

# 2030 Digital Transformation Strategy for Slovakia

## Strategy for transformation of Slovakia into a successful digital country



# Table of contents

Table of contents .....	2
Summary .....	3
1 Purpose of the strategy .....	7
1.1 Introduction .....	7
1.2 Document context .....	8
1.3 Global trends and technologies .....	12
1.4 Financial planning of the digital transformation at the level of the European Union .....	13
1.5 Digital strategies of developed countries .....	14
2 Starting point of Slovakia .....	16
2.1 Position of Slovakia in international indexes .....	16
2.2 SWOT analysis of the Slovak starting point .....	17
3 Vision of the digital transformation of Slovakia .....	27
3.1 Economy: Entrepreneurs are successful and can use and create innovations .....	28
3.2 Society and education: Citizens and consumers are able to use their potential in the digital era and their rights are protected .....	30
3.3 Public administration: Functioning and modern public administration that can effectively manage the territory from national to local level .....	32
3.4 Territorial development: Building smart cities and regions with participative development and agile use of data .....	33
3.5 Science, research and innovations: They can keep the pact with the current global trends and bring new high quality scientific knowledge .....	34
3.6 Intentions of the digital transformation .....	35
4 Recommendations for digital transformation of Slovakia 2019 – 2030 .....	37
4.1 Choice of Priority Areas and Technologies .....	37
4.2 Principles for Deploying and Using Technologies .....	39
4.3 Method and Tools of Implementation .....	42
4.4 The Short Term Horizon of the Strategy of 2019–2022 .....	44
4.5 The Long-Term Horizon of the Strategy for 2022–2030 .....	50
Conclusion .....	61
Annex 1: Explanation of Concepts .....	62
Annex 2: Building a Digital Single Market in the EU .....	63
Annex 3: Overview of Digital Strategies for Advanced Countries .....	64
Annex 4: Slovakia’s position in the DESI Index .....	71
Annex 5: The steps taken so far towards the digital transformation of Slovakia .....	74
Annex 6: Resources and Method for Developing the SWOT Analysis .....	76
Annex 7: Infobox: Recommendations for the Development of Artificial Intelligence in Slovakia .....	77

# Summary

*The 2030 Strategy for Digital Transformation of Slovakia is a framework cross-sectional government strategy that defines the policy and particular priorities of Slovakia in the context of currently on-going digital transformation of economy and society under the influence of innovative technologies and global megatrends of the digital era.*

The Strategy represents a key and decisive document for Slovakia at the beginning of the 21<sup>st</sup> century, at the time of necessary **transformation of industrial society into information society**. It covers the time period from 2019 to 2030 and it has been prepared as part of already launched and partially managed processes of digitalization, informatization and agenda of single digital market of the European Union (hereinafter only as the “EU”), as well as in the context of global priorities of a broad digital transformation. Thus, the Strategy puts primary emphasis on current innovative technologies such as **Artificial Intelligence** (hereinafter also as the “AI”), **Internet of Things** (hereinafter also as the “IoT”), **5G Technology**, **Big Data and Analytical Data Processing**, **Blockchain and High-Performance Computing** (hereinafter only as the “HPC”) that will become the new engine of the economic growth and strengthening of competitiveness. Therefore, at the national level, it will be necessary to accelerate already launched processes, connect national strategic measures with global trends as well as implement new policies based on the latest cross-cutting priorities of the EU and specific needs of Slovakia.

**The digital transformation is bringing about both, social and technological challenge that is affecting all Slovak citizens.** The target entities are **citizens** who should have an easier and more quality everyday life at the workplace as well as in the private life and citizens-entrepreneurs who should benefit from reduced paperwork burden to the maximum possible extent and who should be supported by adequate incentives from the government. Information and digital technologies must therefore be developed and used for increasing the quality of lives of citizens and optimising their benefit for the **economic, social and environmental growth of the country with the emphasis on sustainable development**. Therefore, it is the strategic goal of the government to approach the digitalization of economy and society in a conceptual manner and apply cross-cutting approach in order to make significant progress in the digital transformation.

**The Office of the Deputy Prime Minister of the Slovak Republic for Investments and Informatization** (hereinafter only as the “ODPMII”) as the central state administration authority for informatization of the society, including preparation of single digital market policies, is the main coordinator of this strategy resulting from the thematic and conceptual focus of its activities. In cooperation with other central state administration authorities, the ODPMII is in charge of preparation, setting priorities as well as implementation of the strategy. It is necessary to **correctly set regulatory as well as non-legislative measures**, which will launch the digital transformation in the right direction with a direct positive impact on citizens and the business environment. Investments into digital economy can provide Slovakia with sufficient growth that cannot be achieved by original pillars of our economy. For the purposes of informatization and digitalization of various fields of economy and society, there have been several important initiatives developed at different state administration authorities. However, **the ODPMII is aware of the need of their integration into the framework structure of its own digital agenda as well as their transformation into particular measures under one “roof”**. This approach formed the basis for preparation of the strategy contained in this document.

## Vision of the digital transformation of Slovakia

The strategy is a follow-up of the creation of new **Multiannual Financial Framework of the EU** for 2021-2027, including Cohesion Policy instruments as well as directly managed programmes

(including *Digital Europe Programme*<sup>1</sup> and *Connecting Europe Facility* – digital part<sup>2</sup>), where the need for development of the digital economy is given special attention. Besides the aforementioned facts, it also directly reflects conceptual materials and recommendations of international organisations, in particular, the Organisation for Economic Cooperation and Development (hereinafter only as the “OECD”) and the United Nations Organisation (hereinafter only as the “UNO”), which **consider the process of digital transformation as key factor for achieving sustainable and inclusive growth**. At the same time, the strategy was inspired by digital policies of developed countries such as Finland, France, Singapore and the United Kingdom. The strategy also analyses the current starting point of Slovakia – in particular, it is based on the current situation, specific priorities and the most important needs of the country that have been evaluated also on the basis of prestigious international documents, including *Country Report Slovakia 2019* prepared by the European Commission (hereinafter only as the “EC”). At the same time, the **strategy respects and works with existing national strategies and action plans**, in particular, it is based on the *Action plan for smart industry*. All that knowledge was summarised and incorporated into the vision of digital transformation of Slovakia (Figure 1) with a list of recommendations for measures of short-term and long-term horizon that will turn visions into reality. Based on that, the vision of digital transformation of Slovakia has been defined as follows:

*By 2030, Slovakia will become a modern country with innovative and ecological industry built on knowledge-based and data economy, with effective public administration ensuring smart use of the territory and infrastructure and with information society whose citizens use their potential at full and live high-quality and secure lives in the digital era.*

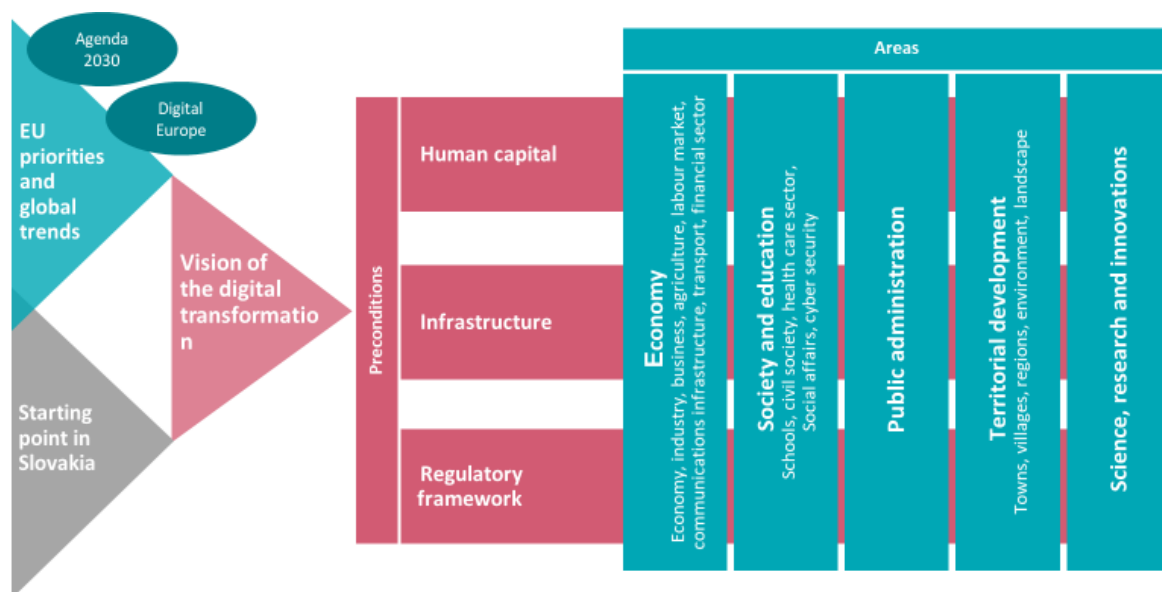


Figure 1: Vision of the digital transformation – prerequisites and areas

To turn this vision into reality, Slovakia has an important economic, geographic and human potential, however, in order to implement such undoubtedly demanding process, it has limited capacities, possibilities and resources. Therefore, in the approach to the digital transformation, Slovakia has the necessary sophisticated systemic view. Based on that, the following aspects have been identified as **prerequisites**, i.e. resources for the digital transformation of economy:

- **Human resources** (educated labour force that can utilise the possibilities of the digital era),
- **Infrastructure** (set of necessary technologies, solutions and systems),

<sup>1</sup> EUR-Lex, European Commission, Proposal for a Regulation establishing the Digital Europe Programme for the period 2021-2027, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A434%3AFIN> (21.3.2019)

<sup>2</sup> EUR-Lex, European Commission, Regulation establishing the Connecting Europe Facility, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R1316> (20.3.2019)

- **Regulatory framework** (framework for defining legislative rules and the manner of functioning).

Based on the existing starting position of Slovakia, the following *areas* have been determined as the necessary ones where it is necessary for us to multiply their potential by means of the digital transformation:

- **Economy,**
- **Society and education,**
- **Public administration,**
- **Territorial development,**
- **Science, research and innovations.**

The process of digital transformation of Slovakia must be understood also in broader circumstances, as a part of the comprehensive process of building of the information society of the 21<sup>st</sup> century. **The ultimate goal of the process of the digital transformation and building of the information society will be creation of conditions for a satisfied and dignified life of every individual in the digital era in the context of respecting and building the digital humanism.**

### Approach to the digital transformation of Slovakia

The task we are facing now is extraordinarily complex and requires coordination of several actors and a systemic approach that will be developed at three levels:

- **Concepts and policies ensuring innovation in selected sectors and segments:** Policies and legislative frameworks will be adjusted in such manner that will support the digital transformation either by simplifying, removing obsolete rules or adopting brand new concepts.
- **Innovation laboratories as a tool for experimenting with new formats of public administration:** In selected sectors, there will be innovation laboratories set up in order to experiment with new policies, business models and technologies and help manage the process of the digital transformation.
- **New approach to projects:** A shift in the perception of projects development and focus not only on grants from Cohesion Policy instruments but also on directly managed programmes of the EU.

The ambition of the strategy is to present the vision of the digital transformation of Slovakia, prerequisites of its materialisation and the priority areas of its implementation. **The purpose of the strategy is not to set particular measures but define the vision serving as the basis for specific measures.** A successful execution of the vision as well as majority of its recommendations will require a broad political support beyond the tenure of the present government administration. Thus, its purpose is to provide the starting points for the current as well as future governments of the Slovak Republic. The vision of the strategy is therefore materialised in assumed priority areas for **short-term (3Q/2019 – 2Q/2022)** and expected priority areas for **long-term horizon (3Q/2022 – 4Q/2030)**. Measures for the short-term horizon will become the key basis of the *Action plan of the digital transformation of Slovakia for 2019-2022, which will be directly built on the presented strategy*. There have been three assumed and recommended priority areas set for the short-term horizon that will become the basis for the *Action plan of the digital transformation of Slovakia for 2019-2022*. It covers the following priority areas:

- **Digital transformation of schools and education in order to increase its quality, improve preconditions for employment and acquiring competences necessary for the digital era,**
- **Setting the basis for modern data and digital economy and for the digital transformation of the economy in general,**
- **Improvement of abilities of the public administration to use data and innovations for the benefit of citizens.**

In the context of the **long-term horizon**, the strategy outlines expected priority areas that are follow-ups and extensions of areas for short-term horizon. It includes the following ambitious goals whose

implementation will require necessary time and space in order to better grasp the concept of the cornerstone of Slovak success in the digital era:

- **Innovative digital and data economy,**
- **Educated, healthy and secure society,**
- **Modern and effective public administration,**
- **Smart territorial development,**
- **High-quality science, research and world-class innovations.**

The success of the digital transformation process is the direct precondition determining the country's position in the global competition. The *2030 Digital Transformation Strategy for Slovakia* sets out the vision of the digital transformation of Slovakia as well as the means and areas for transforming the vision into reality by means of specified priority areas for short-term and long-term horizon.



# 1 Purpose of the strategy

## 1.1 Introduction

Digital transformation is a key topic of the present day

**The digital era of the 21<sup>st</sup> century is bringing new technologies, innovations and trends that are dynamically changing the world and affect all fields of life.** Informatization and digitalization have changed the way how economic value is generated, the structure and functioning of markets and, eventually, formation and development of all relations – economic and social ones<sup>3</sup>. The EU's response to the onset of the digital era is the build-up of the European single digital market that provides room for utilising huge opportunities resulting from engaging digital technologies in various sectors of the economy. Since drafting the *Digital Single Market Strategy for Europe*<sup>4</sup> by the European Commission in 2015, several successful policies have been achieved, such as cancellation of the roaming fees, modernisation of the data protection and improvement of cross-border transferability of online content, with the scope of the digital single market being continuously extended with new areas and sectors. It is an ambition of the EU to gradually become the dominant power in the broader digital transformation of economic sectors and the society.

**Digital Single Market (DSM)** is integral space in which the free movement of persons, services and capital is ensured, and where the individuals and businesses can seamlessly access and engage in online activities under conditions of fair competition, and a high level of consumer and personal data protection, irrespective of their nationality or place of residence.<sup>5</sup> Thus, the digital single market in the EU is built on three basic pillars:

- Ensuring better access to digital goods and services
- Creating favourable conditions for digital networks and innovations
- Enabling the full use of the digital technologies in the society.

→ The semantics of expressions used in the document is provided in *Annex 1: Explanation of terms*.

→ An overview of current results of the digital single market building in the EU is provided in *Annex 2: Building digital single market in the EU*.

The digital single market is an opportunity for accelerating a general digital transformation of Slovakia

**The basic mission of this strategy is not only to achieve a significant increase of Slovak involvement in the European digital single market but, above all, to prepare Slovakia for a general digital transformation of its economy and society.** This process will serve as the necessary impetus for launching the development of information society and transformation of the traditional industry to Industry 4.0. For the purposes of drafting high-quality and useful measures, it is necessary, for each area, to analyse, in detail, the situation and conditions in Slovakia. At the European level, it is desirable to be proactive in all areas, not only in priorities of this strategy and influence positive changes of the regulatory environment in order to regulate only what is necessary for making its functioning more effective. All new measures and regulations of this type will be reflected in the Slovak legislation. Their setting and establishment of a thorough system for monitoring decisive and key indicators at the national and European levels will form the basis for monitoring of the change. Also the key indicators for monitoring positive change of the regulation will be set. Due to the dynamic nature of technological innovations, it will be important to

<sup>3</sup> For more information, see European Pillar of Social Rights – European Commission, European Pillar of Social Rights in 20 principles, [https://ec.europa.eu/commission/priorities/deeper-and-fairer-economic-and-monetary-union/european-pillar-social-rights/european-pillar-social-rights-20-principles\\_sk](https://ec.europa.eu/commission/priorities/deeper-and-fairer-economic-and-monetary-union/european-pillar-social-rights/european-pillar-social-rights-20-principles_sk) (10.4.2019)

<sup>4</sup> EUR-Lex, European Commission, Communication – A Digital Single Market Strategy for Europe, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52015DC0192> (12.12.2018)

<sup>5</sup> European Commission, Shaping the Digital Single Market, <https://ec.europa.eu/digital-single-market/en/policies/shaping-digital-single-market> (15.2.2019)

monitor the success rate of measures and adjust them to changing conditions in the market and in the society. In our opinion, the substance of the real digital single market is:

- Access to data as a rare resource under fair and balanced terms that will enable competitive data economy and increase performance of the state administration;
- Introduction of new electronic services and products based on the trust and protection of privacy of citizens, which will remove digital gaps;
- Functioning information society and innovative digital economy where company can innovate and thus create sustainable jobs that can be staffed by well re-qualified labour force with advanced digital skills.

## 1.2 Document context

The digital transformation of economy and society directly affects all citizens of Slovakia. Reflecting this horizontal nature of the digital transformation, it is necessary to emphasize the interconnectedness of this strategy to other **strategic documents, national concepts, projects and action plans of the Slovak Republic concerning digital agenda**, which are reflected in this strategy and provides their follow-up. The interconnectedness of the *2030 Digital Transformation Strategy for Slovakia* to other strategic documents in Slovakia concerning the digital transformation is depicted in Table 1.

*Table 1: Overview of national policies*

Sector	Document	Year	Ministry	Status	Ambition	Relation to the DTS
Economy, industry and business sector	Economic Policy Strategy for the Slovak Republic Until 2030 (SHP SR)	2018	Ministry of Economy	Approved	Determine the strategic direction of the economic policy with the outlook until 2030, which will provide an idea of further development of Slovak economy with apolitical nature and thus it will make it possible to put conceptual focus on the matter that has been absent in the long-term and that goes beyond the framework of the political cycle.	Both documents focus on the broader digital transformation of economy, the DTS is built on measures of the SHP SR.
	Action Plan for Smart Industry SR (AP IP SR)	2018	Ministry of Economy	Approved	Provide support to industrial companies, companies providing services and trading companies regardless of their size, focused on creation of better conditions for implementing digitalization, innovative solutions and increase of competitiveness with reduction of the paperwork, legislative changes, defining standards, change of educational programmes and the labour market, co-financing of research, etc. Implementation of the AP IP until 2020 will form the basic precondition for a successful transformation of Slovak economy responding to digitalization of industry with expected launch of the digitalization process in majority of companies. To implement such strategic goals, there were the following priority areas set there: <ul style="list-style-type: none"> <li>- Research, development and innovations,</li> </ul>	Both documents focus on digital transformation of industry, the DTS is based on measures of the AP IP SR, their priority areas are mutually connected and complementary.



					<ul style="list-style-type: none"> <li>- --Fundamental principles of IT security in implementation of smart industry,</li> <li>- Labour market and education,</li> <li>- Reference architecture, standardization and creation of technical standards, framework European and national legal conditions,</li> <li>- Providing information and promotion.</li> </ul>	
	National investment plan for 2018-2030 (NIP)	2018	ODP MII	Approved	Defines priority areas and key programmes until 2030, documented by indicative projects, by means of which the economic and social infrastructure will be built or that will improve the state of existing infrastructure in order to continuously meet long-term needs of the Slovak Republic.	DTS is based on priorities of the NIP, in particular, specific features of the build-up of necessary infrastructure.
Education	Nation programme for development of education (NPRVV)	2018	Ministry of Education, Science, Research and Sport	Approved	Specify the direction of the Slovak education system until 2027, with specific attention paid to three cross-cutting topics – development of the system of further education as part of life-long education, integration and inclusion of marginalised Roma communities and pupils from socially disadvantaged environment and connection of the system of education to needs of the economy and labour market. The document also analyses financing of pedagogical employees in the education sector, modernization of the education system (modernization of the education content – State education plan and testing procedures), strengthening of the use of digital technologies in education and financial support to ICT maintenance staff at schools.	Education is one of key priorities of the DTS and it is based on many priority areas of the NPRVV.
	Programme of schools informatization with the outlook until 2030	2019	Ministry of Education, Science, Research and Sport	Under preparation	Prepare education system for Industry 4.0 and digital transformation of the society in the field of education and enhancement of necessary competences for the digital economy in strategic areas: I. ICT infrastructure from central to regional level, II. Electronic services and internal information system of the ministry, III. Digital technologies and digital education content in the curriculum, IV. Skills and competences for the digital economy, V. Security in the information space. Programme implementation will focus on the digital transformation of schools and education, identification and increase of competences of teachers, students and non-pedagogical employees of schools in the digital economy and use of	Direct detailed elaboration of the DTS for the field of education

					the digital coordinator in educational institutions. The programme preparation will also include respective action plans.	
Science, research and innovations	Strategy for research and innovations for smart specialization of the Slovak Republic (RIS3 SK)	2013	Ministry of Education, Science, Research and Sport and Ministry of Economy	Implementation stage	Set investment and structural measures for the policy of research, development and innovations and supports public-private and research and development and innovation cooperation that provides possibilities for growth of all involved parties in order to support the competitiveness, employment and quality of life in the Slovak Republic.	DTS is based on the current situation and results of implementation of the RIS3 SK.
	Document titled Support to innovative solutions in Slovak towns	2017	Ministry of Economy	Implementation stage	Describe key aspects of the Smart City concept with the emphasis on their implementation by business entities and provide a toll for businesses and towns in the form of supporting mechanisms and overview of already implemented examples at home and abroad.	DTS uses Smart City implementation aspect in Slovakia as its inputs.
	Smart Cities Action Plan	2019	Ministry of Economy	Under preparation	In its agenda for supporting innovations and small and medium enterprises, the Ministry of Economy, in cooperation with experts and an extensive platform, is currently intensively working on preparation of the Smart Cities Action Plan. The main goal of this initiative is to build on the Smart Industry Action Plan that is the overarching document of the Ministry of Economy to support “smart” ecosystem and thus create conditions in Slovakia for development of the market for smart and innovative solutions also in towns and villages, in functional (urban) regions and self-governing regions that will improve lives of citizens and/or quality of public services provided by the public administration, especially thanks to the use of technologies, and support formation of Slovak innovative solutions and new companies.	DTS and, above all, the related Action plan for digital transformation, will be coordinated with the Smart Cities AP in order to increase the effectiveness of their implementation.
Public administration and informatization	Strategic document for the growth of digital services and new generation access network infrastructure (2014-2020)	2014	Ministry of Finance	Implementation stage	Set the strategy for further development of digital services and new generation access network infrastructure in the Slovak republic until 2020.  Due to obsolete nature of the document, it is necessary to immediately prepare a follow-up separate strategy for this field of business until 2030.	DTS is based on the existing situation and results of implementation of the strategic document.

