy Průmysl 4.0 z pozice odborů" Pohledy 1/2016, available at: https://www.cmkos.cz/obsah/219/pohledy-12016-volne-ke-stazeni/17350, p. 86.
[91] SPOLEČNOST 4.0 a ALIANCE SPOLEČNOST 4.0, available at: http://digiczech.eu/pilire-spolecnosti-4-0/spolecnost-4-0/.
[92] Action plan for Society 4.0, available at: https://www.dropbox.com/s/f1cgumoxv5vjhe7/Ak%C4%8Dn%C3%AD%20pl%C3%A1n%20pro%20Spole%C4%8Dnost%204.0.pdf?dl=0.

framework responsible for their implementation will be the real test of quality and functionality of the recently developed system.

5.3 Responsibilities: who is now Mr./Mrs. "4.0"

A new government has been formed by the ANO movement after the last 2017 general elections. ANO won the elections with 78 seats (out of 200 seats) in the lower Chamber of the Czech Parliament. So far (until the beginning of April 2018) the government has not been able to secure a majority and currently governs in resignation (i.e. before a new government is formed) but it is highly probable that it will have a majority in any government that may come from ongoing coalition negotiations. Several changes have been introduced into the institutional framework responsible for the 4.0 agenda. The former government created a post of Coordinator of the Digital Agenda at the Office of the Government with responsibilities over coordination of the digital agenda (including 4.0 agenda) between responsible ministries and who was charged with securing dialogue with social partners in this field. This post was dissolved by the new government after the elections.

The agenda has been shifted partly to a newly created position of a **Governmental Commissioner for IT and Digitalization** (Mr. Vladimír Dzurilla) at the Ministry of Internal Affairs. Mr. Dzurilla will chair the Council for Information Society of the Government which is primarily in charge of the agenda of eGovernment and its coordination throughout all governmental departments and in coordination with associations of regions and municipalities in the Czech Republic.

Mr. Ondřej Malý, the previous coordinator of the digital agenda, has become a **deputy at the Ministry of Industry and Trade with responsibility over development of internet** in the Czech Republic. His primary tasks include solving the long-standing issue with EU subventions into high-speed internet (in rural areas) and developing measures in support of the development of internet infrastructure.

A new specific position of **Commissioner for Digital Education** has been also been created at the Ministry of Education with Mr. Ivan Pilný (former Minister of Finance from the ANO movement) responsible for this post. Mr. Pilný wants to accelerate implementation of the Strategy of Digital Literacy of the Czech Republic 2015-2020. He also stresses that life-long learning is a must in the era of new technologies.[93]

Overall it seems that the main focus of the current government in connection with the 4.0 agenda has shifted from long-term systematic planning to specific issues that need to be addressed as quickly as possible. Institutionally, it prefers nomination of a strong personality into a position of a Commissioner assigned to a specific Ministry who is given narrower tasks with clear goals. This may be naturally influenced by the political situation (seeking the majority in the lower Chamber) that determined only a limited timeframe for the current government.

[93] See for instance an interview for iDnes.cz, 16 March 2018, available at: https://zpravy.idnes.cz/rozhovor-ivan-pilny-strategie-digitalniho-vzdelavani-p11-/domaci.aspx?c=A180228_171922_domaci_nub.

5.4 “4.0” in the program of the current government

Development of digital infrastructure with use of EU funds and unhindered access to high-speed internet for every Czech citizen is mentioned among the priorities in the program of the current government.[94] Besides this the program of the current government also pledges that the government, in close cooperation with business, science and research sectors, will secure implementation of the project “Industry 4.0” and that it will prepare an analysis of the possible impact of robotization on the domestic manufacturing sector.

The label “4.0” expressly appears in the program of the current government also in connection with a pledge to support research, development and innovations in the area of Agriculture 4.0 (smart farming).

5.5 5G network build-up

Spread of 4.0 technologies may find a bottleneck in capacity of the mobile internet networks. The concepts of Smart Factories, Smart Cities, Smart Households, Smart Grids, eHealth, various cloud solutions, autonomous cars or drones will all require instant connection and availability of mobile data flow for billions of devices at the same time. The technological answer that will allow full operation of the Internet of Things is the 5G network with the potential of 100 billion connections, 1 ms latency and a speed around 10 Gbps. It should also allow so called network slicing allowing virtual division of the network into separated services focused for instance on high latency that is important for use of autonomous cars.

At the EU level the endeavour is represented by a Public-Private-Partnership launched in 2013 and the communication of the European Commission named 5G for Europe: An Action Plan.[95] In 2017 the Czech Telecommunication Office arranged auctions of five blocks of frequencies for 5G networks. Nordic Telecom 5G, O2, Vodafone and PODA were among the successful bidders. The commercial start of the new networks is expected by 2021. September 2018 has been announced as the date of a first pilot operation of a 5G network in agreement between the Czech Telecommunication Office and Nokia. This testing should indicate potential barriers for 5G connectivity that may appear in the environment of the Czech Republic and should speed commercial use of 5G by several years.[96]

5.6 The Czech discourse on the 4.0 industry: are we entering a jobless era?

One of the key questions connected with the advent of the 4.0 technologies in the Czech Republic is how this will influence the Czech economy and labour market. The discussion on this topic interlinks with other broader discussions. Primarily, it is a discussion on how to overcome the potential glass ceiling of economic growth connected with the currently almost exhausted growth

[94] The program of the government, January 2018, available at: https://www.vlada.cz/cz/jednani-vlady/programove-prohlaseni-vlady-162319/.

[95] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: "5G for Europe: An Action Plan" - COM(2016)588 and Staff Working Document - SWD(2016)306, available at: https://ec.europa.eu/digital-single-market/en/news/communication-5g-europe-action-plan-and-accompanying-staff-working-document.

[96] Elčić Sandro “Spolupráce s Nokií urychlí nasazení 5G sítí v Česku, říká vývojář z ČVUT. Mobilní internet by měl být dvacetkrát rychlejší“ ihned.cz, 6 March 2018, available at: https://byznys.ihned.cz/c1-66069830-spoluprace-s-nokii-urychli-nasazeni-5g-siti-v-cesku-rika-vyvojar-z-cvut-mobilni-internet-by-mel-byt-dvacetkrat-rychlejsi.

strategies based on a relatively cheap labour force and thus how to increase the added value of our economic production and how to secure a sustainable convergence of per capita income to the EU average. Industry 4.0 as a topic has been present for several years with the involvement of representatives of the industry (associations of employers and individual companies), labour unions and academics.

There have been a number of conferences focused on the arrival of 4.0 technologies. In 2016 the Ministry of Industry and Trade and the Agency Czech Invest organized a series of conferences in Czech cities including Brno, Plzeň, Ostrava or Liberec.[97] Various other events were organized by the private sector and media, e.g. the two conferences Industry 4.0 by Economia in Mladá Boleslav in June 2016 and 2017.[98] They focused primarily on presentation of the 4.0 solutions in specific production processes. There are also several highly specialized research centres at Czech universities that work in the area of 4.0 technologies, for instance the Czech Institute of Informatics, Robotics and Cybernetics[99] or the Department of Cybernetics of the Faculty of Electrical Engineering[100] both at the Czech Technical University in Prague.

The impact of new technologies on the labour market receives large attention in the media.[101] In June/July 2017 the new issue of the OECD Employment Outlook reported that the Czech labour market (similarly as the labour market of the Slovak Republic) may be the most negatively impacted by the advent of new technologies from all OECD member states, with approximately 45% of jobs threatened.[102] The expectation is that new technologies of automatization and robotization will cut primarily jobs of middle salary and middle level of skills. Jobs that requires top skills and offer high salary (engineers, programmers) as well as jobs of the lowest level of skills and salary (labourers) will remain. The first will still be needed to develop and oversee the new industrial processes and the cost of the latter are low so that automatization of their posts will come last or not at all.

Later in 2017 the OECD further indicated that the Czech Republic is among the few of its member countries that go against the general trend of de-industrialization on the developed labour markets. The OECD´s Science, Technology and Industry Scoreboard 2017[103] reveals that the Czech Republic has the largest share (around 50 %) of jobs created between 2010 and 2015 in the manufacturing sector. No other OECD member state has such a significant share of newly created jobs in this sector. The nearest followers in this statistic are the Slovak Republic and Poland with about 25% of new jobs in manufacturing, followed by South Korea. The general trend in OECD countries is completely the opposite. Overall, over 90 % of newly created jobs in the OECD are in services. This raises even more questions about the sustainability of such new jobs after the arrival of new technologies.

The last in-depth study to focus solely on this issue in connection with the Czech economy was finalized by Deloitte in March 2018.[104] The study calculates that automatization has the potential to substitute 51% of the current jobs

[97] Conference Industry 4.0 in Liberec, the Czech Invest https://www.czechinvest.org/cz/Homepage/Novinky/Prosinec-2016/V-Liberci-se-konala-konference-Prumysl-4-0-v-praxi.