	Nation concept of public administration informatization (NKIVS)	2016	ODP MII	Implementation stage	Provide direction for informatization of the country until 2020, follow the original principles of informatization defined in the concept adopted in 2008, while reflecting the current state of the public administration integrated information system architecture, implemented development projects and activities and extending them with new principles resulting from current trends and acquired experience as well as opportunities made possible thanks to development of information and communication technologies (hereinafter only as the "ICT").	DTS is inspired by existing results of the national concept implementation.
	Action plan of the Open Governance Initiative in the Slovak Republic for 2017 – 2019	2017	Ministry of Interior	Implementation stage	Increase the transparency, participation, support innovations and open the public administration to citizens. The action plan is of a cross-cutting nature and defines obligations for state administration authorities in the following areas: <ul style="list-style-type: none"> <li>- Open information</li> <li>- Open education and open science</li> <li>- Government open for the dialogue</li> <li>- Open justice and prosecutor's office</li> <li>- Application of decisions</li> <li>- Feedback and follow-up</li> </ul>	Priority areas of the AP are connected to certain priorities of the DTS, which are further elaborated in the DTS.
Society	Vision and strategy of development of Slovakia until 2030	2019	ODP MII	Under preparation	Basic document for strategic planning in the Slovak Republic for central, regional and local levels of the public administration. The vision and strategy of development of Slovakia until 2030 will become the basic programming document serving as the preparation for new programming period of the EU 2021-2027.	DTS is connected to many of priorities of the vision defined in the document, above all, to programmes II (Innovative and sustainable economy), III (High-quality lives for all) and IV (Multi-level management closer to citizens).
	Concept of cyber security of the Slovak Republic for 2015-2020	2014	National Security Authority	Implementation stage	Respond to current needs, new challenges in strengthening the cyber security of the Slovak Republic and define its starting points and goals.	One of the areas covered by the DTS is the need for secure cyber space that is to be ensured by the concept implementation.
	Action plan for implementation of the Concept of cyber security	2016	National Security	Implementation stage	Follow up the Concept of cyber security of the Slovak Republic, specify outline of tasks, manner and time frame for their implementation and responsibility of actors. Adoption of the AP is a decisive	One of the areas covered by the DTS is the need for secure cyber space that is to be ensured by

	of the Slovak Republic for 2015- 2020		Autho rity		step of the Slovak Republic toward ensuring adequate protection of the cyber space of the state from potential threats.	implementation of the AP.
Health care	It is necessary to prepare the digital transformation strategy.					DTS does not cover this field.
Transport	It is necessary to prepare the digital transformation strategy.					DTS does not cover this field.

### 1.3 Global trends and technologies

Occurrence of new trends in digital technologies and innovations accelerated to a record high pace in the past few years. The transition from industrial society to information society and Industry 4.0 constitutes a revolutionary global change comparable to arrival of the steam engine in the 19<sup>th</sup> century, electrical energy in the first half of the 20<sup>th</sup> century and the Internet at the end of the past century. Further development of the industrial society is not possible because the industrial society has reached the summit on its evolution curve and exhausted its development potential. State officials, citizens and businesses can see huge challenges in the process of coping with dynamic changes that result from the information and digital era. **The issue of digital transformation is currently one of the most important approaches in the process of building and managing strategies and visions for countries, companies and organisations.** Based on the latest studies and analyses of global scientific and analytical companies and expert media<sup>6</sup>, the most important technologies from the global viewpoint are the following ones:

- **Artificial intelligence,**
- **Internet of Things,**
- **5G technology,**
- **Big data and analytical data processing,**
- **Edge computing and cloud computing,**
- **Blockchain.**

#### 2030 Agenda for Sustainable Development

**2030 Agenda for the Sustainable Development**<sup>7</sup>, which was adopted by member states of the United Nations Organisation in 2015, is a summary of global commitments by means of which the international community is calling for a joint coordinated procedure for solution of the **most serious global challenges**, which include climate change, poverty, increasing economic and social inequalities or unsustainability of prevailing production and consumption patterns. In Slovakia, the 2030 Agenda is generally perceived as a means for determining long-term development priorities for the development of the country. Specifying development priorities is directly connected to the identification of goals of the digital development of Slovakia, therefore, the 2030 Agenda is one of the background documents for this strategy. At the national level, there have been **6 priority areas reflecting specific Slovak situation**, selected there and they will serve as the basis of future strategic and conceptual work, including their incorporation into the vision and priorities of this strategy:

- **Education for dignified life,**
- **Heading towards knowledge-based, environmentally sustainable and circular economy with demographic changes and changing global environment,**
- **Good health,**
- **Sustainable municipalities, regions and country in the context of the climate change,**
- **Reduction of poverty and social inclusion,**

<sup>6</sup> Daniel Newman, Forbes, Top 10 Trends for Digital Transformation in 2018, <https://www.forbes.com/sites/danielnewman/2017/09/26/top-10-trends-for-digital-transformation-in-2018/#2bd2d1c293ab> (27 November 2018)

<sup>7</sup> United Nations, Transforming Our World: The 2030 Agenda for Sustainable Development, <https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf> (1 October 2018)

- **Rule of law, democracy and security.**

## 1.4 Financial planning of the digital transformation at the level of the European Union

### Digital Europe Programme

European initiative for the digital transformation is an effort to accelerate the use of latest digital technologies in the public and private sector. The **Digital Europe Programme** (hereinafter only as the “DEP”)<sup>8</sup> represents an **investment framework of the European strategy for the digital single market**, which responds to trends of the digital era. The DEP, with its investments in proposed amount of more than EUR 9.2 billion, is supposed to **form and support the digital transformation of the European society and economy**. The programme has 5 specific goals to which the proposed budget will be allocated (Figure 2):

- **Supercomputers / High-performance computing,**
- **Artificial intelligence,**
- **Cyber security and trust,**
- **Advanced digital skills,**
- **Digital transformation and interoperability.**

The DEP will strengthen capacities in Europe in key areas of digital technologies and support their dissemination and use in areas of public interest and in the private sector. The goal of the programme is, inter alia, to **adjust the EU budget to future programming challenges**, while the **digital transformation is reflected in all proposals**, ranging from transport, through energy sector, agriculture up to health care and culture.

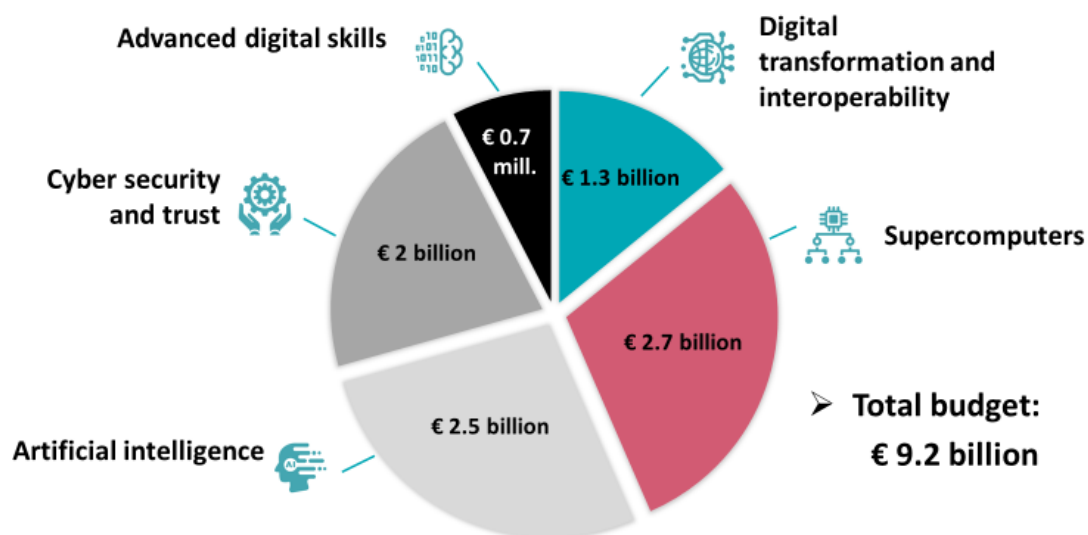


Figure 2: Budget of the Digital Europe Programme

Source of data: [http://europa.eu/rapid/press-release\\_IP-18-4043\\_en.htm](http://europa.eu/rapid/press-release_IP-18-4043_en.htm)

<sup>8</sup> EUR-Lex, European Commission, Proposal for a Regulation establishing the Digital Europe Programme for the period 2021-2027, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A434%3AFIN> (21 March 2019)

## EU Budget Outlook 2021 - 2027

In 2018, the European Commission published its draft **budget outlook for 2021 – 2027**<sup>9</sup> (Figure 3). The Commission submitted ambitious and clearer financial proposals for a modern budget of the EU, with a strong focus on reflecting the progress in the field of innovations, economy, environment and geopolitics.

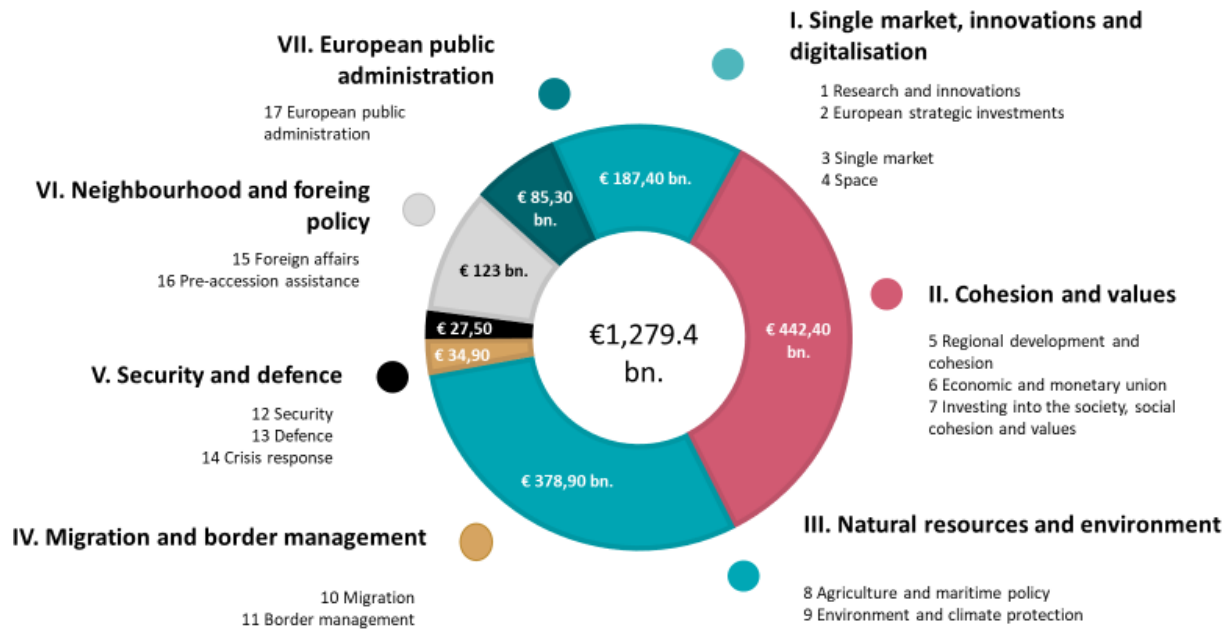


Figure 3: Draft new budget of the European Union for the Programming Period 2021-2027

Source of data: [https://ec.europa.eu/commission/future-europe/eu-budget-future\\_en](https://ec.europa.eu/commission/future-europe/eu-budget-future_en)

Social and economic challenges, such as demographic changes, migration, cyber security threats, climate and environment protection, food safety, sustainability of health care systems, disinformation and fake news, sustainable public finance and unemployment must thus be addressed and treated in a manner that will show the added value of joint and united Europe that will make the maximum possible use of the digital transformation for its own benefit. This is also reflected in the areas to which the Union should invest in the following seven years according to the Commission. And, the area of “**Single market, innovations and digital technologies**” is one of top priorities for the new European budget. It is demonstrated by the fact that the Commission allocated the third biggest amount for this area (following “Cohesion policy and values” and “Natural resources and environment”), while the digital transformation and informatization is also included in other areas, above all the “Cohesion policy and values” (biggest allocation from the budget) and “European public administration”.

## 1.5 Digital strategies of developed countries

For certain time, many countries have been trying to support their digital potential at the conceptual level and, therefore, they adopt ambitious digital strategies at the political level. Recently, it turned up that a new trend is **specialising strategies for developing AI as the key technology whose mastering is a precondition for future prosperity**. Thus, the goal is to incorporate AI to fields of economy where the AI seems to be an opportunity for innovations and growth and continuous creation of innovative ecosystems.

In the analysis, we focused on countries that are visionary and want to maximise the adjustment of their policies to the needs and challenges of the digital era—o strategies of Finland, France, Singapore and United Kingdom. Strategies of those countries have been, moreover, very well received by the expert public and received a full support of representatives of the countries. We chose the orientation on AI because it belongs

<sup>9</sup> European Commission, EU Budget for the Future, [https://ec.europa.eu/commission/future-europe/eu-budget-future\\_en](https://ec.europa.eu/commission/future-europe/eu-budget-future_en) (10.11.2018)



to the priority technologies and, currently, it is influencing the shape of possibility for the digital transformation in a substantial manner. This overview, however, is not exhaustive and, in implementing recommendations of this strategy into particular measures, we will focus on further relevant and inspiring strategies of other countries that are in the process of formation or will be created in the near future.

Digital and AI strategies of developed countries prevailingly contain the following components:

- **Support to the general digital transformation of main sectors of economy and society, including the public administration** – e.g. digital strategy of the United Kingdom is based on 7 pillars: connectivity, digital skills and inclusion, digital sectors, general economy, secure cyber space, digital government and data,
- **Support to the research and development in new technologies and AI,**
- **Support to innovative small and medium enterprises** that can be applied in practice either by means of the know-how and incubators but, especially, thanks to sufficient amount of “venture” capital,
- **Setting rules and standards**, e.g. for the method of creating, sharing and managing data or IoT,
- **Simplification, acceleration and releasing regulations** in order to enable innovations and experiments as well as review impacts of the platform economy and changes in labour in the digital era on the labour law and its institutes in the context of entities affected by it,
- **Development of talents**, which can design and use digital innovations, such as by sophisticated migration policy as well as by making interesting conditions for life in key towns,
- **Support to the infrastructure build-up**, e.g. public electronic services as well as sectorial platforms,
- **Building new models of cooperation** among the industry, academia and the government sector.

Priority sectors and topics are selected depending on the size and potential of the country. Countries like France focus on further development of sectors where they have competitive advantage, such as health care, environment, transport mobility and defence security. France intends to support formation of its own sectorial platforms in such areas. Finnish AI strategy comprehensively covers all components and it is interesting especially thanks to its emphasis on building a strong digital economy and the effort to improve public services thanks to the use of AI, as well as its effort to introduce personal assistants based on the use of AI in combination with personal data. The United Kingdom is building on the best conditions for doing business and low paperwork burden combined with access to the global talent and top universities.

→ Overview of the analysis of digital strategies of selected countries is provided in *Annex 3: Overview of digital strategies of developed countries*.

## 2 Starting point of Slovakia

### 2.1 Position of Slovakia in international indexes

#### Digital Economy and Society Index (DESI)

An effective comparison of Slovak performance to 27 other EU Member States in a broad spectrum of areas is provided by the *Digital Economy and Society Index* (hereinafter only as the “DESI”).<sup>10</sup> It is a complex index reviewed every year by the European Commission that monitors the progress and level of development of the digital economy and society in the Member States of the EU in five main areas of measurement: connectivity, human capital, use of internet services, integration of the digital technology and digital public services. This, the index constitutes an important starting point for identification of problematic areas to which Slovakia should pay attention in order to improve its digital performance. In the 2018 DESI index, Slovakia ranked 20<sup>th</sup> out of 28 EU Member States. Overall, Slovakia belongs to a group of countries with low performance – besides Slovakia, it includes Bulgaria, Cyprus, Greece, Croatia, Hungary, Poland, Romania and Italy.

#### 2019 Country Report Slovakia (EC)

Based on the *Country Report Slovakia 2019*<sup>11</sup>, the economic growth of the country and the growth of the gross domestic product (hereinafter only as the “GDP”) keeps accelerating and Slovakia belongs to the fastest growing economies in the EU. Such favourable results are based on the assumed combination of strong domestic demand and increasing exports growth. The economic growth has also resulted in improving the labour market situation, however, there are still significant regional differences prevailing there in accessibility to job opportunities and also the high long-term unemployment continues, which reflects the discrepancy between needs of the economy and available labour force. Improvement of the quality of public institutions and targeted investments can help in reducing long-term regional and social and economic differences. A very important conclusion of the report is that strategic investments into needs related to education, innovations, infrastructure and technologies can provide the country with growth and prosperity in the future. To make the economy rely more on knowledge, it will be necessary to invest into the digital connectivity and the digital transformation of companies into sustainable and ecological investments, into skills increase and build-up of social infrastructure.

#### Economic forecast for the most developed countries of the world (OECD)

Based on the latest forecast for economies of the most developed countries prepared by the Organisation for Economic Cooperation and Development<sup>12</sup>, the Slovak economy should rank among the fastest growing economies in OECD in 2019. The forecast has stressed, above all, historically lowest unemployment level and sound public finance in the country. However, it recommends dealing with challenges such as lack of labour force with advanced digital skills and weak support to innovations in the business sector. It points out at the most difficult impacts of automation on the labour force in Slovakia from among OECD countries due to existing prevailing focus of industry on closely specialised production with low added value and low level of digital skills of the labour force.

#### Index of Electronic Public Administration Development (UNO)

Slovakia ranked 49<sup>th</sup> out of 190 countries in the e-Government Index of the United Nations Organisation<sup>13</sup>, which measures the state of electronization of the state and public administration, which is improvement by

<sup>10</sup> European Commission, The Digital Economy and Society Index (DESI), <https://ec.europa.eu/digital-single-market/en/desi> (23 September 2018)

<sup>11</sup> European Commission, Country Report Slovakia 2019, [https://ec.europa.eu/info/sites/info/files/file\\_import/2019-european-semester-country-report-slovakia\\_en\\_0.pdf](https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-slovakia_en_0.pdf) (1 March 2019)

<sup>12</sup> OECD, OECD Economic Surveys, Slovak Republic, February 2019, <http://www.oecd.org/eco/surveys/Slovak-Republic-2019-economic-survey-brochure.pdf> (1 March 2019)

<sup>13</sup> United Nations, United Nations e-Government Survey 2018, [https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018\\_FINAL%20for%20web.pdf](https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL%20for%20web.pdf) (3 March 2019)

18 places compared to the preceding study of 2017, however, it failed to reach its level from 2005, when Slovakia ranked 36th. In the Visegrad Group, we are on the 3<sup>rd</sup> place with the Czech Republic ranking worse.

#### Report of the Research and Innovations Observatory (RIO)

The latest report of the Research and Innovations Observatory (RIO) of 2017<sup>14</sup> provides that even despite well-functioning economy and increasing employment, the public financing of research and innovations in Slovakia did not lead to the economic growth based on skills and innovations, which represents a huge deficit for a successful digital transformation of the country.

#### Rank of the Digital Competitiveness (IMD)

In the global rank of digital competitiveness by the Institute for Management Development (IMD) for 2018<sup>15</sup>, Slovakia ranked 50<sup>th</sup> out of 63 countries, which was a decline from the 43th place in the preceding year. Among its strengths, the analysis emphasized the amount of investments into electronic communications and wireless broadband connection; on the contrary, its identified weaknesses were insufficient support to the technological development, low number of foreign experts and missing legislation for supporting the scientific research.

→ Analysis of the position of the Slovak Republic in the DESI Index is provided in *Annex 4: Position of Slovak in the DESI Index*.

→ A summary of existing processes developed for identifying problems and priorities in the digital field in the Slovak Republic is provided in *Annex 5: Recent steps taken towards the digital transformation of Slovakia*.

## 2.2 SWOT analysis of the Slovak starting point

The SWOT analyses reviews the existing status of readiness of Slovakia for the digital transformation, i.e. strengths and weaknesses of the process as well as the most distinct opportunities and possible threats. Thus, it offers main starting points for the strategic outline of priorities of the digital transformation in Slovakia. The framework for the SWOT analysis was based on three *assumptions* of the digital transformation of Slovakia – infrastructure, human capital and regulatory framework (Figure 4) – as they are the necessary driver of the implementation and thus form the best basis for evaluation of the current position of Slovakia. A visual representation of the SWOT analysis for each assumption can be found on Figures 5, 6 and 7.

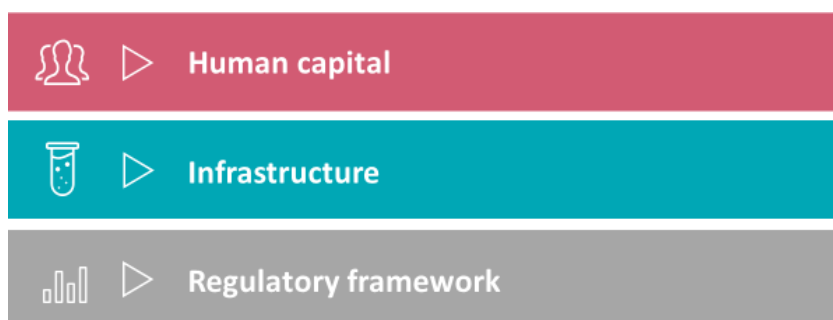


Figure 4: Framework of the SWOT analysis – assumptions of the digital transformation

→ Sources of information for preparation of the SWOT analysis and the method of identification of sources are provided in *Annex 6: Sources and method of preparation of the SWOT analysis*.