[98] Conferences Industry 4.0 in Mladá Boleslav, Economia, https://events.economia.cz/16411-prumysl-4-0 (2016) and https://events.economia.cz/17411-prumysl-4-0-objevte-chytre-reseni-pro-vas-podnik (2017).

[99] Website of CIIRC: https://www.ciirc.cvut.cz/.

[100] Website of Department of Cybernetics of FEE: https://cyber.felk.cvut.cz/.

[101] See for instance the debate on Česká pozice/Lidové noviny in January 2018, available at: http://ceskapozice.lidovky.cz/roboti-nas-predevsim-nauci-flexibilite-d95-/debata-jana-machacka.aspx?c=A180124_102146_machackova-debata_houd.

[102] OECD (2017), OECD Employment Outlook 2017, OECD Publishing, Paris, http://dx.doi.org/10.1787/empl_outlook-2017-en.

[103] OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264268821-en, p. 42.

[104] Marek David et al. "Automatizace práce v ČR - Proč se (ne)bát robotů" Deloitte, March 2017.

in the Czech Republic by the year 2033. The highest threat of job loss is in the transportation and logistics sector and the lowest threat is to jobs in education. The largest number of jobs which may be potentially lost (in absolute numbers) is in manufacturing (183,000 jobs lost), in wholesale and retail (99,000 jobs lost) and in transportation and logistics (53,000 jobs lost). The worst-case scenario of maximum automatization and zero level of requalification estimates unemployment of 16% in 2033. The best scenario of effective requalification (taking approx. 2 years between job loss and re-entry into the work process) would keep the Czech Republic with a low level of unemployment, under 4%. This scenario is also the best from the perspective of potential GDP growth (up to 78% cumulative GDP growth between 2013 and 2033) and growth of average salary (up to 83,000 CZK in 2033). The primary recommendations of Deloitte therefore point to improvement of education and stress preparation for flexibility of workforce, development of ICT skills, ability to approach problems in an interdisciplinary way as well as development of general soft skills. Media reflected this study[105] and stressed its message including an explanation that automatization will not concern only monotonous manual work in the manufacturing sector (where in fact automatization has already gained significant ground in some segments, particularly in the automotive industry) but also monotonous cognitive work in logistics, trade and services.

Also Labour union officials, most vividly Josef Středula, the president of the Czech-Moravian Confederation of Trade Unions, are known for underlining the potential vulnerability of the Czech labour market to new technologies and stressing the necessity to debate the issue of Industry 4.0 from a broader social perspective and frame it thus rather under the Society 4.0 title which would include aspects of Labour 4.0. Mr. Středula also stresses the necessity of lifelong education and suggests the creation of a special fund for lifelong training which would be financed by state, employers and employees alike.[106] The first larger study of the 4.0 phenomenon in literature by trade unions in the Czech Republic brought into the debate important features such as reflection of an exponential growth of technology developments and their application.[107] This perspective underlines the high probability of discontinuity in the 4.0 era as it is happening in a time when the exponential growth of technology developments (especially in the area of computing capacity, the so called Moor´s law) has gained such a speed that every new step in technological progress opens immense space for application which does not only allow for faster performing of the currently known tasks but also allows the creation of completely new tasks or an immense number of combinations of tasks.[108] Historical experience is thus less and less sufficient and new approaches must be developed from scratch. Šulc thus concludes that in the 4.0 era there will be more discontinuity than continuity and we will also face the problem of substituting quantity with quality.[109] Rapid development of digital solutions will also have to cope with subjective/psychological aversion for quick changes.[110] Developments

[105] Klesla Jan "Dva miliony Čechů změní svou profesi, v ohrožení jsou úředníci a prodavači" Lidové noviny, March 2018, available at: https://byznys.lidovky.cz/dva-miliony-cechu-zmeni-svou-profesi-v-ohrozeni-jsou-urednici-a-prodavaci-1r5-/firmy-trhy.aspx?c=A180326_081523_firmy-trhy_ele.
[106] Nováková Denisa "Průmysl 4.0: Chytré továrny? Vláda nesmí zaspat" Euractiv.cz, July 2015, available at: http://euractiv.cz/clanky/obchod-a-export/prumysl-40-nova-era-prumyslove-vyroby-012762/.
[107] Šulc Jaroslav "Makroekonomická reflexe agendy Průmysl 4.0 z pozice odborů" Pohledy 1/2016, available at: https://www.cmkos.cz/obsah/219/pohledy-12016-volne-ke-stazeni/17350.
[108] A good example of this is development of a concept of machine learning which was already well-known decades ago but it has not been possible to use it until reaching of the current levels of computing capacity. This setting also opens great space for both primary and applied research and possibly provide for unlimited number of job opportunities for those who are ready to jump in research projects.
[109] Ibid, p. 74.
[110] Ibid, p. 78.

in medicine that improve possibilities to reach a higher age and gradual aging of the Czech population may strengthen this conservative approach to the implementation of new digital solutions, especially in cases where they are not sufficiently user friendly for their target user group and require specific technical skills.

There have also been voices critical of the notion that Industry 4.0 genuinely represents a new industrial revolution. For instance Lukáš Kovanda stresses that the growth of productivity in the last decade has been the smallest in the whole of the last century which means that Industry 4.0 can hardly represent a true transformation and it may be used only as an argument for state redistribution of finances to subvention schemes.[111] Kovanda however suggests that bigger shifts in productivity can in fact be brought about by sharing economy platforms or greater utilization of blockchain technology for which no subsidies are needed and development in these fields can be achieved within a more liberal regulatory environment.[112] Also professor Zelený considers Industry 4.0 to be only a smart label of German marketing that was initiated at a trade fair in Hannover.[113] He argues that Industry 4.0 (including digitalization, automatization, internet of things, robotization and artificial intelligence) does not represent an industrial revolution but a mere organic and evolutionary innovation of new technologies throughout all sectors.[114] In this concern the Initiative Industry 4.0 clarifies that in the technological sphere the 4.0 transformation has evolutionary form while in the socio-economic dimension it appears as a revolutionary change.[115]

The Czech economy is highly open, with a high level of exports and imports relative to its GDP. At the same time our export market is oriented dominantly to the EU and to Germany in particular. This topic is also widely discussed but is very rarely contemplated from a long-term perspective (let´s say 15 years from now) and with reflection on whether, and to what extent, the advent of 4.0 era can reshuffle these trade patterns. One of the main goals of the project Digital New Deal[116] of the Association for International Affairs and its partners is to open up a debate on this aspect and envisage also potential changes in the politics of the Central European region, and the positions of Central European countries in EU politics and beyond.

The Czech Republic is well aware of the key role of new technologies on our future. Most of the features in the discourse suggest that our country has more than most at stake during the 4.0 technological revolution. It will take many things to prepare our country for the changes. We need to develop sufficient infrastructure, reform our education system, strengthen relevant public institutions and develop a proper regulatory environment that will be at once compatible with global and EU standards but at the same time will give us the competitive advantage of a country that is open to new technologies. Success in this endeavour can boost our economic convergence to the average of the EU and above. Failure could deprive us of this opportunity and even worse, it could end the currently employed growth pattern we have been using in over the last decades but without any substitution.

[111] Kovanda Lukáš "KOMENTÁŘ: Blamáž jménem Průmysl 4.0" iDNES.cz, August 2017, available at: https://ekonomika.idnes.cz/prumysl-4-0-ctvrta-prumyslova-revoluce-iniciativa-mpo-komentar-kovanda-13i-/ekonomika.aspx?c=A170825_144424_ekonomika_ane.

[112] Ibid.

[113] Zelený Milan et al. "Průlomové technologie, automatizace a digitalizace" April 2016, available at: http://www.milanzeleny.com/cs-CZ/stranky/1/-/0/427/prulomove-technologie-automatiza.

[114] Ibid.

[115] Initiative Industry 4.0, available at: https://www.mpo.cz/assets/dokumenty/53723/64358/658713/prilohaoo1.pdf, p. 36.

[116] Digital New Deal project, AMO: http://www.amo.cz/en/smooth-functioning-of-the-internal-market-between-v4-countries-en/.