<sup>14</sup> RIO, Country Report Slovak Republic 2017, <https://rio.jrc.ec.europa.eu/en/country-analysis/Slovakia/country-report> (3.3.2019)

<sup>15</sup> IMD, The IMD World Digital Competitiveness Ranking 2018, <https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2018/> (4.3.2019)

## SWOT analysis – Human capital

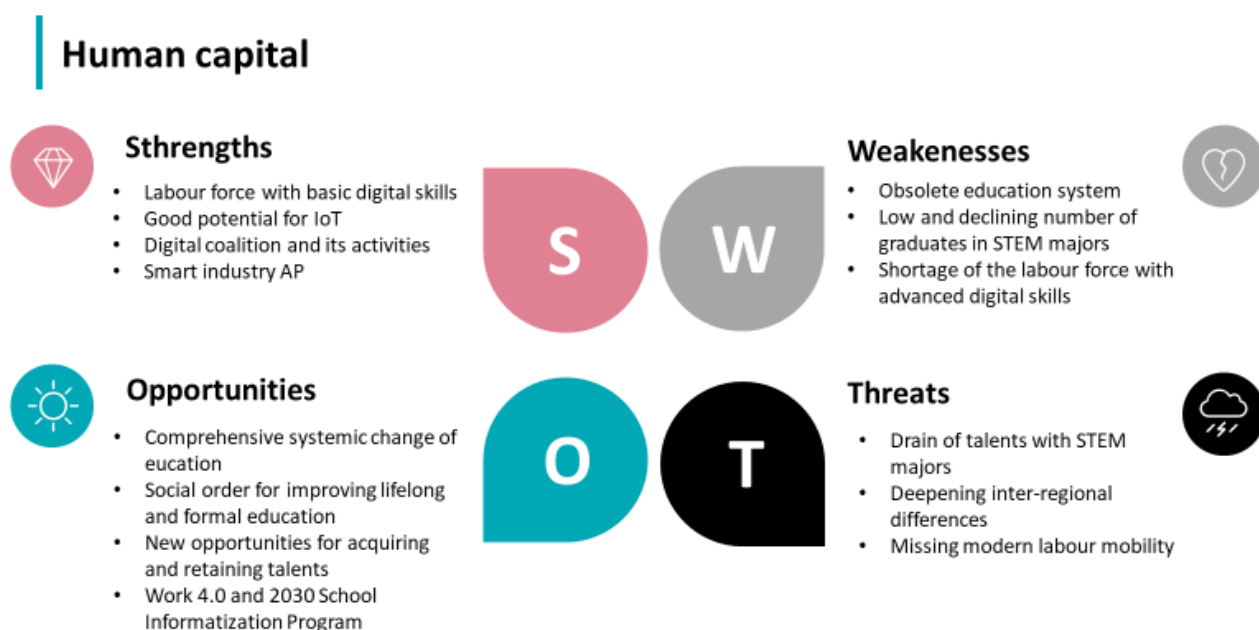


Figure 5: SWOT analysis – Human capital

### SWOT: Strengths – Human capital

#### ▪ Labour force with basic digital skills:

Based on results of the DESI index for 2018<sup>16</sup>, we can conclude that 59 % of Slovaks reached at least the basic level of digital skills, which is above the EU average (57 %).

#### ▪ Good potential for IoT and life-long learning in IT:

Based on experience of Slovak IT companies the content of education at various types of schools (primary, secondary, college) already contain the matter of IoT and Slovak pupils/students have excellent results in IoT and robotics at competitions for secondary school and college students and in international contests (e.g. RoboCup junior<sup>17</sup>, Robocup, First Lego League<sup>18</sup>). There are several companies in Slovakia providing high-quality further education (life-long learning) in IT, such as GOPAS, ELCT, and a successful programme Cisco Networking Academy<sup>19</sup> at secondary schools and universities that prepares specialists in computer networks and IoT.

#### ▪ Digital coalition and its activities:

Digital coalition<sup>20</sup>, which was set up in 2017 upon the initiative of the IT Association of Slovakia, and with a support from the ODPMI, is a successful example of activism across a broad range of public, private, academic and civic organisations and institutions in Slovakia in order to improve the digital skills of citizens.

#### ▪ Action plan for smart industry:

Slovak government has already approved its own *Action plan for smart industry*<sup>21</sup>, which represents a means for creating conditions for development of industry in Slovakia and which responds to global digitalization trends in order to increase the competitiveness of companies and maintain sustainable increase of incomes, employment and quality of life.

<sup>16</sup> Digital Economy and Society Index (DESI) 2018, Country Report Slovakia, [http://ec.europa.eu/information\\_society/newsroom/image/document/2018-20/sk-desi\\_2018-country-profile\\_eng\\_B4415E7E-9154-E26E-7B403212919F3F7C\\_52238.pdf](http://ec.europa.eu/information_society/newsroom/image/document/2018-20/sk-desi_2018-country-profile_eng_B4415E7E-9154-E26E-7B403212919F3F7C_52238.pdf) (17.1.2019)

<sup>17</sup> RoboCup Junior, <http://www.robotika.sk/rcj/>

<sup>18</sup> First Lego League, <https://www.flf.sk>

<sup>19</sup> Cisco Networking Academy, <https://netacad.sk/>

<sup>20</sup> Digital Coalition, <https://digitalnakoalicia.sk/>

<sup>21</sup> Slov-Lex, Draft Action Plan for Smart Industry in the Slovak Republic, <https://www.slov-lex.sk/legislativne-procesy/SK/LP/2018/402/> (11 February 2019)

**SWOT: Weaknesses – Human capital**

- **Obsolete system of education:**

As indicated by Slovak IT companies and academic institutions, such as TUKE, the current model of the education in Slovakia is based on the so called “push” system that is based on mass education. Its shortcoming is large scale of uncertainty concerning future jobs of graduates because the priority is put on knowledge and less effort is paid to its transformation into solutions or development of analytical thinking. A huge gap has occurred between existing knowledge and achieved results (knowledge-performance gap).

- **Low and declining share of students and graduates on information and communication technologies, science, engineering and mathematics (STEM):**

A McKinsey report<sup>22</sup> shows that the share of male university graduates in information and communication technologies, science, engineering and mathematics (hereinafter only as the “STEM”) is alarmingly low (6.7 %), with even more alarming share of female graduates of such majors (0.6 %). Moreover, Slovakia has a huge shortage of experts in digital technologies in general.

- **Shortage of labour force with advanced digital skills:**

Discussions with the expert public and studies of national strategies<sup>23</sup> show that Slovak companies and public administration have suffered, in the long run, lack of labour force with advanced digital skills and/or lack of experience in the use of technologies and/or insufficient technical education.

**SWOT: Opportunities – Human capital**

- **Comprehensive systemic change of education at all levels towards increasing the quality of human capital for the needs of private and public sector:**

Slovak and European statistics, analyses<sup>24</sup> and discussions with the expert public confirm that Slovakia immediately needs a comprehensive systemic change of education, which will ensure that primary and secondary schools and universities offer more subjects and majors, from the viewpoint of quantity and quality, where pupils and students will acquire advanced digital and technological skills and high quality education. Equally, the education system must be set to respect the requirements for work in the labour market in the digital era.

- **Social demand for improving the quality of life-long and formal education:**

Employees as well as employers have come to realize that they must keep working on their skills in order to keep the track with the global competition and adjust to changes in the labour market. Examples of the best practice from abroad and digital strategies of other countries<sup>25</sup> show that one of the most effective opportunities of how to improve digital skills and competences of the population is to support providing trainings, courses, life-long and formal education, requalification and other forms of educational support and expert preparation for development and modernization of digital skills of Slovak companies and government authorities (e.g. requalification for the unemployed).

- **New possibilities of acquiring and retaining talents and their development:**

Slovak results in international indexes<sup>26</sup> imply that, for a successful transformation, the country will necessarily require talented experts in various fields. Therefore, Slovakia should work on building its attractiveness from three viewpoints: first, to make the country attractive enough so that Slovaks were not leaving the country for study and work; second, to inspire Slovaks abroad to come back home; and third, to make the country support acquiring talents from other countries by means of modern labour mobility policy and creating interesting and attractive conditions for life.

<sup>22</sup> McKinsey, The Rise of Digital Challengers: How digitization can become the next growth of engine for Central and Eastern Europe – Perspective on Slovakia, [https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers\\_Perspective-on-SK.pdf](https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers_Perspective-on-SK.pdf) (20 March 2019)

<sup>23</sup> The list is provided in Annex 6.

<sup>24</sup> Ibid.

<sup>25</sup> Strategies provided in Annex 3.

<sup>26</sup> The list is provided in Annex 6.

### ▪ **Labour 4.0 Strategic document a PIS-ready education 2030:**

Thanks to strategic document Labour 4.0 and 2030 Education Informatization Programme<sup>27</sup> it will be possible to elaborate two key areas in detail – labour market and education for the digital era.

#### SWOT: Threats – Human capital

### ▪ **Drain of talents with STEM education:**

Slovak statistics<sup>28</sup> confirm that Slovakia is facing a drain of talented Slovak STEM experts, who are leaving it to study abroad and, after completing the study, they stay abroad or, after completing their study in Slovakia, they leave abroad. In general, the drain of talents poses a big threat for Slovakia and its future.

### ▪ **Intensifying regional differences:**

National analyses and statistics<sup>29</sup> warn that the differences among individual Slovak regions are becoming increasingly deeper which constitutes big economic, political and social risk.

### ▪ **Missing modern labour mobility:**

The current situation in the country shows risks that result from continuing non-existence of modern labour mobility policy. Slovakia needs to create flexible and attractive conditions for types of groups: employing citizens from EU countries and employing citizens from countries outside the EU, so called third countries. This is how the current shortage of experts in the Slovak labour market as well as increase the international attractiveness of Slovakia as a country.

## SWOT analysis – Infrastructure

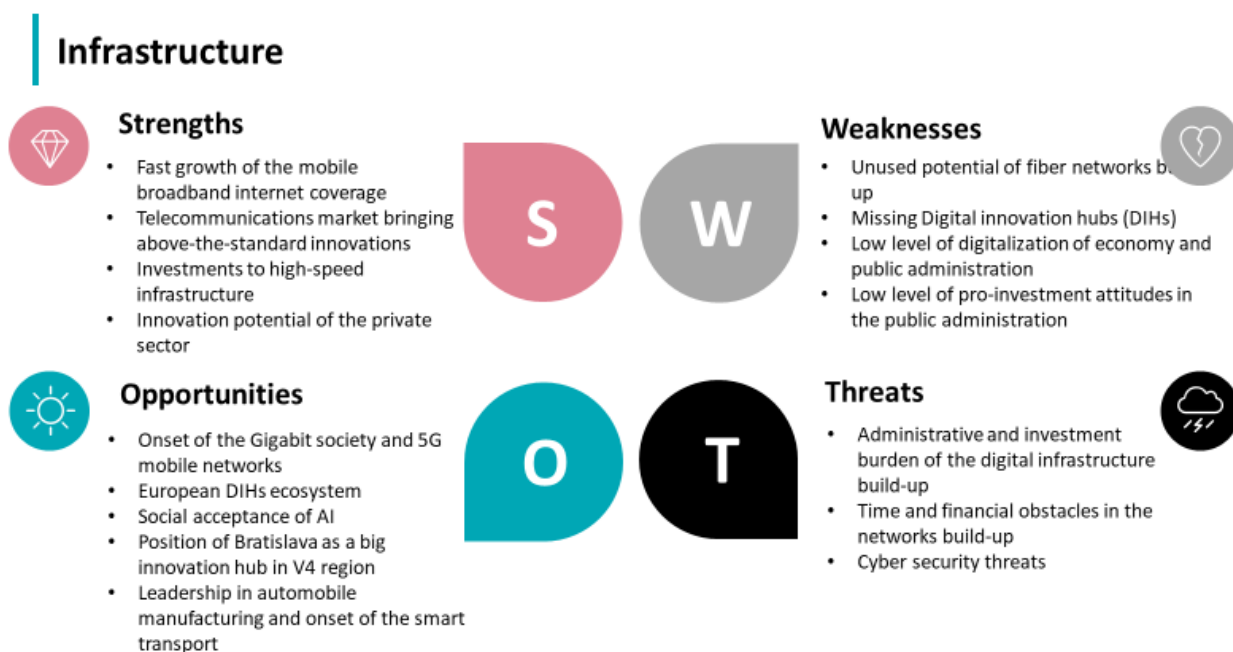


Figure 6: SWOT analysis – Infrastructure

#### SWOT: Strengths – Infrastructure

### ▪ **Fast growth of the coverage by mobile broadband internet:**

<sup>27</sup> Currently under preparation.

<sup>28</sup> The list is provided in Annex 6.

<sup>29</sup> Ibid.



Data available from the telecommunications market<sup>30</sup> show that the 4G/LTE mobile coverage is at above-the-average level in the EUU, as each of three biggest mobile operators has the population coverage above 94%.

- **Saturates and competitive market of electronic communications bringing above-the-standard technological solutions and innovations:**

Statistics of telecommunications companies<sup>31</sup> show that Slovakia is one of countries implementing advanced technologies in practice and often earlier than other EU countries, which is demonstrated by the latest innovative services of Slovak telecommunications operators.

- **Long-term intensive investments into high-speed infrastructure:**

As confirmed by statistics of the TREND Weekly<sup>32</sup>, operators belong to top investors in the Slovak Republic and by doing that, they cumulatively make the sector of electronic communications one of the most attractive sector for investments.

- **Innovation potential of the private sector and presence of global ICT companies:**

Slovakia is the venue of operation of several successful multinational companies, IT companies and start-ups, which work with digital technologies and bring to the market a lot of state-of-the-art and unique innovations and technological solutions – such as IBM, Lenovo, Orange, Dell, Eset, Slovak Telekom, O2, AT&T, Accenture, Exponea, WebSupport, sli.do, Innovatrics, GymBeam, Photoneo, Staffino, Quality Unit, etc.

#### SWOT: Weaknesses – Infrastructure

- **Unused potential for building fibre networks:**

Available data from the telecommunications market<sup>33</sup> show that building fibre networks in the country is still continuing slowly.

- **Slower preparation for introducing 5G networks:**

Preparatory works for launching auctions started in more than half of EU countries already in 2019 and many Member States intend to finish them this year too; one third of the Member States have already commenced auctions for frequencies suitable for 5G. Slovakia is about to run auction for the frequency band of 700MHz, which is suitable for terrestrial systems capable of providing wireless electronic communications services (5G) only at the beginning of 2020. The build-up of 5G networks should respect coordinated approach of EU Member States also to the issue of cyber security and industrial security in the supplier chain from the viewpoint of risk assessment.

- **Missing Digital Innovation Hubs (DIHs) in Slovakia:**

Commission Report on DIHs<sup>34</sup> has pointed out that Slovakia is one of 4 last EU Member States (together with Bulgaria, Romania and Malta) that have no functioning digital innovation hub in the country. It is alarming that there is not a single hub in operation in Slovakia, unlike other EU Member States where there are dozens of hubs working there – e.g. in Spain, there are 43 hubs and 19 more are in preparation, in Germany, there are 23 hubs with 25 more in the process of preparation; out of V4 countries, there are 3 hubs operating in the Czech Republic, 2 in Hungary and 2 more are in preparation stage and 4 hubs are already operated in Poland, with 7 more being set up.

- **Low level of digitalization of economy and ineffective functioning of public sector eGovernment:**

---

<sup>30</sup> The list is provided in Annex 6.

<sup>31</sup> Ibid.

<sup>32</sup> Trend, Most investing companies in the Slovak Republic, <https://www.etrend.sk/trend-archiv/rok-2018/cislo-45/investicie-8.html> (27 February 2019)

<sup>33</sup> The list is provided in Annex 6.

<sup>34</sup> European Commission, DG Connect, Digital Innovation Hubs, December 2018, [https://ec.europa.eu/futurium/en/system/files/ged/digital\\_innovation\\_hubs\\_in\\_digital\\_europe\\_programme\\_final2\\_december.pdf](https://ec.europa.eu/futurium/en/system/files/ged/digital_innovation_hubs_in_digital_europe_programme_final2_december.pdf) (18 December 2018)

Results of the DESI index for 2018<sup>35</sup> show that Slovak manufacturing and services and, above all, the public sector still report low level of informatization. A specifically serious problem is the low quality of eGovernment services.

- **Inadequate infrastructure for data economy in the public administration:**

Overall results of the DESI index for 2014-2018<sup>36</sup> indicate that Slovakia has shortcomings in building infrastructure for data management functioning in the public sector.

- **Low level of engagement in international initiatives that provides countries with innovations and know-how:**

Slovak towns and villages have generally very low level of engagement in international projects and call, such as Smart City, whose objective is to create and introduce innovations in order to improve lives of inhabitants.

- **Low number of pro-investment approaches of the public administration into infrastructure build-up:**

Results of the *Country Report Slovakia 2019*<sup>37</sup> point out at the fact that the public administration reports only low amount of investments into infrastructure and its stabilization.

#### SWOT: Opportunities – Infrastructure

- **Onset of the gigabit society and 5G mobile networks:**

Based on telecommunications market analyses<sup>38</sup>, the build-up of gigabit fibre infrastructure seems to be an important precondition for development of national economy sectors and services. To achieve it, it is necessary to support the build-up and sharing of infrastructure and its protection. Moreover, Slovakia is facing the task of setting the regulatory environment to enable deployment of 5G mobile networks in practice under conditions favourable for security, trust in transactions and for new investments.

- **European ecosystem of Digital Innovation Hubs (DIHs):**

Examples from other EU Member States and the Commission Report on DIHs<sup>39</sup> confirm that digital innovation hubs provide unique opportunity to ensure extended use of digital technologies in economy and society. Therefore, it is a big opportunity for the country to get involved in the process by creating an ecosystem of Slovak DIHs.

- **Social acceptance of AI and other technologies in order to improve functioning of the private and public sector:**

Specialised AI can, under correctly set conditions, increase the effectiveness or replace a lot of aspects of human cognitive work. Thanks to AI and digital technologies can be used by private companies and the state administration in order to increase their efficiency and effectiveness, companies can grow and be competitive at the international level, they can reduce paperwork, increase transparency of decisions and thus reduce the risk of corruption and improve the quality of provided services. Digital technologies can be equally used to increase the efficiency and working conditions of employees in private and public sector. One big opportunity lies in increasing the quality, effectiveness and subsequent enhancement of eGovernment services.

- **Position of Bratislava as a big innovation hub in the V4 region:**

Discussion with the start-up community indicate that Slovakia should work on interconnecting the infrastructure in the V4 area and use the perspective of the capital town with good connection to surrounding countries as the innovation hub in the region.

<sup>35</sup> Digital Economy and Society Index (DESI) 2018, Country Report Slovakia, [http://ec.europa.eu/information\\_society/newsroom/image/document/2018-20/sk-desi\\_2018-country-profile\\_eng\\_B4415E7E-9154-E26E-7B403212919F3F7C\\_52238.pdf](http://ec.europa.eu/information_society/newsroom/image/document/2018-20/sk-desi_2018-country-profile_eng_B4415E7E-9154-E26E-7B403212919F3F7C_52238.pdf) (17 January 2019)

<sup>36</sup> European Commission, Digital Economy and Society Index – Charts, <https://digital-agenda-data.eu/datasets/desi/visualizations> (12 December 2018)

<sup>37</sup> European Commission, Country Report Slovakia 2019, [https://ec.europa.eu/info/sites/info/files/file\\_import/2019-european-semester-country-report-slovakia\\_en\\_0.pdf](https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-slovakia_en_0.pdf) (9 April 2019)

<sup>38</sup> The list is provided in Annex 6.

<sup>39</sup> European Commission, DG Connect, Digital Innovation Hubs, December 2018, [https://ec.europa.eu/futurium/en/system/files/ged/digital\\_innovation\\_hubs\\_in\\_digital\\_europe\\_programme\\_final2\\_december.pdf](https://ec.europa.eu/futurium/en/system/files/ged/digital_innovation_hubs_in_digital_europe_programme_final2_december.pdf) (18 December 2018)

▪ **Leadership in car production and beginnings of smart transport:**

Slovakia should make use of the fact that it is currently the world leader in car production per inhabitant and in total car production volume per year. There are four big global carmakers present in Slovakia – KIA, Jaguar Land Rover, Peugeot and Volkswagen. This fact should be used to modernise the infrastructure for the needs of smart transport and AI-based solutions.

**SWOT: Threats – Infrastructure**

▪ **Administrative and investment costs of building the communications infrastructure:**

After long-term and extensive investments into the communications infrastructure in Slovakia, the investment potential of the private sector is approaching its limit because the local market potential will obviously not be enough to cover investment and operational costs for building such ambitious infrastructure.

▪ **Delayed favourable policies necessary to put the 5G technology in practice:**

Successful, effective, safe and early deployment of the 5G technology requires a balanced preparation of related necessary legislative measures.

- **Growing resistance of a part of activists against building mobile, wireless and fixed networks.**
- **Financial and time obstacles in the build-up of networks caused by the public administration, in particular, self-government.**
- **Impact of global retail chains on selection of technology vendors and thus related dependence on research and development of ICT technologies abroad:**

In a small economy, such as Slovakia, it is necessary to respect the fact that new technologies are developed by global powers and the room for Slovakia is to look for innovative services.

▪ **Threat to the cyber security and data security:**

Penetration of digital technologies and opening of services to innovation processes increases the cyber vulnerability of public and private networks.

**SWOT Analysis – Regulatory Framework**

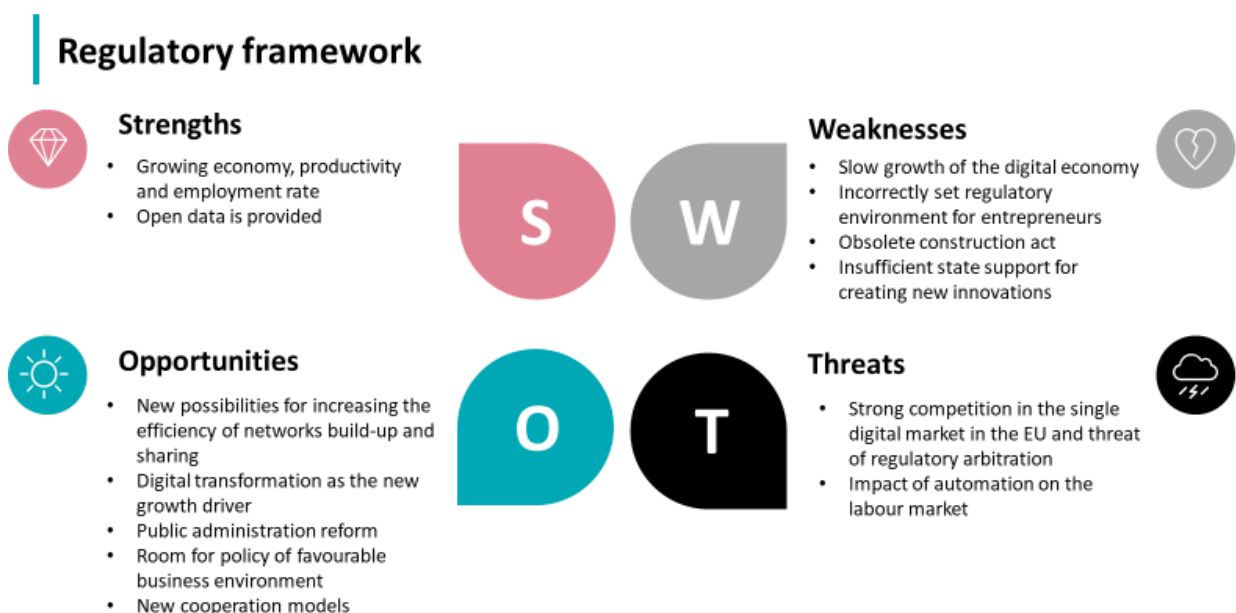


Figure 7: SWOT analysis – Regulatory framework

SWOT: Strengths – Regulatory framework

- **Growing economy, productivity and employment rate in Slovakia:**

Economic statistics of the Slovak Statistical Office<sup>40</sup> confirm that the growth of Slovak economy is accelerating and the gross domestic product is growing with fastest pace since end of 2015. In the first half of 2018, the GDP generated in Slovakia amounted to more than 43 billion euros and grew, year of year, by 6.5 % in current prices. In October 2018, the registered unemployment rate was 5.23 %. The biggest share in the economic growth can be attributed to foreign investments, extension of production in traditional sectors, export of products and services, growing labour force as well as financing from the EU funds.

- **Open data is provided:**

Portal for open data<sup>41</sup> provides access to data in the form that meets open and technologically neutral standards with the use of public licences enabling efficient use of data.

SWOT: Weaknesses – Regulatory framework

- **Slow growth of the digital economy:**

Analysis of the EC, such as *Country Report Slovakia 2019*<sup>42</sup> show that the Slovak economy is still primarily based on traditional sectors such as automobile industry and it is only slightly oriented at the digital economy and innovation industry. The digital economy is growing slowly in Slovakia: in the period 2012 to 2016, the digital economy in Slovakia was growing by only 0.7 % year-on-year, which is 4 times lower figure than reported in strong digital economies of the EU. Current economy growth factors will soon reach their future limitations (e.g. insufficient capitalisation, growing labour costs, delayed productivity), unless Slovakia re-orientates towards the digital economy as soon as possible.

- **Not suitably set regulatory environment for businesses and investors:**

Results of the Commission reports<sup>43</sup>, as well as experience of the private sector, indicate that the current regulatory environment setting in Slovakia does not support and simplify functioning of starting businesses, small and medium enterprises neither of well-established big companies that are ready to continue investing into the local economy. The government should present motivational tools in order to support the build-up of the strategic ecosystem, while it is necessary, with regard to the market reality in Slovakia, to avoid discrimination between small and medium and big enterprises.

- **Obsolete building act and act on territorial planning:**

Discussions with the expert public and representatives of the private sector indicate that the legislative environment related to the build-up and territorial planning in Slovakia are currently significantly slowing down the build-up of and investments into the necessary infrastructure. In Slovakia, we need to quickly adjust the obsolete form of Act No. 50/1976 Coll. on territorial planning and Building Code (Building Act) as amended, which originated in 1976 or other related legal regulations. The Building Act fails in practice; there are frequent conflicts of interests in its interpretation which leads to obstacles in the construction. Legislative regulation in the form of decrees to the current act and the preparation of the new act are necessary in order to accelerate the build-up and modernisation of networks. Support from public funds could be provided also in the form of demand where there is no business case, e.g. in the form of vouchers (like in Greece and other states).

- **Insufficient support from the state to create new innovations:**

Experience from the private sector shows that the companies are not sufficiently motivated to create new innovations and they are not adequately informed about possible call and projects. Even despite the fact that start-ups create jobs, bring investments and can lead to development of big companies and vice versa, big companies are supporting development and growth of start-ups, the government is not sufficiently

<sup>40</sup> Economic development in the Slovak Republic in January 2019, [www.slovak.statistics.sk](http://www.slovak.statistics.sk) (20 March 2019)

<sup>41</sup> Data Gov, [www.data.gov.sk](http://www.data.gov.sk)

<sup>42</sup> European Commission, Country Report Slovakia 2019, [https://ec.europa.eu/info/sites/info/files/file\\_import/2019-european-semester-country-report-slovakia\\_en\\_0.pdf](https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-slovakia_en_0.pdf) (1 March 2019)

<sup>43</sup> European Commission, Country Report Slovakia 2019, [https://ec.europa.eu/info/sites/info/files/file\\_import/2019-european-semester-country-report-slovakia\\_en\\_0.pdf](https://ec.europa.eu/info/sites/info/files/file_import/2019-european-semester-country-report-slovakia_en_0.pdf) (1 March 2019)

supporting existing start-ups, neither occurrence of others, and it is not attracting innovative companies from abroad to relocate to Slovakia.

#### SWOT: Opportunities – Regulatory framework

- **New possibilities to accelerate and increase the efficiency of building and sharing infrastructure:**

Based on foreign practices in developed digital countries<sup>44</sup>, it seems that the digital transformation and the build-up of the information society are preconditioned by existence of sufficiently robust and functioning communications infrastructure (fibre networks as the basis for mobile and fixed new generations networks), which enable permanent connectedness of all systems, their mutual communication and effective management and supervision. It is necessary to set transparent and unified policies and regulatory approaches that will help establish conditions for acceleration of investments into fibre network and providing coverage for the whole Slovakia. Equally, it is important to support the conditions for effective cooperation of telecommunications companies in the infrastructure build-up. Moreover, new directive came into force in December 2018, setting the *European Electronic Communications Code/EECC*<sup>45</sup>, which transposition into the Slovak legislation provides an opportunity for reviewing the relevant regulation in the Slovak Republic towards creation of environment stimulating investments into infrastructure. A separate chapter is deployment of 5G networks that serve as the critical information infrastructure in the future thanks to their features because, after their deployment, 5G networks will become the basic pillar of a broad range of services that are necessary for functioning of the market and maintaining key social and economic functions (energy, transport, banking, health care, industry, etc.).

- **Digital transformation as the new engine of the economic growth of the country:**

Examples of the most developed EU Member States in the digital economy<sup>46</sup> confirm that it is the digital transformation and shift towards the innovation industry that have the huge potential to become the real engine of the Slovak economic growth. Based on a McKinsey analysis<sup>47</sup>, the digital transformation can bring as much as 16.1 billion euros to the GDP of the country until 2025 – in 2016, the digital economy in Slovakia amounted to EUR 4.8 billion, which is 5.9 % of the GDP (total of 81.2 billion euros); by means of the digital transformation, the share of the digital economy could increase up to 20.9 billion euros in Slovakia, which could amount to 16.9 % of the country's GDP in 2025 (total of 123.8 billion euros).

- **Public administration reform in the right direction in order to increase competences and accelerate processes:**

The development in Slovakia confirms that the process of decentralisation has been carried out also in areas where there is objective shortage of human capacities to manage competences. Therefore, they should be concentrated on regional or possibly national level, especially in areas that require expert skills – build-up of network industries, especially electronic communications, public procurement and informatization in general.

- **Room for policy for creating favourable environment for small, medium and big enterprises:**

Discussions with the expert public show the necessity to simplify conditions for doing business and make them more attractive in order to stimulate start-up environment and increase the adoption of digital tools and technologies by small, medium and big enterprises in Slovakia. It is necessary to simplify, accelerate and release regulations for everyone in order to enable innovations and experiments as well as to assess impacts of the platform economy and changes of the work in the digital era on labour law and its institutes in the context of concerned entities. It is also important to improve and standardise the ICT regulatory environment in Slovakia in order to increase the attractiveness of investments into networks. It is necessary

<sup>44</sup> Strategies are provided in Annex 3.

<sup>45</sup> EUR-Lex, Directive establishing the European Electronic Communication Code, <https://eur-lex.europa.eu/eli/dir/2018/1972/oj> (10 March 2019)

<sup>46</sup> Strategies are provide in Annex 3.

<sup>47</sup> McKinsey, The Rise of Digital Challengers– Perspective on Slovakia, [https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers\\_Perspective-on-SK.pdf](https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers_Perspective-on-SK.pdf) (20 March 2019)

to transpose the Code (EECC) so that its positive features supporting investments into network could be used to the maximum extent.

▪ **New models of cooperation between the private, academic and public sector:**

Best practices from abroad<sup>48</sup> show that an effective cooperation between industry, entrepreneurs, scientific facilities, universities and public administration entities is the key for Slovakia to produce high quality science, research and innovations that can be implemented into practice and, upon that, made accessible to citizens in order to improve their lives as well as improve the general economic performance of the country.

▪ **Cooperation with Central and Easter Europe Countries (CEEC):**

An analysis of McKinsey<sup>49</sup> recommends CEE countries, including Slovakia, to grasp the full potential of informatization by means of close cooperation, for the following reasons:

- CEE countries are facing similar problems, above all, drain of talents and need of long-term requalification of the labour force – their shared effort, equally, shared effort of companies operating there can help find and introduce the most efficient solutions,
- CEE countries report a similar level of informatization – their cooperation in the field of digital investments and regulatory policy should therefore be very efficient,
- Sharing best practices and cooperation among CEEC will ensure sharing of the best practices, know-how and accelerate the digital transformation of different countries.

#### SWOT: Threats – Regulatory framework

▪ **Strong competition for Slovak companies in the digital single market of the EU and the threat of regulatory arbitration:**

Slovak companies feel strong competition in the digital single market of the EU, for which they were not prepared and they must fight it. The regulatory arbitration occurs when innovation positive regulatory environment in another country attracts also Slovak companies that, instead of setting up their head office and performing their activity in Slovakia, they leave to a country with better regulation and better pro-innovation stimuli.

▪ **Big number of jobs can be replaced by automation:**

A McKinsey study<sup>50</sup> shows that as many as 53% of work activities in Slovakia – which is equivalent to around 1.2 million jobs – can be automated until 2030, which has a significant impact on the labour market and the society.

<sup>48</sup> Stratégie uvedené v Prílohe 3.

<sup>49</sup> McKinsey, The Rise of Digital Challengers – Perspective on Slovakia, [https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers\\_Perspective-on-SK.pdf](https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers_Perspective-on-SK.pdf) (20.3.2019)

<sup>50</sup> McKinsey, The Rise of Digital Challengers – Perspective on Slovakia, [https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers\\_Perspective-on-SK.pdf](https://digitalchallengers.mckinsey.com/files/The-rise-of-Digital-Challengers_Perspective-on-SK.pdf) (20.3.2019)



### 3 Vision of the digital transformation of Slovakia

The vision of the digital transformation of Slovakia until 2030 has been defined as follows:

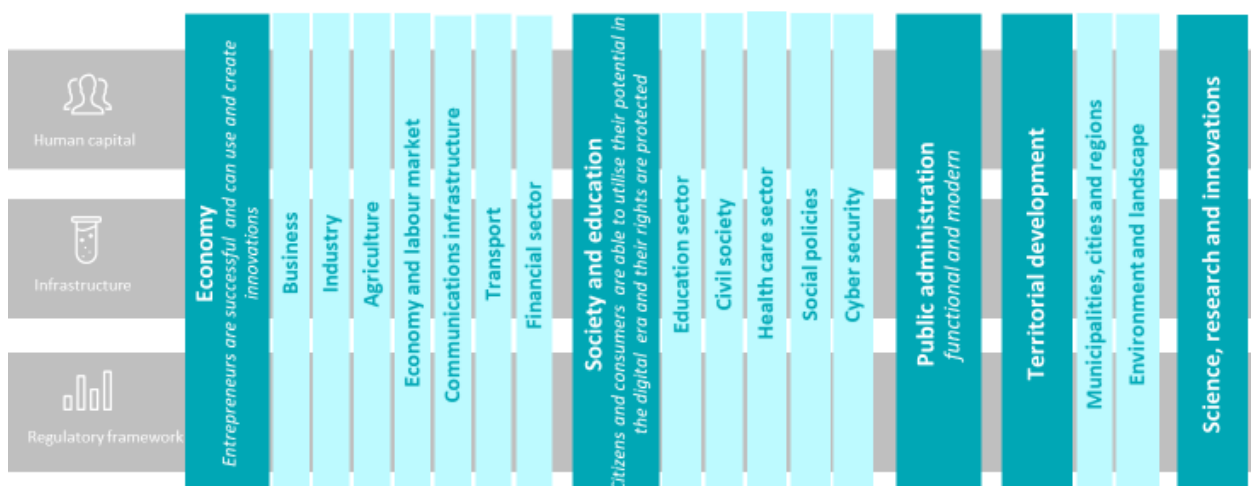
*By 2030, Slovakia will become a modern country with innovative and ecological industry built on knowledge-based and data economy, with effective public administration ensuring smart use of the territory and infrastructure and with information society whose citizens use their potential at full and live high-quality and secure lives in the digital era.*

The vision implies that **we envision the success of the digital transformation of Slovakia in finding a balance to satisfy needs and priorities in a new arrangement of five areas that will undergo a fundamental digital transformation** (Figure 8):

- **Economy,**
- **Society and education,**
- **Public administration,**
- **Territorial development,**
- **Science, research and innovations.**

In order to achieve this arrangement, it is necessary to use both, domestic innovation potential, local sources and energy as well as global sources from the commercial environment, such as cloud services that are developing in a fast pace and that are being optimised based on actual experience and quantity of data with which they work. Equally, it is necessary to continue in the build-up of the information infrastructure that is the basis for development of the information society and modern services for citizens and entrepreneurs. While developing innovative entrepreneurial environment and supporting start-ups in Slovakia, it will be necessary to pay adequate attention to strengthening of private investments in the form of risk capital. Also this type of financial support will ensure that starting entrepreneurs will be interested in doing business in Slovakia and contribute, by their activities, to the development of the digital and innovative economy. Such setting will enable faster accomplishment of desired results, their relevance and, above all, sustainability of solutions.

#### Vision of the digital transformation



*Figure 8: Basic framework for the vision of digital Slovakia*

### 3.1 Economy: Entrepreneurs are successful and able to use and create innovations

#### Economy, industry and agriculture adapted to the needs of the digital era

Slovakia needs to create conditions for continuous digital transformation of all sectors of the economy. It includes, above all, transformation of the current industry to Industry 4.0, which refers to the current trend of digitalization and related automation of manufacturing and data exchange in production processes. Industry 4.0 will become the driver of the economic growth in the country. The goal will be to utilise the technological potential and increase private and public investments into new technologies. Therefore, it will be necessary for the state to help businesses to get ready for such transformation. That preparation will be possible, primarily, if the government provides businesses with knowledge and possibility to access technologies, as well as stimuli and initiatives to deal with specific problems, for example by means of digital innovation hubs. Innovative approaches and benefits of Industry 4.0 can strongly help the economy in Slovakia to work in a sustainable, ecological and effective manner.

Thanks to continuous deployment of automated technologies, majority of industrial and agricultural sectors will experience a growing shift in the nature of skills. When working with new technologies, employees must be able to assume complex, less automated tasks, such as fix problems, come up with new solutions and approaches and think critically. Equally, cognitive abilities, social skills, communication skills, organisation skills, technological expertise and creativity are the categories whose importance will grow constantly and will be sought after in the labour market and the Slovak market will have to effectively cope with it.

Slovakia will also create preconditions for occurrence of dynamic data economy. Legislative environment will be set in a way that will enable application of new business models built on platforms and AI in practice. In the economy, there will also be a sufficient demand for innovative solutions in order to make innovations. Thus, Slovak companies will be employing a growing number of data analysts.

In the dynamics of the global economy, the phenomenon of platform economy has played a decisive role in the past few years. The list of fastest growing global brands is slowly being dominated by a new platform-based business model – three out of five biggest companies in the world, based on their market value (Apple, Google and Microsoft), have been using this business model intensively. A platform constitutes a means of economic activity enabling external producers and consumers to effectively take part in value creation by means of mediation. That value may be sale of goods, providing services or increasing the social status. However, the platform itself usually owns no resources to create the value – for example, successful online platform Airbnb, which puts together accommodation providers and tourists, owns no hotel. The online platform only provides digitally open and a participative infrastructure (online portal) to perform such interactions that are also regulated based on its rules.<sup>51</sup> Therefore, one of the keys to success of the European economy will be to develop and create new European platforms, as well as possibilities for businesses to effectively operate in this new type of market (logistics platform, platform for automobiles and transport, platform for smart household, platform for smart industry, platform for health care, etc.). It is necessary for businesses to get prepared for expansion to new markets. In this effort, they can make use of programmes for building innovation hubs and clusters where is possible to share experience, best practices and make partnerships across sectors with domestic and international entities.

#### Businesses using innovations

Slovakia needs a business ecosystem that is capable of facing global competition and producing successful innovations. Technological progress and investments to infrastructure are brought in, above all, by multinational companies operating in Slovakia, however, a significant share can be attributed to small and medium businesses and start-ups. For this reason, it is necessary for the government to support all such entities as much as possible. The digital transformation should provide entrepreneurs in Slovakia with:

<sup>51</sup> Geoffrey G. Parker, Marshall Van Alstyne, and Sangeet Paul Choudary: Platformová revolúcia, W.W. NORTON & COMPANY, 2016

- Unified and simplified processes for doing business in the entire EU,
- Reduction of transaction costs in providing content and services across borders (thanks to unified contractual rules and well set VAT tax mode),
- Regulations adapted to the digital era that will support fair economic competition, fix problems of digital monopolies and support innovative business models,
- Effective electronic communication with the public administration that will save entrepreneurs' time and money,
- Financing that will support business innovations and state-supported “living labs”, where they can test innovative solutions and further scale and improve them,
- New possibilities of data use of and processing, including ensuring free movement of data as the fifth freedom of the EU internal market.

Unification of rules in the EU can also lead to a significant increase of the competition that will bring about many challenges and opportunities. In general, it is possible to expect that companies, which want to succeed, need to innovate and digitalise their processes and, predominantly, offer services and products with high added value. Therefore, it is important for such companies to receive the following support:

- Support to test and create new business models,
- Support to introduce Ai solutions in business processes,
- Support in access to human capital, knowledge and technologies,
- And, last but not least, financial support during the entire innovation cycle from applied research up to innovations scaling.

#### Robust, functioning and secure communication infrastructure

The digital transformation will only be possible in the case of existence of sufficiently robust, secure and functioning communication infrastructure that will enable permanent connectivity of all systems, their mutual communication and, of course, effective management and supervision. Build-up of electronic communication networks is part of the national and EU policies and it is in the public interest. Therefore, it will be necessary to introduce transparency and uniformity into processes for issuing permits for construction and territorial planning, construction categorisation that will enable simplification of the build-up and modernisation with regard to specific features of such networks. It is necessary to set policies and positive regulatory approaches (in the sense we regulate only what is necessary to make its operation more efficient), which will help to create conditions for accelerating investments into fibre networks and providing coverage of the entire Slovakia. Equally, it is necessary to set conditions for effective cooperation of telecommunications companies in the infrastructure build-up in order to prevent doubling parallel and independent coverage. It will be necessary to prepare an Atlas of passive infrastructure and ensure effective operation of Unified information spot, in particular, adherence to rules by all involved parties.

#### Smart transport

Slovakia is one of the global leaders in car production. For several years, Slovakia has been leading global ranks in the number of cars manufactured per one thousand inhabitants – in 2018, it was 198 cars. In the rank of total car production, Slovakia ranked twentieth in 2018 with the production of a bit above 1 million cars per year.<sup>52</sup> However, from the viewpoint of Industrial revolution 4.0, Slovakia needs to be a leader not only in the manufacturing but also in innovations and in transport. Introducing smart transport policies, smart mobility and integrated public transport systems constitutes a huge opportunity to set up new enterprises dealing with innovations and value added activities. Slovakia should create environment and conditions for testing and deployment of smart public transport and autonomous mobility concepts into practice as part of the national transport infrastructure. Equally, Slovakia should get involved in the C-Roads project.<sup>53</sup>

<sup>52</sup> SME, Na Slovensku sa vlani vyrobilo rekordné množstvo áut [A record number high number of cars was manufactured in Slovakia last year], <https://ekonomika.sme.sk/c/22025271/na-slovensku-sa-vlani-vyrobilo-rekordne-mnozstvo-aut.html> (15 January 2019)

<sup>53</sup> C-Roads, <https://www.c-roads.eu/platform.html>

### Progressive financial sector providing financial innovations

Digital innovations and technological progress are utterly transforming every aspect of functioning of the financial sector. There is a radical change happening in the way how products and services of banks, insurance companies and similar financial institutions are used and provided. The development in the field of financial innovations is moving forward in a tremendous pace and therefore it is necessary for regulatory bodies to be in close contact with market entities and innovative companies and create favourable and dynamic conditions for the digital transformation of the Slovak financial sector. It is important to keep the financial sector stable and adequately protect financial consumers and, at the same time, ensure such regulatory environment in Slovakia that will enable established as well as new financial institutions apply progressive procedures and make full use of the new technologies potential, which will support the transition of the Slovak financial sector to the digital era.

## 3.2 Society and education: Citizens and consumers are able to use their potential in the digital era and their rights are protected

### Modern and high quality education for the information society build-up

Slovakia needs a comprehensive systemic change of the education system. Progress in the digital economy can be achieved only by means of improving the quality of education and developing skills of students, employees and consumers, who can respond to new challenges in the labour market and accept technological innovations that will be occurring in an increasing pace. Education at all levels of schools must focus on overall development of one's personality, development of relations culture as well as the ability to learn, abstract problems and acquire knowledge in a targeted manner as well as find one's way in extensive data of the digital world.