5.7 The Czech Republic (SWOT)

STRENGTHS (present)	OPPORTUNITIES (future)
▪ **Entering the 4.0 era with the lowest level of unemployment in the EU (unemployment of 2.4% in January 2018)** The current high demand for workforce can cushion to some extent adverse effects of new technologies on labour market and thus ease their initial political and social acceptance. The situation on the labour market may also push us to earlier adoption of new technologies. ▪ **Relatively low level of public debt (under 35% of GDP in 2017)** which provides some space for investment into necessary infrastructure, improvement of education (schools, lifelong training) and support of research. ▪ Genuine and viable Czech companies in the fields of e-commerce and cybersecurity (regionally) and internet (domestically) ▪ Good strategic estimation of the Czech position at the beginning of 4.0 era that has been produced within recent years (e.g. Initiative Industry 4.0)	▪ **Advent of new technologies can push forward transformation of the Czech economy towards higher levels of added value** (especially in time when older growth strategies based on relatively cheap labour force have been almost exploited) ▪ **Industrial tradition with sectors that have already started to implement 4.0 concepts** (ability to develop and export 4.0 industrial solutions, both hardware and software based on big data analysis of their use in practice) ▪ 4.0 concepts in broader sense such as internet of Services or online platforms (sharing economy) have a potential to provide alternatives to old concepts of employment and/or additional revenue for households
WEAKNESSES (present)	**THREATS (future)**
▪ **Underfinanced education system with low salary of teachers and limited access to high-tech teaching aids**. Narrow possibilities for lifelong learning in general. ▪ The capital city Prague as the country´s main attraction for knowledge economy that requires creation of international groups of experts **has limitations in access to EU funds and is missing important infrastructure** (easy connection to the airport or highway bypass for transit) ▪ **A culture of public administration that limits entrepreneurial spirit/start-ups** (paperwork, complicated and frequently changing laws, eGovernment solutions without proper reflection of user-friendliness)	▪ **High share of the manufacturing sector on Czech GDP and employment means that slow adoption of 4.0 solutions is connected with correspondingly high stakes** (among threats e.g. possibility of transfer of production elsewhere with end of status of low wage economy/high technical skill/obedient labour force) ▪ **High level of foreign ownership in Czech economy** which leads to supplier/subcontractor character of significant portion of the manufacturing sectors and inability to form independent investment/export strategies at the level of individual firms and subsequently limits strategic planning also at state level ▪ **Limited level of capital available for investments to new technologies, in particular in case of some SMEs**

6. V4: the Conclusions

The V4 countries enter the 4.0 era with relatively low unemployment. The Czech Republic has the lowest unemployment in the EU (2.4%) while Hungary (3.8%) and Poland (4.5%) belong to the top 10 EU countries with lowest unemployment; only the Slovak Republic (7.5%) is slightly above the EU average of 7.3% of unemployment rates, seasonally adjusted, January 2018.[117] This shows that the growth pattern based on the offer of a low cost labour force which is relatively technically skilled and has a low tendency for strikes, is almost exhausted. On first assessment it may seem that the arrival of 4.0 technologies, including automatization and robotization, that will free up some of the labour force is coming at exactly the right time. According to the *OECD Employment Outlook 2017* the Czech and Slovak labour markets include approximately 45% of jobs that are threatened by the arrival of new technologies, which is the worst situation from all OECD member states.[118] This may significantly shift the situation in the labour market. It is therefore necessary to develop proper strategies of lifelong training and adaptation to changes.

With the exception of Poland all V4 countries are extremely open economies, with a high level of both exports and imports relative to their GDP. Also Poland, with a relatively bigger internal market, has a level of imports and exports relative to GDP higher than countries of a similar size of population, e.g. Spain. Germany is the biggest purchaser of regional exports and one of the primary sources of incoming investments in the region. V4 companies that are locked in supply chains with German companies will be strongly influenced by standards adopted at other levels of the corporate chains. This may be good news from the perspective that Germany is the EU leader in the introduction of 4.0 industrial technologies and this guarantees that at least some parts of the industrial base in V4 countries will be forced to be among early adopters of new technologies and keep a high level of competitiveness. A downside to this is that alternative solutions that are globally available may not be preferred for compatibility reasons. Overall, the introduction of new technologies within the industrial sector will most probably lead to a strengthening of economic position of the region.

[117] Eurostat, File:Unemployment rates, seasonally adjusted, January 2018 (%) F2.png, available at: http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Unemployment_rates,_seasonally_adjusted,_January_2018_(%25)_F2.png.

[118] OECD (2017), OECD Employment Outlook 2017, OECD Publishing, Paris, http://dx.doi.org/10.1787/empl_outlook-2017-en.

Association for International Affairs (AMO)

AMO is a non-governmental not-for-profit organization founded in 1997 in Prague to promote research and education in the field of international relations. This leading Czech foreign policy think-tank owes no allegiance to any political party or to any ideology. It aims to encourage pro-active approach to foreign policy issues; provide impartial analysis of international affairs; and facilitate an open space for informed discussion.

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