In the context of increasingly globalised labour markets, companies are fighting for skills and qualifications necessary to support innovations. Investing into skills and qualifications can turn the digitalisation into a net provider of jobs, it can support innovations, productivity, growth and employment. World Economic Forum has warned that later significant changes in the global economy and individual societies will be even bigger and more severe as the recent ones. Therefore, it recommends government all over the world to initiate necessary reforms. It is necessary to start educating in areas of emotional intelligence, creative thinking and cooperation. These three areas will be the most important ones in the process of transition to the information society.

The build-up of the information society will put humans outside of the direct production process. The transition to the information society will increase the importance of humans because the means they create will only serve them – they are part of the human world. A breakthrough in the development of the human society rests in the fact that the build-up of the material world is accomplished and the development started to move towards the build-up of information world and, thus, the gravity point in lives of humans will be in the information world. The world is transforming not only from the technical viewpoint but also in its values. The basic quality feature from the technical viewpoint will be to be smart and, from the mental viewpoint, to possess a set of key professional and expert competences. 21<sup>st</sup> century information means are intended to support human activities and for their private needs, however, the decisive factor is their use in the production process. Due to this change of the position of information, the information society is characterised by the dominant position of humans whose most significant attribute is education. In the present-day society, humans, as individuals, are in interaction with three “worlds”:

1. *Material world* (living and no-living nature, energy sector, industry, trade, transport, medicine...),
2. *Digital-virtual world* (information as the dominant commodity in information society, e-systems, ICT, internet in the broader sense, augmented and virtual reality, autonomous smart solutions...),
3. *Human world* (social systems and communities, civil society, certain services, education, art and culture, religions...).

To live an active and high-quality life, each citizen in the modern society will need adequate literacy for each of the “worlds”. University educated person will have to be very well prepared not only from professional viewpoint, study major they will study, but it will be necessary to be very well equipped with a set of competences for both, the digital and human “worlds”. Then, it will be possible to actually meet the mission of universities, which is a harmonic personality development. In this mission, there is irreplaceable role of universities because education at primary and secondary schools has absolutely different attributes from education at universities; anyway, at those levels, it is also necessary to start putting emphasis on supporting activities in order to ensure a comprehensive and balanced development of a healthy personality.

Even though not all citizens will have university education, it is highly probable that all of them will get in touch with digital technologies and become a part of the digital “world”. Therefore, it is necessary to analyse impacts of such technologies on the development, mindsets and social interactions of humans. Equally, it is necessary to recommend models of their adequate utilisation in order to achieve maximum satisfaction (well-being) of individuals and development of their personalities and minimise associated negative phenomena that are connected to inadequate or unsuitable use of such technologies. Only individuals who can find their optimal position in all those worlds can significantly contribute to a satisfied self-actualisation and will be a contribution in the build-up of a balanced, sustainable and modern society. Due to the currently fast changing nature of our society, it is – even despite undoubtedly positive impact of the technological progress on the society – necessary to evaluate, in a critical and continuous manner, impacts of digital technologies on the functioning and direction of the society. And, subsequently, apply the findings in practice at all levels of education – from primary schools up to universities.

#### Advanced and inclusive civil society

Information and communication technologies and innovations bring new opportunities for building a stronger and more inclusive civil society. All over the world, much effort is made to use the potential of digital technologies in order to mobilise civic measures at local, national and international levels. Such effort includes, not limited to, online access to high quality journalism – provided that the copyright is protected and compensation is given for professional journalism work – civil activism in social networks, introducing voting over the internet, etc. On the other hand, there are also negative effects that can have impact on digital technologies, standards and the nature of the public life, social cohesion and level of democracy that are threatened by spreading of disinformation and hoaxes on the internet. Therefore, it is important to set the system of technologies utilisation to strengthen the civic society and democratic values and effectively fight all forms that intend to weaken it.

All citizens will thus be able to participate in life in the digital era and adapt to new challenges:

- Consumers will have access to credible and transparent digital services and digital content under the same terms in the entire EU;
- They will be able to make full use of those services thanks to improved digital skills, regardless of the age or completed education level – no one can be left out of the course of events in the digital space and benefits it brings;
- Citizens will understand the value of their personal data, learn to protect it, manage and use it in order to have the maximum possible benefit of it. Thanks to the availability and possibility to process one’s personal data, they can improve their health and better ace their financial matters. It is important for the state to make maximum effort to achieve progress in cyber security in order to make digital services secure and have any data and infrastructure protected from misuse;
- Thanks to a successful transformation of industrial production, there will be a sufficient offer of high quality jobs – requalification and education programmes for citizens will open brand new job opportunities that will increase the standard of living in Slovakia;
- Citizens will have much broader and flexible possibilities of how to self-actualise thanks to one’s skills.

#### Fully digitalized health care using innovations

Innovation in health care, such as *eZdravie* integrating all entities in the health care sector, new visualisation methods, telemedicine, personal genomics and mobile health care, have huge potential to make it possible for health care professionals to provide more efficient, better quality and secure health care; for citizens to



take over the control over their health; to improve the quality of health care, level of public health and “well-being” of healthy citizens and patients.

#### Flexible and innovative social policy

Digital era provides the socially disadvantaged, heavily disabled and needy people with new available possibilities to improve their everyday lives. New technologies can improve the efficiency and quality of life not only to the socially disadvantaged, disabled and needy citizens but also to their families. The goal is to create and ensure conditions for independent and free life of all citizens who depend on the help of the society in the natural social environment of the community. As part of its social policy, it must also enable reasonable and flexible social insurance for employees in the platform economy. The social policy and the labour market policy will adapt to new challenges of the flexible employment in order to protect every employee and freelancer.

#### Cyber security

Ensuring cyber security constitutes a necessary precondition of successful functioning of every state in the digital era. For this reason, cooperation is necessary at the national level between the public sector, private sector and academic sector. Equally necessary are international cooperation, sharing best practices from abroad and, particularly, and cyber diplomacy. Effective cooperation will require all partners to provide adequate capacities in order to manage security risks that affect them based on their positions and tasks. Therefore, it is necessary for each organisation as well as natural persons to be aware of risks they are facing and realize that to prevent the threat, they will have to make certain effort, spend money and, last but not least, express the will to act in a way that reduces security risks instead of increasing them.

Cyber security plays a very important role at the time of digitalization and informatization as any data is transferred in the virtual world that knows no borders. The virtual world must be necessarily credible and secure because citizens and economy are increasingly dependent on electronic services. On one hand, data security must be guaranteed, on the other hand, privacy and fundamental rights of citizens in the “online” environment must be kept.

### 3.3 Public administration: Functioning and modern public administration that can effectively manage the territory from national to local level

#### Public administration that innovates

Functioning and modern public administration that provides high quality services to citizens and creates well set regulatory environment can be the key factor for success of the digital transformation of economy and society. Public administration should therefore improve its ability to set national strategies and policies as well as effectively implement them in regions, towns and villages with palpable results. Public administration can provide excellent 21<sup>st</sup> century services thanks to predictive analytics and personalisation. eGovernment can be viewed as an online platform providing open application interfaces for innovative business solutions that will serve citizens as well as businesses. Such digital transformation of the public administration will make demand for many value added solutions which will enable innovative companies to succeed in the market.

#### Public administration with sufficient capacities and culture of invention

An important aspect of successful modernisation is the culture of invention. Institutions must know, share, interactively cooperate and, above all, experiment, either with draft policies, regulations or solutions of standard problems at the level of government, region and municipality. Such change will require human resources and expert capacities with a part of them working in agile teams. It means that the public administration will transform its structure and support setting up innovative laboratories and special units.

#### Public administration using data and artificial intelligence

The key to increase the productivity is a significant improvement of the use of data and application of methods such as impact assessment, risk analysis, automated evaluation of cases or applications or predictive planning of future public service capacities. A successful deployment of such approaches into



practice can bring material successes. However, all approaches require high quality data and sharing data from various sources – public as well as private sources, on the commercial basis, with a lot of stakeholders not prepared for it yet.

#### European dimension of public administration informatization

Another step in the progress in electronic public administration will be its European dimension. The European vision is the public administration in the EU that will be open, effective and inclusive and that will provide cross-border, personalised and user friendly electronic public services to all citizens and entrepreneurs in the EU. In designing and providing better services, there will be innovative approaches and modern digital technologies used there based on needs and requirements of citizens and entrepreneurs. Interoperability of information systems will be guaranteed too. Modernisation will include application of the following principles:

- Cross-border digital services as the standard, i.e. citizens will be able to arrange everything online, without the need to visit offices even though if they live and work in different EU countries,
- Once and for good at the European level, which means that citizens and entrepreneurs will not have to report the same fact to any authority in the EU twice,
- Credibility and security first, thanks to which citizens and entrepreneurs will not have to be concerned about losing their privacy or misusing their data or identity.

### 3.4 Territorial development: Building smart cities and regions with participative development and agile use of data

#### Smart City as the way to a modern and smart territorial development

Territorial development offers new, modern and better ways of the use of the territory of Slovakia that will respect needs of the society, however, only if we can better understand its use by means of data analysis. New technologies can collect huge quantity of real time data about the quality of air, soil and water, transport, needs of citizens and entrepreneurs. Analysis of that data will make it possible to plan development of the country, regions and towns and, at the same time, take care of the environment and protect our precious and beautiful nature.

What can strongly help in the process of the digital transformation of the territorial development of Slovakia is the concept of a Smart City that uses technologies in order to increase the quality of life in towns and/or regions. Thus, Smart City is a part of town, a town or a region that uses different types of electronic sensors to collect various data sets on the location (geodata, sensoric data, open data, data from citizens), which is subsequently used for effective management of assets and resources. Development of existing information systems will ensure verified and secure data on transport in real time, which will increase the quality of information about the road, railway and air transport for the general public. Thanks to data collected from Smart Cities, it will be possible to not only significantly modify the territorial planning and environment protection but also to achieve significant energy savings, improve mobility of citizens, their security, respond to climate changes, ensure more effective functioning of offices and increase overall quality of lives of citizens.

#### High quality participative territorial planning that uses data and innovations

However, if we want Slovak regions, towns and villages to become smart places for high-quality lives of their inhabitants, we need to significantly improve and transform the current form of preparation of the territorial planning that is the determining feature in the life of towns and villages, however, its preparation is rather obsolete and does not reflect needs of the life in the 21<sup>st</sup> century. It seems inevitable for the current status of the territorial planning in Slovakia to undergo a significant transformation in order to start preparing in an agile manner, together with the strategic planning based on data collection and use of any available data by means of participation and with the help of experimental pilots and effective communication. Effectiveness of the network build-out could also be made possible by means of shared corridors in the territory.

### 3.5 Science, research and innovations: They can keep the pact with the current global trends and bring new high quality scientific knowledge

#### Functioning ecosystem for research, development and innovations

Science, research and innovations are basic preconditions of a successful digital transformation. Current status of research, development and innovations is, in general, considered as unsatisfactory and, without its significant changes, it is not possible to achieve successful and competitive development of the country in the future. The goal of necessary change is to set a functioning ecosystem for research, development and innovations for the digital era, which is based on the following aspects:

- Human resources development: big attention will be paid to education, encouragement and development of skills in science, technology, together with development and design of products, management, sale, finance, in order to achieve business success;
- Harmonisation of scientific and research activities with business efforts: when looking for the maximum possible economic impact, innovations will be approached to with regard to their future commercial applications, with a functioning cooperation between scientific and research institutions and businesses in order to increase their commercialisation;
- Availability of the capital for all stages and levels of research and development: support will be provided to all levels of financing, ranging from small grants for early stage research up to extensive investments aimed at business purposes. That will lead to creation of a balanced environment of state support, European funds, corporate investments, venture capital, etc.;
- Balanced support from the state means: it is of key importance to increase investments into science and research in order to increase the quality and attractiveness of the science and research environment, attract domestic and foreign talents and produce excellent scientific knowledge. Therefore, it is necessary to introduce policies, regulations, stimuli and taxes to support creation and growth of research and development activities. It is important for the industry to influence the development of the ecosystem in line with changing needs;
- Support to open science and publication in the open approach that has impact of higher effectiveness of science and makes it more reproducible and transparent: science that is financed from public funds must be freely accessible;
- Interconnection of academic, public and private sector in DIHs: we consider that key role will be played by the connection between academic, public and private sector where DIHs will play an important role and create a platform for sharing experience, innovation diplomacy, creating partnerships and combining demand and supply. Our research and development institutions will thus be able to get involved in international scientific grant calls more efficiently, they will make contacts and cooperate with prestigious scientific agencies abroad, get involved in creating international scientific teams, which will improve the quality of science and research in the country.

#### Emphasis on actual results in science and research

Due to the fact that sources of our country are limited, it is necessary to:

- Concentrate funds – basic and applied research in priority technologies will be supported by the Slovak Centre for Artificial Intelligence Research that can focus the best talents, cooperate and perform top level research and development;
- Make sure that results were audited and monitored from the viewpoint of achieved effect and purposefulness.

Slovakia needs to become more attractive to get top talents in research, development and deployment of data processing and AI. Therefore, it is necessary to introduce a national agenda for labour mobility for simple acquisition of the right to reside for experts from abroad with the possibility to relocations of their families. Attractiveness of Slovakia will be supported by public investments into solutions of difficult matters in the field of autonomous vehicle testing, Smart Cities, health care and the digital transformation of the public administration. These matters will form the core focus of operation of experimental

laboratories connected with investment capital funds and there will be strong support provided to setting up university spin-offs.

### 3.6 Intentions of the digital transformation

The intention of the Digital Transformation Strategy for Slovakia is to implement real innovations with a potentially global impact. Innovations in priority sectors contribute to meeting priorities of Slovakia in the field of sustainable development, defined in *2030 Agenda for Sustainable Development* as it is presented in Table 2.

*Table 2: Intentions of the digital transformation*

Sector	Innovation	Implementation of the 2030 Agenda
Education	Educational institution as knowledge organisation. Use of digital technologies (educational platforms) and digital educational content enabling innovative and motivating teaching methods in order to increase the quality of education and practice digital skills of graduates. Enhancement of competences of pupils, students and participants of courses for the digital economy. Personalisation (digital inclusion) for equal access to education for all. Supported systemic life-long learning.	Education for a dignified life in the digital era: <ul style="list-style-type: none"> <li>- for all citizens to use the benefits of the modern era and understand them,</li> <li>- for citizens to be able to find adequate jobs in the era of robotization and automation</li> </ul>
Health care	Electronization of health care services, development of eHealth, mobility in health care, personalised medicine for more precise diagnostics and better quality care of patients, electronized public health for the benefit of supporting and maintaining health of citizens.	Good health thanks to the use of electronic health care system and support tools or public health, personal data on health and lifestyle: <ul style="list-style-type: none"> <li>- citizens must have access to their data on health condition and lifestyle, support to the public health and community health care in protection and support of their health;</li> <li>- citizens must learn how to protect their sensitive data and use smart assistants and services that will help them remain active for long time;</li> <li>- the government must support innovations in the field of health care and, at the same time, pay attention to protection of sensitive personal data, rights and liberties of citizens.</li> </ul>
Social policy	Support to social innovations that will be sustainable thanks to effective and close cooperation of the public, private and non-profit sector.	Reduction of poverty and social inclusion: <ul style="list-style-type: none"> <li>- digital space can provide also the disadvantaged persons with new possibilities in the field of education, employment and business and thus get them involved in the social life,</li> <li>- new technologies can increase the effectiveness and quality of the social policy and simplify lives not only for the disadvantaged but also for their family members.</li> </ul>
Transport	Autonomous transport and smart mobility, which will enable citizens simply plan and use many transport modes ranging from bicycle to trains and car sharing and autonomous means of transportation.	Smart City and smart transport using digital and communication technologies to simplify and increase the efficiency of mobility and thus increase the quality of lives of citizens.
Electronic communications	NGA technologies – the future of high-speed connectivity in Slovakia rests in more robust and extensive fibre networks. Therefore, Slovakia should continue in investments in this field, also by means of European funds for	Build resistant infrastructure, push through inclusive and sustainable industrialisation and innovations.  Develop high quality, reliable, sustainable and resistant infrastructure at the regional and cross-

Sector	Innovation	Implementation of the 2030 Agenda
	development of the communication infrastructure. Such funds can support the market with optic fibre providers and ensure access to funds they need to extend the ultrafast broadband connection to areas with low commercial potential. 5G wireless networks and fibre networks will be of key importance in the future in order to continue effective development of the Internet of Things, autonomous transport, smart transport systems and thus they will contribute to solutions of many problems faced by towns, citizens and entrepreneurs.	border level in order to support economic development and increase the quality of life with the focus on affordable and equal access for all.
Agriculture	Application of the latest knowledge about sustainable use of soil by means of robotization and analysis of data from sensors.	Sustainable towns, regions and countryside in the context of climate change – building new sensoric networks in the Internet of Things will help us better understand impacts of our activities on the climate change and propose effective measures for building sustainable towns.
Industrial production	Deployment of smart industry technologies, new digital platforms, regulations supporting innovative solutions, standards for the internet of industrial things, big data analysis in manufacturing and application of circular economy principles will support competitive, sustainable industrial production.	Heading towards a competitive, knowledge-based and environmentally sustainable economy in the situation of demographic changes and changing global environment and rise of Asian countries – in particular China.
Public administration	Application of the latest standards in the functioning of public administration entities and development of eGovernment services.	Rule of law, democracy and security – public administration must learn how to work with data, not only for better decision-making but also for the growth of trust in democracy by involving citizens into its financing.

## 4 Recommendations for digital transformation of Slovakia for 2019 – 2030

### 4.1 Choice of Priority Areas and Technologies

Areas we will focus on first

For the right direction of the strategy, it is necessary to define **expected area, based on which clear and sustainable measures for their digital transformation will be prepared**. Figure 9 shows the expected prioritisation of areas.

#### Priority areas

Economy	Business
	Industry
	Agriculture
	Economy and labour market
	Communications infrastructure
	Transport
	Financial sector
Society and education	Education sector
	Civil society
	Health care sector
	Social policy
	Cyber security
Public administration	
Territorial development	Municipalities, cities and regions
	Environment and landscape
Science, research and innovations	

Figure 9: Priority areas

Technologies we want to use

Digital transformation focuses on several technological trends thanks to which it is possible to be successful in the digital transformation of economy sectors. It is necessary to rationally assess capacity possibilities of Slovakia and the perspective of further development of the trends in Slovakia. If we, as a small country, want to succeed, we must focus on technologies:

- Whose broader deployment, in particular in the EU, has just started,
- Which do not require extensive investments exceeding possibilities of the country,
- For which there are existing capacities (occurring),
- For which we can attract talents from abroad relatively quickly,
- To which it is possible to apply principles of openness and free access,
- Which enable multiple utilisations.

The openness, free access, multiple utilisation are the qualities that will help meet criteria of success of projects and, at the same time, they are signs of modern civil society. From the viewpoint of current trends that meet the requirements, it seems that the most efficient solution is to support priority technologies displayed in Figure 10.

### Priority technologies

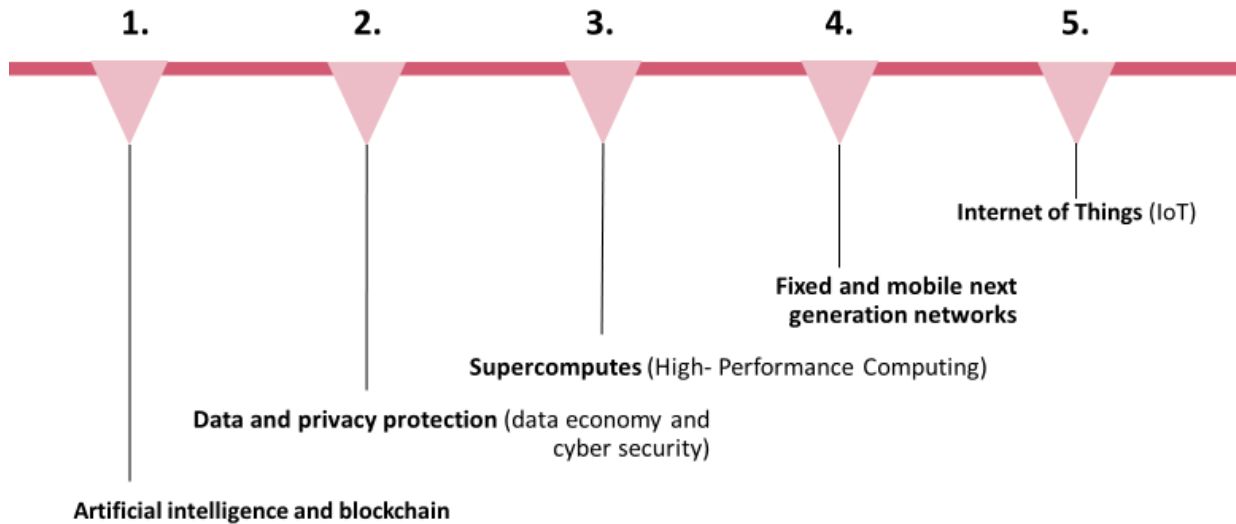


Figure 10: Priority technologies

- **Artificial intelligence and blockchain:** in order to use the most revolutionary current technologies and find sufficient use of them (with the perspective export of services). Talking about AI in Slovakia, we mean two important factors. The requirement on the part of the supply is existence of a sufficient number of companies that can design and implement new business models and that will be competitive also from international perspective. On the part of the demand, our companies must apply more sophisticated solutions and innovations in their processes and thus save costs and operate with higher level of productivity.
- **Data and privacy protection:** in order to be able to create a functioning base for a vibrant data economy where consumer rights are safe. Data may be a kind of a new crude oil and to fully unleash the new potential, we need to create a comprehensive ecosystem of partners from private, public and academic sector that can design new services and bring real applications. We also need data sources. The basic precondition for functioning of the data economy is creation of sufficient data sources and a credible system of its management.
- **High-performance computing (HPC):** in order to get access to high-performance computing and storage capacity that also efficiently uses resources and is the cornerstone of success in the digital era. However, it is important to remember that development of latest generation IT systems is reaching limits of technological possibilities. Further adequate technological development in the following decade is possible only by changing the paradigm. The age of quantum technologies is approaching – **quantum computers, quantum cryptography and quantum sensors as part of the IoT** will become the technologies that will be decisive in the new IT age.
- **Next generation fixed and mobile networks:** in order to get access to high-speed broadband connection, extension of NGA technologies in order to transfer data quickly and seamlessly. Subsequently, it will be necessary to build 5G networks to support autonomous and connected mobility and smart transport systems with expected massive utilisation in the future.
- **Internet of Things (IoT):** in order to use technologies where we, as the country, are already showing promising potential. In particular, the content of education of various primary and secondary schools and universities in Slovakia has already been extended with matters concerning IoT, thanks to which Slovak students have excellent results in IoT and robotics. We also have a lot

of existing projects and a broader background for faster and more effective development in relatively short time.

→ Summary of possibilities and approaches to the development and use of Ai in practice in Slovakia is provided in *Annex 7: Infobox: Recommendations for development of artificial intelligence in Slovakia*.

## 4.2 Principles for Deploying and Using Technologies

### Strengthening of the cyber security

**Strengthening of the cyber security must be deemed one of basic preconditions of functioning economy and society.** All of us are or can be the target of cyberattacks. Practically every day we come across information about new cyber threats, leak of information or cyber-attack of various severity and level of rendition. Ranging from simple attacks, such as DDoS, up to advanced persistent threats to state administration authorities, public administration agencies, critical infrastructure features, private companies and organisations as well as citizens themselves. The goal of such attacks is financial benefit, effort to become visible or leave certain political message or acquire sensitive, confidential or protected information.

Out of all threatened organisations and institutions, there are groups of them that operate features of critical infrastructure or provide services that are essential from the viewpoint of functioning of the government and providing essential services to the population, such as providing health care, electricity supply or water supply and operation of electronic communications and banking services. The government must make sure that all such services be provided reliably and securely. For this reason, it must often adopt regulations and measures to protect such services and ensure preventive mechanisms (in order to safeguard the basic level of security by providers of such services) and reactive mechanisms, which ensure effective and reliable solutions of security problems.

For this reason, the NIS Directive was adopted at the European level, which was transposed, in Slovakia, to Act No. 69/2018 Coll. on Cyber Security and on amendment to other acts as amended by Act No. 373/2018 Coll., laying down obligations for providers of basic services and providers of digital services, specifying central administration authorities – state administration authorities that are in charge of setting security requirements in their sectors and that are obliged to operate or ensure capacities specified for handling cyber security incidents in their sectors that could pose threat to these basic services. Most sectors include private companies as well as agencies set up by the state.

**It is necessary to build cyber security in Slovakia at four levels:**

- **Institutional**, by establishing a system of bodies with assigned competences in the field of cyber security;
- **Legislative and strategic**, where the legislative and strategic framework are created in order to secure competences and obligations of different actors as well as possible sanctions;
- **Operational and technical**, where personal, organisational, administrative and financial capacities are arranged for the purposes of cyber security at the level of competent authorities, all public administration authorities, private providers of basic services as well as build-up of technical capabilities for cyber security;
- **Personal**, where targeted education is provided in the field of cyber security at individual level in the form of lifelong learning (from primary schools up to seniors).

Cyber security is a topic that personally affects a larger number of entities. From the viewpoint of the Slovak Republic and necessary activity from state authorities, this contact is basically divided into three levels:

- At the level of basic services and features of the critical infrastructure, this contact is represented by regulation where the government must ensure, by means of adequate instruments, their reliable and efficient functioning; critical infrastructure protection should also be compensated by the government,



- For other agencies, this contact is represented by proactive services for providing information on security threats and recommendations how to prevent security incidents, effectively manage them and possibly reduce their influence,
- For natural persons, this contact is represented by recommendations and procedures how to protect their digital assets, how to behave in the cyber space in order to minimise security risks.

Strengthening of the cyber security and protection from attacks requires funds for technical arrangement as well as for highly qualified personnel. In order to enable hiring and retaining highly qualified staff for cyber security, it is also necessary to change the method of their rewarding.

However, to sufficiently ensure cyber security, it is necessary to cooperate with the private sector, academia, state administration authorities as well as cooperation at international level in the EU, NATO and other partners.

### Risks of Artificial Intelligence

Artificial intelligence represents for today's world what was once a steam engine or electricity – it is a “resource” that can soon affect every aspect of our society, and change the way we work and lead our everyday lives. Of course, as in the case of steam and electricity, we also expect the AI, first of all, to simplify the processes set and established in our lives, and make them more comfortable. However, the AI does not only bring new scientific discoveries, cheaper and better services and goods, or modern healthcare, safer transport, more efficient public administration and sustainable development; at the same time, it also brings a number of risks that need to be properly identified in order to eliminate their potential negative impacts on the society as much as possible.

**The fundamental risk of AI is the question of ethics, impartiality and transparency** (ability to describe its decision-making process). AI creates systems that are so far capable of fulfilling mainly the strictly specific and rather routine tasks that require a certain level of human intelligence. The problem of ethics and morality in the short term lies in the fact that these systems are increasingly being deployed to assess individuals' personal data and requests (e.g. in applying for a job, reviewing a loan application, or creating an individual's personal profile based on their habits and behaviours), as well as deciding how the AI will behave in a critical situation, where damage to property or human health cannot be avoided (e.g. in the event of an autonomous vehicle crash). This is also related to the questions as to which activities can be left to the AI in terms of ethics, and which should remain explicitly in the hands of the people.

In the long run, the problem is that, as research progresses, AI becomes more sophisticated, which may result in it becoming super-intelligent, superior to human performance<sup>54</sup>. On the one hand, super intelligence could give rise to the positive developments, and bring economic, military or strategic advantages. The risk is that machines as such are not subject to any ethical and moral principles, and if they become superior, they could act unpredictably, which could pose catastrophic risks to our security. Another problem is the possible lack of confidence in technology due to a questionable level of transparency in the process, in which the machines take their decisions, or a risk that they might become misused by the people themselves for negative goals. A prerequisite in the pursuit of a responsible and unbiased functioning of AI is the use of the quality and impartial data, as well as the use of algorithms to be able to assess and verify the basis, on which AI has made individual decisions.

Last but not least, other technologies too, such as IoT and block chain, carry a number of risks that will need to be addressed. The lack of security for IoT devices can be reversed by the cyber security rules for IoT. Lack of IPv4 addresses in the network infrastructure can be solved by supporting the IPv6 deployment. Another risk in the massive deployment of IoT, as well as the block chain technology, is in high power consumption, while block chain is also at risk of slow transaction processing (for a large number of clients). All these risk factors will have to be taken into account and addressed as to their process and concepts in order to reduce the risks in using new technologies.

---

<sup>54</sup> Centre for the Study of Existential Risks, Cambridge University, Risks from Artificial Intelligence, <https://www.cser.ac.uk/research/risks-from-artificial-intelligence/> (1.10.2018)

The vision of transparent and ethical use of artificial intelligence in the State

**The use of AI must be based on trust, which is the cornerstone of the socio-economic dynamics of the human society.** This is why AI must inevitably be subject to the fundamentals of ethics and morality, as well as the principles of the transparent and safe use. In order to do this, **the vision of AI functioning in the State** needs to be based on the following five principles:

### **1. Increase the transparency of artificial intelligence:**

Public authorities, in collaboration with the academia and private sectors, must make sure the citizens are made familiar with all aspects and plans for the functioning of AI so as the necessary trust in its use is created. To increase AI transparency, it is also necessary to require and develop software solutions that will be publicly funded and provided along with a public license (e.g. EUPL 1.2, GNU LGPL 3, and GNU GPL 3). Public licensing means public scrutiny, as everyone has the right to study the source code created in the programming language, which is in line with the *National Public Administration Concept*, as well as with the *Digital Europe Programme*. Likewise, researchers, engineers and developers must bear a full liability for their mission and must be aware of all potential negative effects of their technologies on the society, while making a positive effort to limit them<sup>55</sup>. It is important for the State to support the development and research of responsible AI-utilizing solutions that are based on the quality and unbiased data, as well as to disseminate awareness about their responsible use.

### **2. Recognize and correctly address the social risks arising from artificial intelligence:**

Public institutions, in collaboration with the private sector, must sensitively and objectively explain to citizens how the AI will affect their lives and work, such as possible job cuts in industry, doubts about the security of private data, and so on. Good public policy could mitigate the negative effects of AI without limiting positive results, for example in the labour market<sup>56</sup>.

### **3. Adapt education and training to the digital age:**

A close cooperation between teachers, entrepreneurs and legislators is essential in order to improve education and training in digital skills; therefore, it is necessary to concentrate on improving the quality of higher education in all accredited disciplines, as all specializations – i.e. the technical, social and arts – are equally necessary for the digital age<sup>57</sup>.

### **4. Regulate and improve data processing:**

The State needs to work to develop specific regulations that allow for the appropriate use of the aggregated anonymised data and, in particular, of the pseudonymised individual data, in response to the current cyber security concerns<sup>58</sup>.

### **5. Adapt the protection of rights and freedoms to the digital age:**

It is necessary to adapt the protection of our rights and freedoms in such a way as to prevent the potential abuse associated with the use of new technologies and AI. Current legislation aimed at protecting individuals is not yet in line with the logics introduced by these systems. In order to eliminate this gap, we need to create collective data-associated rights. At the same time, it is necessary to ensure that organizations that deploy and use these intelligent systems remain legally responsible for any damage caused thereby<sup>59</sup>.

---

<sup>55</sup>Cédric Villani, AI for Humanity: For a Meaningful Artificial Intelligence, [https://www.aiforhumanity.fr/pdfs/MissionVillani\\_Report\\_ENG-VF.pdf](https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf) (19.12.2018)

<sup>56</sup>BBVA, How to make artificial intelligence more ethical and transparent, <https://www.bbva.com/en/make-artificial-intelligence-ethical-transparent/> (8.8.2018)

<sup>57</sup>Ibid.

<sup>58</sup>World Economic Forum, Mitigating Risks in the Innovation Economy: How Emerging Technologies are Changing the Risk Landscape, September 2017, [http://www3.weforum.org/docs/WEF\\_Mitigating\\_Risks\\_Innovation\\_Economy\\_report\\_2017.pdf](http://www3.weforum.org/docs/WEF_Mitigating_Risks_Innovation_Economy_report_2017.pdf) (19.11.2018)

<sup>59</sup>Cédric Villani, AI for Humanity: For a Meaningful Artificial Intelligence, [https://www.aiforhumanity.fr/pdfs/MissionVillani\\_Report\\_ENG-VF.pdf](https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf) (19.12.2018)

### Steps towards the transparent and ethical use of artificial intelligence in the State

The State has to create conditions for a successful digital transformation to use AI and other digital age achievements to support our social values and legal principles. The State should focus on the following steps in the area of properly setting the procurement and use of intelligent systems:

- Modify and strengthen legislation to protect the rights and freedoms of the individual, as well as the rights in the use AI-based intelligent systems;
- Strengthen communication and cooperation between the public authorities and technology companies in order to better address any social and other digital transformation risks for citizens;
- Legislatively regulate legal liability, as well as the related insurance frameworks, of the technology and innovation companies for their innovation to work to eliminate them in the event of potential errors and risks so as to ensure credible use of AI and its responsible deployment;
- Improve education and training at higher education level;
- Simultaneously address and implement sufficient security mechanisms (especially in the area of unambiguous and AI system-unalterable initial constraints in relation to dealing with the related ethical dilemmas and conflicts, e.g. in dilemmas of protection of a natural person in the border situations, or in case of a technological component failure).

## 4.3 Method and Tools of Implementation

For the effective application of the described innovative technologies, it is necessary to fulfil the conditions of their functioning; therefore, it is necessary for the public administration to demonstrate the following necessary prerequisites.

### Principles of fulfilling this strategy

The basic principles underlying the achievement of tangible results under this strategy are as follows:

- Combine the long-term strategy and a conceptual approach with experimentation;
- Promote the capacity of enterprises and investment in research, development and infrastructure;
- Promote openness of products, methods, tools, and principles of free software access:

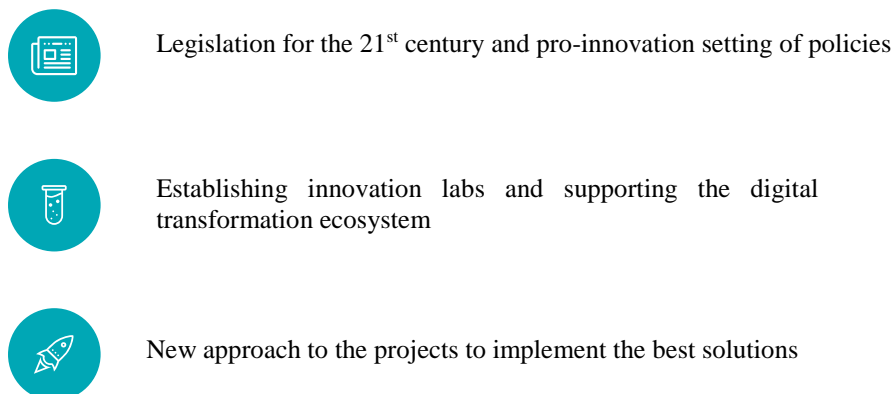
Open products, methods and tools (such as open hardware, open software, open APIs, open data, or the open learning resources) to be created are those that should be provided with a public license and that will use or apply appropriate open standards (such as data formats, communication protocols), if any. The principles of free access to software created (according to FSF5) enable launching a programme for any purpose, studying and editing the programme, and copying and improving the programme for the benefit the entire society.

### How to implement the strategy

The procedure will be based on three instruments (Figure 11) that the public administration can dispose of and that it will specifically use:

- **Concepts and Policies and Legislation:** Definition of concepts and drafting policies;
- **Organization – Innovative Laboratories:** Organizational measures that allow preparing for the implementation in practice, and experimentation, strengthening capacities and human resources, networking communities;
- **Projects:** Implement best practices through projects and initiatives.

## Way of strategy implementation



*Figure 11: The way of Strategy implementation*

### Concepts, policies and legislation for the 21<sup>st</sup> century

In order to support the significant digital transformation of the economy and society in Slovakia, it is necessary to combine conceptual thinking and a long-term vision with the implementation of experiments to be able to achieve the optimal innovation of public policies. Public policies are important as they allow the public sector energy to concentrate on the most important issues. An important way to implement this strategy will be to:

- Propose concepts for changing and transforming individual sectors. It is important that these concepts are based on a combination of the transfer of experience from the advanced economies, and the utilization of the most advanced scientific approaches;
- Edit policies to support the digital transformation of the sector/area (for example, using AI methods);
- Incorporate the use of experiments and the new methods of sector monitoring, in particular the use of big data methods, into the design of policy modernization.

Current legislation often does not count with the new technologies at all. An important way to modernize the economy and public administration is to set the legislative frameworks for the needs of the 21<sup>st</sup> century, whether by simplifying/removing obsolete rules, or by adopting completely new concepts, if effective (for example, in terms of the data use):

- When making proposals to problem solving, we prefer to **simplify and eliminate current the regulations** wherever possible. We see the Digital Single Market initiatives as an opportunity to adapt the regulatory frameworks to the digital age, and eliminate any unnecessary and duplicate rules. All new proposals must be carefully evaluated. In particular, we support pan-European solutions and electronic support for regulatory compliance. The new rules should thus result in the harmonization and reductions in unnecessary regulations at a national level, and the elimination of the “gold plating”<sup>60</sup>;
- Gradually, we will **introduce sector-specific dynamic regulations** to allow stakeholders experimenting and innovating the procedures to achieve the desired regulation objective. Thus, the dynamic regulation does not prescribe an exact way how to comply with it, allowing the business environment more freedom. It is particularly suitable for sectors, such as the digital and platform economy, which are developing very rapidly;
- The concept of **a control sandbox** is to be used to test a new type of regulation. There, the State will propose a controlled experiment, where businesses can operate in a new way legally, while public

<sup>60</sup>Gold-plating is a pejorative term that refers to the undesirable spread of the contents of EU directives in a way that brings a new regulatory burden without adequate benefits for the national legislation and competitiveness.

administration officials continuously evaluate results, consult with consumers and market participants, and gain knowledge for broader initiatives;

- Regulatory impact assessment and evaluation will be based on the use of the **big data analytical models**. The use of big data will be primarily a commercial matter. The use of this data will also be possible for the needs of the State and local governments, but on a commercial basis.

#### Innovative laboratories as a new way of public administration

The preferred way of achieving significant changes is to introduce the innovative laboratories for different sectors of public administration. The innovative laboratory will:

- Solve problems in a given sector;
- Propose changes to policies and recommendations in the sector (such as to adapt legislation);
- Suggest new concepts, pilot projects, and experiments;
- Conduct experiments (control sandboxes at a regulatory level);
- Monitor the effectiveness of regulatory regimes;
- Bring a “start-up” culture and style of work to the public sector institutions. Partnerships between the public, private and academic sectors will be established within innovation laboratories; these should form ecosystems (or be part of the ecosystem).

Innovative laboratories should be developed in all important areas, where we want to improve the public policy effects. It is a continuation of the Analytical Units concept in the public administration, which has already been largely developed. While analytical units are able to offer, in particular, an independent perspective, quality analytical materials, policy reviews and recommendations; the innovative laboratories will deliver results in experimenting and validating ideas that will then be ready for being implemented in practice. A concept of innovative laboratories has an important aspect in the provision of financing of the promising projects or capital for the interesting start-ups, or scale-ups, which can solve problems in a given sector.

#### Projects that create the necessary infrastructure and implement the digital transformation in practice

Thanks to the visionary designed operational programmes for the period of 2014 to 2020 (especially the *Integrated Infrastructure Operational Programme*, Priority Axis 7, or the *Effective Public Administration Operational Programme*, and the *Research and Innovation Operational Programme*), interesting projects can be implemented that can contribute to the objectives of the strategy. In principle, it is mainly about building a nationwide communication infrastructure and supporting the transformation of the public administration institutions so that they can fully exploit their potential and offer the quality and modern services to citizens and entrepreneurs in the 21<sup>st</sup> century. As part of the strategy, we suggest:

- Digital transformation projects of public administration;
- Projects of building the key elements of infrastructure, such as of the consolidated analytical layer of the State, or “my data” service;
- Research and innovation support projects.

However, this process will not be enough in view of the long-term competitiveness of our digital economy. Projects that will be selected from the best solutions within the EU need to be launched. Therefore, the strategic goal of Slovakia is to shift in the perception of projects and to reorient from grants to the pursuit of success in the directly managed EU programmes and community programs. Therefore, the capacities that will support the Slovak institutions, organizations and businesses to apply for such support will be strengthened. There will be pressure to implement the high-end solutions.

## 4.4 The Short Term Horizon of the Strategy of 2019–2022

Measures that can be implemented from 3Q 2019, with their implementation expected by 2Q 2022, are measures designed for the short-term horizon. Their funding is linked to the 2014-2020 programming period. Measures for the short-term horizon will become the basis for the ***Digital Transformation Action Plan of Slovakia for 2019-2022***, which will be directly related to the *Strategy for Digital Transformation*

of Slovakia by 2030. Within the short-term horizon, three **assumed priority areas** have been identified based on the initial situation of Slovakia and the global and European priorities (Figure 12); they will form the basis of the concrete measures of the *Digital Transformation Action Plan of Slovakia for 2019-2022*:

### Short-term horizon 2019-2022



Figure 12: Predicted short-term priority areas and their links to the priority areas of the digital transformation vision

- 1. We will support the digital transformation of schools and education to ensure their quality, improve the employment preconditions and acquire the skills needed for the digital age**

### Lifelong learning and competence for the digital economy

In the short-term horizon, preparation for digital education needs to be accelerated – by adapting the State and educational programs of schools, university degree programs, and courses especially focusing on the data science and programming for all levels of the education system. *Developing the Education Informatization Programme* with a prospect to 2030 and implementing the pilot projects will seek to improve the quality of teaching, digital transformation of schools and the education system, support for a change in education to enhance the teachers' professional competences and pupils' competences for the digital economy, introduce the lifelong (continuous) systematic teacher education, promote personalized learning, motivate pupils for learning, offer strong support for soft skills, stronger links between education and practice, and others. It is essential to support the retraining of the workforce, in particular that of the '45+ generation', for the digital economy, to put in place an effective system with a financial support scheme for lifelong learning and digital skills.

Digital competences should be encouraged from the lowest age, considering the use of progressive digital technologies in education, including AI, to increase the success of the learning process. In cooperation with the Digital Coalition, we will prepare the Analysis of the State of Digital Skills and Competences in Slovakia, proposing the concrete measures, and we will actively engage in a pan-European training and retraining programme for employees in the digital economy. The State will create the conditions and tools to protect its citizens, especially, but not only the most vulnerable ones (children, young people and the elderly), from the negative consequences associated with the improper and disproportionate deployment and use of digital technologies and deepening the generation gap in the use of digital technologies and



access to them. The lifelong learning system aims to introduce validation and recognition of the previous learning outcomes and to set up the accredited continuing education programmes for IT qualifications, and their description within the *National Qualifications System*.

In collaboration with the Digital Coalition, we will support the implementation of the national “IT Academy – Education for the 21<sup>st</sup> Century” project to educate the top ICT specialists, prepare the pilot projects for digital transformation of the education system and schools to identify and enhance the digital economy competencies, digitally transform the vocational education and training at all its levels of education, including the higher vocational education and post-secondary specialized education, with the option to offer a free choice of educational path by choosing the bachelor’s higher education degree, or by recognizing tertiary education completed with the possibility of a smooth transition to higher university study of the second degree.

The Ministry of Education, Science, Research and Sport of the Slovak Republic will, in cooperation with the Digital Coalition and with ITAS, support the preparation of new teachers, as well as continuous education of informatics, mathematics, STEM subjects, and other subjects in order to increase their competences for the digital economy. The Ministry of Education will also support the creation of cooperation programmes between schools under the Erasmus+/e-Twinning programmes and, in cooperation with the Digital Coalition, will draw up a proposal for drawing EU funds from the operational programme 2021-2027.

### **Modernizing and opening up the labour market**

---

It is important to adapt the rules of the labour market to the digital age: to allow meaningful and flexible social insurance for workers active in the platform economy and to assess the effects of the platform economy and work changes in the digital age on the labour law and its institutes in the context of the entities concerned. We also need greatly to simplify the possibility of attracting the best experts from abroad for innovative businesses, as well as the science and research institutions.

## **2. We will create the foundations for a modern digital and data economy and for the digital transformation of the wider economy**

### **Slovakia will become a dynamic data economy within the EU**

---

The legislative environment will be set up to allow the application of new platform- and AI-based business models in practice. There should be sufficient demand for innovative solutions within the economy in order to be able to maintain a sufficient market and generate innovations. Thus, Slovak companies will employ a growing number of data analysts. Innovation is expected to be exported within the Single Digital Market in Europe and beyond. We will consider introducing a systematic impact assessment of regulations on the innovation and the digital economy, including a legislative assessment of the impact of technology on the citizens’ rights and freedoms. We will streamline and simplify the data-associated legal framework in order to make Slovakia a model country for the follow-up regulation within the EU. We will set the rules for data processing and algorithms in a way so as the public can trust the data economy, whether thanks to the citizens supporting the management of personal data, or by creating a public data trust.

### **We will support the innovative capacity and implement artificial intelligence-based solutions**

---

We will improve collaboration options with academia in the applied AI and data-related research. We will greatly simplify the process to become able to depreciate the R&D investments. At the same time, we will support the new business models in the digital economy so that platforms disrupting the standard sectors, such as transport, finance and health could emerge in Slovakia. It means creating control sandboxes, introducing future-proof regulations, and redesigning the authorization procedures for the needs of the digital age.

### **We need important innovations to emerge directly in Slovakia**

---

We need to provide enough experts, quality teaching at the universities (the teaching quality management centres), and the transfer of innovation to practice. For this purpose, the *Slovak Centre for Artificial*



*Intelligence Research*, and the *Teaching Quality Management Centres* will be established, which will work closely with the top research centres abroad. This will be supported by the established National Innovation Lab and HUB for the teaching quality management. We need to provide enough experts, quality teaching at the universities and the transfer of innovation to practice. We will explore the possibilities of simplifying the process of acquiring the right of residence for top experts. We will launch activities under the *Coordinated Plan for Artificial Intelligence* (COM(2018)795 final)<sup>61</sup>, which will be followed by efforts in the long term.

---

### **We will create the conditions for smart mobility**

---

Slovakia is currently lagging behind in its commitments to the EU in building the communications networks and intelligent transport systems, and in supporting cross-border testing of the interconnected and autonomous vehicles. To catch up with this delay, the indispensable prerequisites include strengthening capacities, developing a strategy/action plan, adjusting the legislative environment, active participating in the transnational working groups, strengthened coordination of stakeholders and strengthening cooperation between the private, public and academic sectors. We are interested in being a country, where the new business models can be tested in transport. The goal is to launch the services based on the traffic data processing in Slovakia in order to provide the new platforms testing. We will design the transport policies and solve the traffic problems based on the data analyses and processing. Regulatory innovations that enable innovative companies to bring new solutions to smart mobility are important. Transport platforms need the high-quality data, especially the accurate mapping data. Building the smart mobility infrastructure should become part of the national research and development.

---

### **Innovation of the financial sector will be tested in Slovakia**

---

The Ministry of Finance of the Slovak Republic, through the Centre for Financial Innovations, performs the function of an innovation lab. In the near future, the innovative hub will be established at the National Bank of Slovakia, and a possibility of introducing the concept of a control sandbox of financial innovation will be explored. At the same time, the need for, and the most appropriate form of, crowd-funding regulation is being analysed. A system set up for the asset tokenisation is also expected to be a significant contribution to financial innovation. Significant strengthening of the capacities of the Financial Innovation Centre and the National Bank of Slovakia for these purposes could be a suitable tool for strengthening the process of introducing financial innovation.

---

### **Building a network communication infrastructure built on the NGA technologies**

---

Through the Broadband Competence Office competencies, we will strive to expand the Internet access in Slovakia without restrictions. In pursuit of delivering optical coverage, the State should support the construction projects in the areas with lower household densities (where optical coverage providers face the economic constraints), as well as in areas with effective regulation and investment-supportive legislative environments. Available broadband networks and high-speed connectivity are a prerequisite for ensuring the economic growth and building a modern society that would be ready to face the challenges of the 21<sup>st</sup> century. We want to start talking about broadband as the fourth utility. We will support the preparation for the deployment of the safe and high-speed 5G networks in order to ensure the balanced regulatory conditions, healthy competition and a favourable pro-investment environment. Likewise, support for IPv6 deployment will help improve connectivity for a large number of clients (public administration, businesses, homes) and a large number of IoT devices, helping to improve cyber security.

---

<sup>61</sup> European Commission, Coordinated Plan on Artificial Intelligence, <https://ec.europa.eu/digital-single-market/en/news/coordinated-plan-artificial-intelligence> (8.12.2018)

### 3. We will improve the capability of public administration to innovate and use data for the benefit of citizens

#### **We will launch the implementation of the “Data-Driven State” concept**

The intention requires a significant improvement in the use and processing of data for the analytical purposes by the public administration institutions, so that the public administration could provide quality services, and the State could take decisions based on the best available knowledge. As part of this process, we will ensure compliance with the relevant legislation and implement control mechanisms at a national level with a view to safeguarding the fundamental rights and freedoms of data subjects. Our institutions need to know how to actually use the data. It is also necessary to propose a transformation of the organization so that the real data-based decision-making could be made. Such a change in the functioning of public administration requires actions to be taken at all levels of public administration, which must follow the global trends in Smart Cities and make its data available for assessment on a fair and balanced basis. The change envisaged also needs political support and strong technical capabilities. The initiative is centrally coordinated by the Public Administration Data Office, which was established at ODPMII. Frameworks will be centrally designed, but real changes in the institutions can be implemented locally, so there will be room within the Integrated Infrastructure Operational Programme for implementing the transformation projects supported by technology, such as AI or block chain. In this endeavour, it will then be possible to continue implementing the DEP projects.

#### **The public will learn to innovate**

The key is to create a roof strategy for research, development and use of artificial intelligence to support the creation of an overall ecosystem for deploying solutions built on the credible AI<sup>62</sup> and digital technology in the public administration and society. On this basis, the detailed concept of AI shall be elaborated in the conditions of the Slovak Republic until the end of 2019. In its framework, each department of public administration shall define its priorities and departmental measures. This will ensure that the enormous potential of artificial intelligence is used to drive the digital transformation of Slovakia, while minimizing any risk aspects associated with this technology. The time needed to implement innovations in practice will be significantly reduced. It will be common in the public administration to test pilot solutions and apply the innovative procurement methods. Efforts should be made to reduce the innovation cycle of IT solutions and subsequently adapt the rules in the public administration. Experimenting, organizing tenders and involving the small and medium-sized enterprises will become an essential standard for the functioning of the public administration institutions. We will therefore reform the partnership principles with the academic and private sectors. Adjustments to the procurement processes and the introduction of higher transparency principles will be proposed, and a focus will be laid on the result orientation. We expect significant support for experimenting with technology in the public administration (of course, while ensuring stringent security conditions) and the overall change of culture towards the start-up thinking or putting the “e-Government as a platform” concept into practice, which means that the public service innovations could also be made by the third parties, the private sector or non-profit organizations in an interesting way.

#### **Basic framework for the short-term horizon – Establishing an institutional background to support Slovakia’s performance in innovation**

Given its competences, ODPMII is the main guarantor of recommendations for the qualitative and effective measures set out in the priority areas from the short term. However, to implement them, it is necessary to create the appropriate institutional background that would become a foundation of an innovative ecosystem that, in addition to public institutions, will be composed of the academic, private and civic platforms and entities. This is based on the priority recommendations and, in some cases, on the commitments under the European policies or directly the Member States’ agreements. An example of a beneficial initiative is the establishment of the **Slovak National Coalition for Digital Skills and Professions**, which successfully fulfils its objective in terms of improving the digital skills of citizens, IT specialists, and all employees, and in education by mobilizing the relevant public, private, academic and civic organizations and institutions.

<sup>62</sup> Draft Ethics guidelines for trustworthy AI <https://ec.europa.eu/digital-single-market/en/news/draft-ethics-guidelines-trustworthy-ai> (18.10.2018)

Another example of the implementation of priority tasks in this planning period can be a project of a centre (HUB, Lab) to be founded for the teaching quality management in schools in the country.

Slovakia is one of the last four EU Member States that does not operate the **digital innovation hubs (DIHs)** network. Hubs act as “one-stop shops”, as part of which businesses, especially the small and medium-sized entrepreneurs, but also the public sector entities, gain access to the use of AI, HPC and other digital technologies in order to improve their functioning and competitiveness in the digital age. It is therefore necessary to establish a network of DIHs in Slovakia.

The rapid evolution of AI usage is associated with many benefits for the society, economy, life and health of the individual and, last but not least, for better public policy making. At the same time, the use of AI-based systems opens up many questions that the today’s society does not have the exact answers for. These are, for example, the socio-economic impacts, legal, societal and ethical issues, issues of responsibility for the disproportionate and irresponsible deployment and use of the AI-based systems, identification of the appropriate requirements for the research, development and creation of the AI-based credential systems, issues for verifying the recommendations and decisions of those systems, as well as the issue of damage caused by the use of this technology. In order to comprehensively and responsibly assess the AI benefits/risks, and set up the conditions for its application in the society and in the public administration, ODPMII will establish and coordinate the work of the **Interdepartmental Working Group on the Development and Implementation of Artificial Intelligence**. This cross-departmental working group, wider composed of representatives from the private, academic and civic sectors, including from the professional and development community, will continuously monitor, assess and evaluate the impacts of research, development and deployment of this technology in order to maximize its benefits and minimize any risks associated therewith. Based on the results of the above-mentioned working group, the government will consider creating similar mechanisms for monitoring and identifying the key issues of research, development and deployment of other innovative technologies.

For the purpose of supporting basic research and its linking to the applications, the establishment of the **Slovak Centre for Artificial Intelligence Research**, which will interconnect the interests of the business, academic and state spheres and, at the same time, cooperate with the foreign research centres, will be supported. Given the potential of the block chain technology and its ever increasing use by the public administrations abroad, it may be appropriate to consider also a stronger support for testing/monitoring and, where appropriate, progressive deployment of this technology.

Support in a form of high-capacity hardware security is essential to take full advantage of innovative technologies. The establishment of the **National Competence Centre for High-Performance Computing (HPC)** would provide access to expertise, sharing best practices, and expanding the use of computing time, especially towards the industry and public administration. Local users could benefit from programming by optimizing programmes and receiving general advice on the use of HPC. In addition, a significant room for its partial funding from the directly managed EU programmes, as well as from the European Structural and Investment Funds, would be created. In addition, the establishment of the National Competence Centre for HPC has a legislative support by the EU.

Last but not least, it is necessary to pay attention to **cyber security**. Every institution and every citizen can be subject to cyber-attack. Building cyber security is needed at four levels – the institutional, legislative-strategic, operational-technical and personal. It is therefore essential to strengthen a functioning model of cyber security cooperation between the relevant public administration authorities. In addition, building public awareness of cyber security, as well as targeted support for other activities in this area, including science and research, standardization, building professional capacities and education, and coordination with other centres in the EU and the world, are very topical. Intensive international cooperation, sharing best practice examples, as well as cyber diplomacy are equally essential. We therefore propose establishing the **National Cyber Security Competence Centre**, which will also be an appropriate response to the legislative framework for the *pan-European Competence Centres* (Regulation of the European Parliament and of the Council establishing the European Cybersecurity Industrial, Technology and Research Competence Centre and the Network of National Coordination Centres – COM(2018)630 final).

The precise specification of measures for the short-term horizon will be contained in the document “**Action Plan for Digital Transformation of Slovakia for 2019-2022**”.

## 4.5 The Long-Term Horizon of the Strategy for 2022–2030

The anticipated priority areas of actions for the long-term horizon of the strategy cover all the selected sectors of digital transformation in Slovakia – Economy; Society; Public Administration; Territorial Development; Science, Research and Innovation – thus comprehensively covering the digital transformation of the most important components of the country (Figure 13). The implementation of the long-term horizon is expected from 3Q 2022 to 4Q 2030, i.e. after the implementation of the *Action Plan for Digital Transformation of Slovakia for 2019-2022*, which will include a short-term horizon, is finished. In 2022 at the latest, a review and countdown of the implementation of the *Action Plan for Digital Transformation of Slovakia for 2019-2022* will take place. It is precisely on the basis of this Action Plan, as well as upon the global direction and priorities of the EU, that the *Action Plan for Digital Transformation of Slovakia for 2022-2030* will be identified; eventually this period will be divided into more action plans.

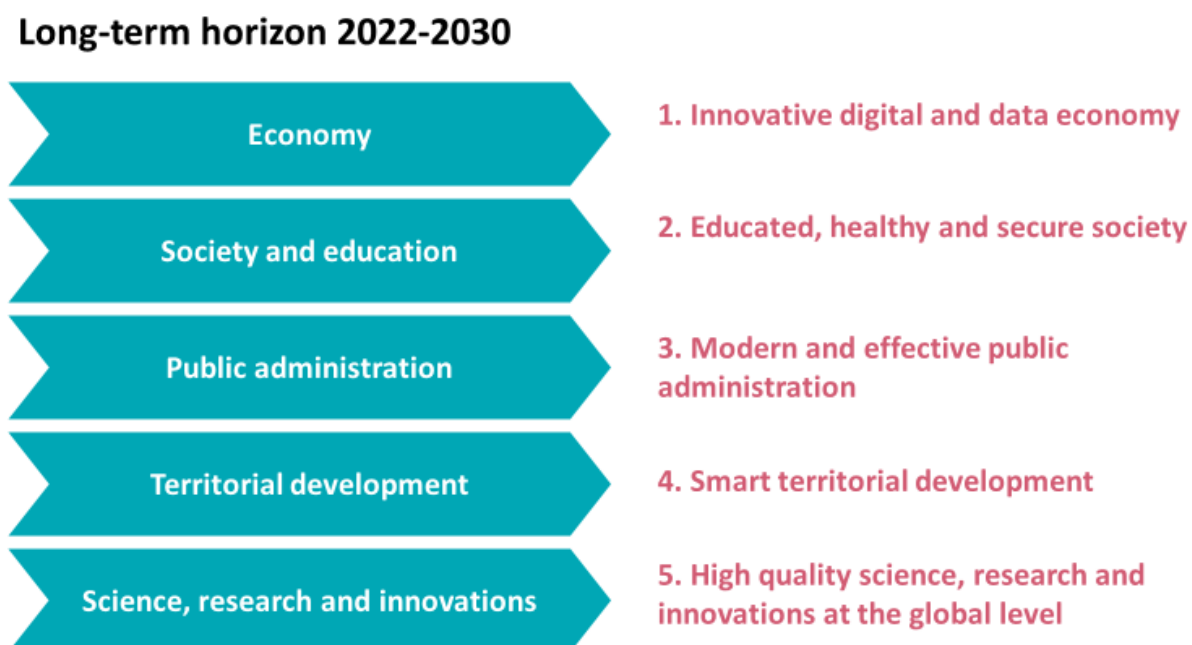


Figure 13: Predicted long-term priority areas and their links to the priority areas of the digital transformation vision

Thus, the following sub-chapter only provides the **indicative recommendations for the long-term horizon, i.e. a proposal for five priority target areas that Slovakia could and should achieve by 2030. Based on Slovakia’s initial situation, we have identified the general long-term sub-priorities for each area to achieve the five objectives as indicated above.**

It is important to note that these are the anticipated priorities given the current initial situation, needs, commitments and objectives, and these long-term priorities can be changed and adapted in view of the success and results of the implementation of the *Action Plan for Digital Transformation of Slovakia for 2019-2022*. Similarly, the success of *Digital Transformation Strategy of Slovakia* and its related Action Plan/s will largely depend on the effective international cooperation and sharing best practice examples. These areas are:

- **Innovative digital and data economy**
- **An educated, healthy and safe society**
- **Modern and efficient public administration**
- **Smart territorial development**
- **Quality science, research and world-class innovation.**

**Thus, the strategy defines the “digital pillar” of the upcoming Vision and Strategy for Slovakia’s development by 2030.** All segments of the economy and society will gradually be transformed digitally, with an active support of the public administration and through the use of tools that will be tested between 2019 and 2022.

## **1. Innovative Digital and Data Economy**

---

Sector: Economy

Subsectors: Industry, Economy and Financial Sector, Enterprise, Infrastructure, Electronic Communications, Transport and Agriculture.

I. Long-term priority:

### **Transforming traditional industries into the smart, innovative, digital industry**

---

Digital transformation and a move towards an innovation and technology-oriented industry have enormous potential to become a true engine of the economic growth in Slovakia. The Slovak economy needs to re-orient from the classical industrial production to the digital level of the economy. The standard breakdown of the economy to industries is gradually diminishing, while its interdisciplinary and intra-industrial character is intensifying. The aim will be to exploit the technological potential and to increase the private and public investments into the progressive technologies, such as AI, IoT, 5G, HPC, big data, block chain, green power, and so on. To achieve this priority, Slovakia needs to take the following steps in the first place:

- Create opportunities for the first implementations of the above technologies and promote the benefits of their use;
- Support online platforms and disruptive models for traditional sectors (transport, health, banking and financial services, logistics, energy, etc.);
- Engage in the pan-European tests and pilot projects and promote their scalability (such as the ongoing extensive testing of interconnected and autonomous mobility, and similar approaches will be developed in other sectors);
- Prepare implementation of 5G technology and autonomous transport.

II. Long-term priority:

### **Building a modern, robust, functional and secure communication infrastructure**

---

Building a gigabit optical infrastructure is the foundation for the mobile and fixed networks of new generations; it is a prerequisite for the economic development as it allows permanent interconnection of, communication between, and effective management and supervision of all systems. The cutting-edge communication infrastructure is also a prerequisite for the development of modern services for a citizen and entrepreneur, and for the advent or emergence of digital firms and innovation companies. It is essential to support the construction and sharing of infrastructures and their protection in order to achieve the cutting-edge infrastructure as follows:

- Set up policies and regulatory approaches to help create the conditions for accelerating investments to fibre optics and ensure coverage across Slovakia;
- Support the conditions for an effective cooperation of the market actors in the construction of optical networks by aiming at effective cooperation and use of resources in favour of uncovered areas;
- Ensure the capability of real coverage monitoring and the use of the up-to-date digital technologies for process control;
- Implement the state interventions and the use of state resources to introduce a communication infrastructure into the commercially uninteresting areas, while considering the appropriate level of investment in relation to the required transmission capacity in these locations;
- Ensure the continued development of 5G networks by maintaining proportionality for the return on investment in 5G networks, with the balanced regulatory conditions and preservation of competition and state aid principles.

### III. Long-term priority:

#### **Building a functioning data economy for the better data use**

---

Data poses an enormous potential, as we can significantly improve the productivity and overall economic performance of the country, as well as its individual sectors, through their collection, quality analysis, trustworthy management and systematic assessment. To build a data economy, Slovakia needs to take the following steps in the first place:

- Create a comprehensive ecosystem of partners from the private, public and academic sectors that can design services and deliver real applications;
- Ensure sufficient amount of credible data for AI-related R&D needs;
- Ensure a free flow of non-personal data, making it easier for businesses to develop the new innovative services and facilitate cross-border online purchases and sales for people and businesses.

### IV. Long-term priority:

#### **Creating an ecosystem of Slovak Digital Innovation Hubs (DIHs) and building a unique innovative hub in Bratislava**

---

Slovakia needs to be involved in the initiative of the European Digital Innovation Hubs and to create its own DIH ecosystem, following the pattern of other EU Member States. To achieve this goal, it is necessary to:

- Create an ecosystem of partners from the private, public and academic sectors and start establishing the first hubs;
- Engage in a close cooperation with the international digital innovation hubs;
- Create a unique innovation hub from Bratislava – Slovakia needs to work on interconnecting the infrastructure within the V4 area and use the capital's perspective as an innovative hub for start-ups and innovators in the region. Bratislava has several unique advantages that make it an important hub for Central European space, i.e.:
  - Unique geographic location of the city: the capital of the country has a unique location as it is geographically very close to metropolises, such as Vienna (70 km), Budapest (200 km) or Prague (330 km). No other V4 country has the same potential. It is the connection of the Central European capitals that represents a huge investment attraction;
  - Size and appearance of the city: many entrepreneurs and innovators from abroad, who operate in Bratislava, have confirmed that Bratislava's small size of the city (compared to other European capitals) and its distinctive character and potential, as well as craftsmanship of the people living in the city, satisfy their business needs;
  - An evolving community of digital developers and creative persons: innovation is a major long-term driver of economic growth, and Slovakia needs to take advantage of the extraordinary companies and start-ups in Slovakia, as well as to attract foreign entities and encourage the emergence of others.

## V. Long-term priority:

**Preparing and implementing a new legislative and regulatory policy to create an innovative business ecosystem**

---

In order for the State to improve and simplify the rules for entrepreneurship and to adapt business-doing in Slovakia to the digital age, it is necessary to develop the following activities:

- Simplify, speed up and relax regulations to be able to innovate and experiment;
- Prepare the modern tools for the development of the digital industry and streamline the assignments of the planning processes for action plans, strategies and reforms so that a wide range of people from the non-State sectors from Slovakia and abroad, i.e. from the external consultants and experts to entrepreneurs and innovators, get involved in the digital economy development processes;
- Encourage the emergence of the innovative public policy laboratories linked to the investment capital funds;
- Develop the rules for a truly unified digital market that will allow entrepreneurs to do cross-border business and scale their digital business;
- Amend Act No. 311/2001 Coll., the Labour Code, as amended (hereinafter referred to as the “Labour Code”) for the needs of the collaborative economy, i.e. to simplify the employment rules for entrepreneurs operating in several EU countries in the digital economy, as well as the rules of taxation and regulatory compliance for a faster expansion of Slovak businesses to other EU countries.

## VI. Long-term priority:

**Improving public policies in terms of transport, innovative transport capacity and fostering partnership for smart mobility**

---

The potential of Slovakia as an automotive power in Europe must be exploited for the needs of building smart mobility in Slovakia by the following activities:

- Propose mainstreaming of transport policies in the digital age and create legislation and an overall ecosystem to support innovation and modern trends in transport;
- Establish a functional ecosystem for smart transport, including research and development;
- Encourage the production of autonomous vehicles in automotive companies based in the country;
- Support 5G boot.

## VII. Long-term priority:

**Applying the sustainable use of land through precision farming technology and by analyzing big data from sensors**

---

Technologies, such as humidity and temperature sensors, weather stations, soil moisture sensors, sensors for early disease and pest prediction, and linking them to the mobile applications and Internet systems, make the work of landowners easier and better. Precision farming is based on the principle of producing more efficiently, more environmentally friendly and for less money, thus optimizing inputs according to the current crop needs. This approach will bring the new productions, services, as well as jobs in the sector, and will contribute substantially to building modern agriculture; therefore, it is important to take the following steps:

- Make full use of the data-based technologies, robotization, remote sensing, use of satellite precise localization images, and sensor data analysis in order to set the most appropriate processes;
- Create partnerships between the public, private and scientific sectors to bring new innovations to agriculture and apply them effectively and efficiently.

**2. An Educated, Healthy and Secure Society**

---

Sector: Company

Subsectors: Education and Training, Civil Society, Health, Social Policy, Cyber Security, Foreign Relations, Media and Information.



## I. Long-term priority:

**Implementation of a comprehensive systemic change of education for the labour market requirements in the digital age and the conditions of building an information society**

---

The development of society at the beginning of the 21<sup>st</sup> century has a turning point and requires radical changes not only in the organization and financing of education, but also in its content, methods and quality. Slovakia needs a new legislative framework for education, implying an immediate transition to the information society platform. The current model of study based on the push system consists in the mass education. The new model is the pull system-based. The philosophy of education lies in the interactive activity of students in a virtual reality environment – in the digital world with direct active connection to practice, the transition from the intuition-dominated work to the science-based work. ICT must become an integral part of the education of all subjects, whether to a greater or lesser extent. The success of a trained job seeker in the 21<sup>st</sup> century labour market under the new conditions will mainly depend on these assumptions, which are:

- Knowledge (as a result of acquiring knowledge related to the work or study);
- Skills (cognitive and manual – the ability to apply knowledge in accomplishing tasks and solving problems);
- In addition to the professional, also the key competencies (communication, mathematical thinking and the fundamentals of science and technology, information, problem solving, learning, social and personal, working and business, civic and cultural).

If we want to ensure the quality of education provided in Slovakia and to improve the quality of teaching, it is not enough to introduce the modern innovation subjects (including informatics) into the study programs of schools but it is, in particular, necessary to re-train the university teachers in acquiring quality competences through the quality teaching management system courses. Teachers well and properly trained can help students develop their competences needed in the global labour market that are based on the increasingly high levels of competence.

The following steps appear to be necessary:

- Analysis and implementation of best learning outcomes abroad;
- Orient educational programmes to develop the skills and competences to better address the new demands of the labour market and the challenges of the digital age;
- Prefer procedures that will improve a critical thinking capacity and practical digital skills that support the analytical skills in data interaction;
- Create a school curriculum on the principle of “Sustainable design based on needs” → best tested practice procedure → implementation”;
- Create the conditions for better linking of the education system, research and development with practice in IT sector;
- Systematically improve the material and technical equipment of schools; create modern school classrooms and improve the knowledge equipment of pedagogical staff, which corresponds to the current development and needs of the society;
- Create better conditions for motivating, educating and preparing the high-quality STEM teachers;
- Develop, in cooperation with the State Educational Institute, normatives for teaching informatics and informational education at all levels of the education al system;
- Emphasize the role of teaching as a decisive factor in the quality system of a school for the information society, and provide teachers in all types of schools with a standard of living and a social status comparable to that of a teacher in the advanced western countries, which in turn will make it possible to gradually increase the demanding criteria for pedagogy study, and the performance of the teaching profession;
- Use the AI and other technologies for personalized learning that will respect the needs and potential of each pupil and student;
- Establish a more flexible innovation system of the study programmes to make the higher education study more effective, while promoting the cross-cutting and cross-industry programmes to the detriment of a narrow industrial orientation, thereby increasing graduate’s flexibility in the labour market;

- Preparedness of graduates must not only be at a high professional level, but must also be of a universal nature, as the industrial jobs will be diminishing in the coming years due to the restructuring of the industry, and job opportunities will move to the innovative industry, the IT sector, services, as well as science and applied research. It is also possible to expect an increase in job instability in the future, and one will have to be flexible and change several jobs and/or industries in his or her active life;
- Monitoring the labour market needs through the sector councils within the national Sector-Driven Innovation project;
- Quantification of the future labour market needs through the national *Development Prognosis in the Slovak Republic II* project.

## II. Long-term priority:

### **Develop a system for providing training, courses, lifelong and formal education, retraining and other forms of special training to improve advanced digital skills**

---

Building a system for enhancing the level of advanced digital skills is key in ensuring the skills that are needed to design, develop, manage, deploy and maintain technologies, and for overall management of the digital transformation of sectors. Therefore, it is important to:

- Prepare a draft digital skills prediction for Slovakia as a basis for the development of the lifelong learning programmes, e.g. also on the basis of the relevant information from the national *Labour Market Forecasting in the Slovak Republic II* project, and the national *Sector-Driven Innovation* project;
- Prepare a call for the demand-driven projects to develop and implement the long-term specialized lifelong learning courses in the advanced digital skills according to DEP;
- Support the existing digital literacy-improving projects, increase women's share in IT, facilitate collaboration between the academic, private and public sectors, and/or representation of the digital industry as a whole;
- Prepare a support system for the civil society organizations that will assist in the education and use of ICT, the development of critical thinking and analytic skills, and perform the task of permanent supervision of the personal data management.

## III. Long-term priority:

### **Supporting the search, acquisition and development of the domestic and foreign talents for the private and public sectors**

---

- Make the conditions of education and employment of talented people more attractive in the public and private sectors, and create a motivation programme for their development;
- Slovakia has to work to build its attractiveness from three perspectives: firstly, to make the country attractive enough for Slovaks not to leave it for study and/or work abroad; secondly, to inspire Slovaks abroad to return home; and thirdly, to ensure the country attracts talent from other countries;
- Develop a strategy for promoting, developing and attracting talents.

## IV. Long-term priority:

### **Promoting the introduction of innovations in the health sector**

---

- Reorient the healthcare system so that, in addition to providing healthcare, it also focuses on the protection and promotion of well-being;
- Establish a comprehensive health impact assessment and digitize the public health with the data science methods;
- Introduce the digital healthcare and personal assistants to promote healthy lifestyles, diagnostics, chronic disease management, and the like; Create a framework for a personalized mobile medicine (app-market) and equip each patient with a personal assistant by data use and further development of the *National Health Information System* (national eHealth);

- Encourage the deployment of digital innovations in clinical processes;
- Further develop the health record sharing system – especially in the field of image information from examinations.

#### V. Long-term priority:

##### **Building a new social policy in the digital age**

---

It is essential that technological progress is also used to reduce social inequalities in the society and to improve the lives of the socially disadvantaged segments of the population. The digital age cannot only affect the elites and the richest segments of the population, but must be accessible to the widest possible range of society. It is therefore necessary to develop the following activities:

- Adapt the conditions and rules of employment and wages to the demands of the digital age;
- By means of the social measures of the State, allow access to technologies for the disadvantaged people and to the socially most deprived segments of society;
- Implement the principles of the European Social Model into Slovak legislation;

#### VI. Long-term priority:

##### **Enhancing cyber security**

---

Cyber security is one of the basic assumptions of a functioning digital society. To do this, we need to develop the following activities:

- Complete the implementation of the national concept of cyber security in Slovakia, thoroughly implement the *National Cyber Security Act* as well as the pan-European legislation and the cyber-affairs-related strategies, including cyber security, cyber defence, and the fight against cybercrime;
- Strengthen the national cyber security ecosystem in order to maximize the resilience of public administration and industry information systems, as well as of data of citizens stored in them, against the potential attacks and abuses;
- Identify security deficiencies in networks and information systems to define and actively manage security risks;
- Conceptually and systematically set up and address the education/training issues, and building awareness in cyber security at all levels, including through the use of innovative learning methods;
- Strengthen the effective international cooperation, share the best practices and activities related to cyber issues and especially cyber diplomacy;
- Open a social debate on the State's approach to the ethical hackers, who will alert, in a controlled and transparent manner, to the security flaws in the securing of the public administration information systems or in other critical information infrastructure, since the functioning of critical infrastructure elements is directly dependent on the critical information infrastructure (energy, transport, telecommunications, industry, health, water, and postal service), and the disruption or destruction of which would negatively affect the implementation of the economic and social function of the State and the life and health of the population;
- Encourage the creation of a community for the effective interconnection of the state administration and the private sector in the field of information exchange and cooperation on cyber security;
- Promote security with the predictive police tools, and significantly improve the work of security forces with the information, data analysis, and AI tools.

#### VII. Long-term priority:

##### **Create an effective system to combat misinformation**

---

Any deliberate, systematic and widespread dissemination of disinformation is one of the most serious and acute challenges for European democracies and societies. Disinformation undermines citizens' confidence in democracy and democratic institutions, as well as the values of humanism and universal human rights. Disinformation also contributes to the vast polarization of public opinion and interferes in the democratic decision-making processes, especially in the electoral campaigns, and in the elections themselves. New

mechanisms need to be built to eliminate this dangerous phenomenon, which require coordinated efforts by all EU Member States. Following this, it is inevitable to:

- Establish a mechanism to strengthen the activities to raise awareness of the entire society of the negative impact of disinformation and false news, increase the media literacy, as well as to support independent media and quality journalism;
- The State must strengthen its own resources and capacity to combat misinformation, and must work with experts from the public, private and civil sectors at the national and international levels to detect, analyze and publish disinformation campaigns, by creating multidisciplinary teams consisting of the independent information verifiers and researchers, who will be reveal disinformation campaigns on the social networks;
- State institutions also need to support the work of independent media, fact verifiers and investigative journalists through the creation of multidisciplinary teams;
- The State has to support the citizens' engagement in eliminating hate speeches on the Internet – citizens as co-creators of content on the Internet have the possibility to report illegal content or hate speeches on the Internet. It is necessary to use the AI developed for Slovak conditions to combat online hate speech;
- The State must designate a competent coordinator of issues that will coordinate it interdepartmentally and socially.

VIII. Long-term priority:

#### **Disseminate awareness of the responsible use of digital technologies**

---

Lead the citizens, especially the pre-school and school children, to use digital technologies responsibly to prevent dependence on digital technologies and the consequent potential health complications, such as attention deficit disorders, sleep disorders, depression to various mental illnesses. It is therefore important to:

- Create tools and conditions to protect all groups of the population from the negative impacts of the misuse of ICT and against deepening the generation gap in the use of digital technology;

### **3. Modern and Efficient Public Administration**

---

Sector: Public Administration

Subsectors: All public administration entities

I. Long-term priority:

#### **Modernizing the functioning of the State sector – digital transformation of public administration**

---

- The electronic world will stop copying the paper one; the legislation, methodologies and workflows will change to allow for the optimal use of the modern technology options; the act No. 71/1967 Coll. on Administrative Proceedings (Administrative Order), as amended, Act No. 395/2002 Coll. on Archives and Registries, and on amendments to certain acts, as amended, and other key legal regulations will change;
- Modern ICT tools will be deployed both, in the field of operational exercise of public authority, and in the strategic management, from the analyses and predictions to practical planning;
- Data will be shared between authorities and everything possible will be automated, including the case analyses, the use of supportive analytical tools for better operational decision-making (for example, the use of self-learning systems for risk analysis and prediction of future events, or the analyses of social networks to grasp causalities); in principle, it is about the extension of the knowledge base of officials;
- Units, the operation of which is closely related or overlapping, will be abolished or merged with the aim of streamlining and making the State apparatus more efficient;

- Leaner and more efficient offices will release the labour capacity to the commercial sector; at the same time, by employing people in productive sectors, the State's revenues in the social and pension security will increase;
- Changes will lead to increasing the attractiveness of work for public administration; changes will also include the introduction of domestic work, part-time work, videoconference communication and other practices common in the commercial world;
- The State will protect its critical infrastructure and ensure its full accessibility for both citizens and entrepreneurs;
- The State will protect its citizens and businesses from the misuse of the data it records from them, and will keep its information systems permanently in top condition;
- The State will act responsibly and transparently in building, restoring and operating the information systems; procurement of the new and renewal of old information systems will allow quality competition while respecting economic criteria;
- The environment will open up for outsourcing services, including the end-to-end processes, which will lead to savings on public spending in particular cases, as well as to the professionalization of services;
- Like workers in other sectors, public administration staff will continue to educate themselves in order to make their work in the digital age more effective, and to improve services for citizens.

## II. Long-term priority:

### **Improving digital services for citizens in Slovakia**

---

- There will be a shift from the concept of providing digital services to the virtual personal assistants based on data processing and proactive handling of the citizens' life situations;
- A citizen and entrepreneur will have a wider range of access channels available, from the standard office visits through the social networks to video boards; access channels will flexibly take into account the recipient's preferences and his/her life situations;
- A citizen preferring personal contact with the authorities will handle his/her need at one counter;
- Thanks to new technologies and services, citizens will be able to manage all the data (except for specific regulations, such as the Criminal Code, the Criminal Register Act, etc., which cannot be directly reached or accessed by the citizen), which the public administration records, and use it for the third party services. They will gain new opportunities for a comfortable and secure online identity;
- Entrepreneurs will have one virtual point available for all routine interactions with the State, where company information can be integrated without the need to modify reporting for different institutions and uses;
- Simplified procedures for by-proxy negotiations will allow delegating the tasks to intermediary firms and agents with a strong technological background for other progressive business models.

## III. Long-term priority:

### **Public administration will proactively support the current trends and company transformation**

---

- The State will establish a mechanism for flexibly translating innovations and new knowledge into legislation on opportunities, as well as threats;
- The state will continually optimize its governance model, including in the area of strategic management, based on the inter-departmental drafting and implementation of reforms;
- The current reform for better policy/regulation drafting will be further pursued in order to improve the lives of citizens and businesses and increase the country's competitiveness on the basis of quality data and credible predictions;
- The system for obtaining the euro-fund support from the State will be simplified and more transparent; routine administrative tasks, such as checking the facts and providing the documents, will be automated; the purpose of the subsidy and the ability to implement the project will become decisive;
- The State will provide the truthful and comprehensive information to the extent, in which its functioning is not yet threatened, and personal and business rights are not misused;

- The State will warn citizens and businesses of the false information, false messages and hoaxes that could disorient them in serious and daily decisions; the State will extend its action to actively prosecute creators and propagators of such reports;
- The State will ensure that its information and communication systems meet environmental standards.

#### 4. Smart Territory Development

---

Sector: Territorial Development

Subsectors: Municipalities, Cities and Regions; Environment and Landscape

I. Long-term priority:

##### **Modernizing the process of developing the strategic and territorial planning and managing self-governments**

---

- Create a modern system of strategic and spatial planning of regions, cities and municipalities using the modern tools and digital technologies;
- Establish jointly shared corridors in the territory to ensure infrastructure construction efficiency;
- Establish a system of participatory decision-making and online democracy at local level;
- Improve the communication and intensify cooperation between the state, civil, academic and private sectors through the regular thematic meetings and communication on the online thematic boards;
- Create the national projects and promote international initiatives to create smart regions, cities and municipalities – Smart City.

II. Long-term priority:

##### **Implementing an environmental policy**

---

Protecting the environment and combating climate changes are one of the absolute global priorities. Slovakia must commit itself to respect and implement in practice all regulations from the international climate treaties. Likewise, the State must be more respectful of its environment and pay maximum attention to its protection and care.

#### 5. Quality Science, Research and World-Class Innovation

---

Sector: Science, Research and Innovation

Subsectors: All Scientific and Research Entities; Innovators.

I. Long-term priority:

##### **Building an excellent world-class science and research environment to address the company's key needs with a direct link to the application in practice**

---

- Formulating a long-term State science and research policy that will provide the best research teams with the motivation-oriented support for free research in order to support the transformation of science and research in the digital age;
- Developing a human capital in research, development and innovation – supporting the return of Slovak scientists; motivating researchers from abroad to come to Slovakia; preventing the outflow of scientists abroad, and increasing the motivation of young people to engage in science and research;
- Development and operation of the specialized ICT infrastructure for the research and development needs; the information support for research and development; implementation of policies and tools for open access to scientific information and data (Open Access);
- More efficient use of the current science parks and research centres, as well as support for the construction of the new research and technology parks at the selected universities – the existing instrumentation and staffing capacities need to be used to promote excellence in research, and to



develop cooperation with the business sector, as well as to create conditions for the technology and development companies to support their close collaboration with universities and their technological infrastructure and research resources (take over the model that is being already applied by the most successful universities in the world);

- Support research in new technologies and AI.

## II. Long-term priority:

### **Linking the academic, public and private sectors for science and research**

---

- Create a transparent incentive system to support the implementation of research and development by companies in the Slovak Republic in order to increase the share of private capital in research and development financing;
- Create conditions for the effective cooperation of the public and private sectors, as well as cooperation of the public academic sector and the private sector in the field of applied research and development focused on the sustainable effective use of the natural and human resources in the regions of Slovakia;
- Develop and modernize the research infrastructure in the public and private sectors and promote the use of the public research infrastructure (university science parks and research centres) for private sector needs.

## III. Long-term priority:

### **Significant involvement of Slovak science and research in the international environment**

---

- Restructuring of an over-sized network of higher education institutions based on the quality of education, the quality of research and the needs of society, and the introduction of an objective assessment of the quality of education and research at the higher education institutions in relation to international standards;
- Increase the number of the State grants to support the scientific and research mobility towards Slovakia, and facilitating the employment of foreign experts in Slovakia;
- Organize the quality practical training that increases the chances of the Slovak scientists to succeed in applying for the international grants and EU projects, as well as global grants and projects;
- Creation of a system of cooperation between the Slovak research and development workplaces of the public sector and companies in the top international innovation-oriented research, including the active involvement of innovative diplomats in the key countries for the transfer of know-how and the innovation market;
- Involvement of the Slovak institutions in the large pan-European research infrastructure projects and support for the development of the international research and development cooperation.

# Conclusion

*2013 Digital Transformation Strategy of Slovakia* is a government strategy for the years 2019 to 2030 that needs to be seen as a key and decisive material for Slovakia at the beginning of the 21<sup>st</sup> century, when an inevitable transformation of the industrial society to the information one takes place. The strategy represents a means for Slovakia to succeed in the digital transformation as brought not only by integration into the European digital single market, but also by the digital age in broader understanding. The document provides a beyond-departmental strategy to accelerate the digital transformation measures that have been already launched, define the new measures resulting from global digital trends and the European Union's priority policies, and transform them into a unique vision of Slovakia's digital transformation.

The complexity and severity of this issue requires a thoughtful view of the system to address it. This is reflected by the logical structure of the Strategy. Three assumptions were made – the resources for the digital transformation of society – i.e. human capital, infrastructure and regulatory framework. At the same time, five priority areas have been defined in the State, in which the individual transformation priorities are to be directed between 2019 and 2030, i.e. Economy, Society and Education, Public Administration, Territorial Development, and Science, Research and Innovation.

Consequently, the assumed or expected priority areas are derived from this vision; they are divided into two time horizons in terms of the current status of preparation and difficulty, i.e. to the short and long term time horizons. From our point of view, however, it is necessary to understand the process of digital transformation of Slovakia even in a wider context, as part of the wider process of building the 21<sup>st</sup> century information society in the context of respecting digital humanism.

If Slovakia wants to fully benefit from the digital transformation and the huge opportunities it brings with, the time to implement it is now. A responsible and ambitious implementation of this Strategy will transform Slovakia by 2030 into a modern country with the innovative and green industry benefiting from the knowledge-based digital and data economy, with the efficient public administration that manages the intelligent territory and infrastructure use, and with an information society, the citizens of which fully benefit from its full potential and live the quality and safe lives in the digital age. Thus, the implementation of the Strategy can truly include Slovakia among the digital leaders by 2030 and make the country become one of the top digital states worthy of being followed.

## Annex 1: Explanation of Concepts

### **Informatization**

In the context of this Strategy, informatization means a purposeful and systematic deployment of the information and communication technologies to all relevant areas of the social, political and economic life, with the aim of increasing the knowledge potential of the society. Informatization is a process that transforms a traditional industrial society into an information one. As part of this, informatization of the public administration is defined as a controlled process of creating the social, legislative, methodological and personnel-organizational conditions for the application of the information and communication technologies and the use of information in an electronic form, as well as own application of the information and communication technologies, especially in the processes of exercising the administration authority, as part of the substantive competence, the horizontal and vertical public administration structure.

### **Digitization**

In the context of this Strategy, digitization means a controlled process of converting a traditional system as a whole, as well as an individual object, from its physical or analogue form into a corresponding electronic form. In some cases, it replaces the term informatization with regard to stylistic operations with a specific text; however, it is commonly used e.g. in the field of digitization of cultural heritage, digitization of archives and documents, or digitization of the analogue terrestrial broadcasting.

### **Critical Information Infrastructure**

In the context of this Strategy, critical information infrastructure means the interconnected information systems and networks, the disruption or destruction of which would have a serious impact on health, safety or the economic well-being of citizens, or on the effective functioning of the government or economy. The term does not refer to Act No. 45/2011 Coll. on Critical Infrastructure.

## Annex 2: Building a Digital Single Market in the EU

Since the Strategy was drafted in 2015, the following policies have been implemented in practice across the EU, from which the most important ones are selected below<sup>63</sup>:

- Roaming charges have been cancelled;
- Data protection has been streamlined;
- Cross-border portability of online content has been improved;
- An agreement has been reached to remove barriers to e-commerce by avoiding unjustified geographic blocking;
- It has been decided to use the 470-790 MHz frequency band to harmonize frequency bands for the next generation mobile communications;
- Access to the published works of art has been facilitated for the blind, visually impaired or other handicapped readers;
- Rapid Internet access has been promoted by funding the creation of hotspots, e.g. in parks, squares, libraries and museums, under the WiFi4EU brand;
- The VAT package on e-commerce was approved to introduce a number of simplifications for cross-border electronic services;
- Cooperation between the national authorities responsible for enforcement of the consumer protection legislation in the digital age (CPC) has been strengthened;
- A regulation was adopted on the cross-border parcel delivery services to make tariffs for the parcel delivery services more transparent, while the regulators will have more market monitoring powers.

Measures that have been already agreed:

- Revision of the audiovisual media services directive
- Electronic communications code directive
- Copyright regulation – satellite broadcasting and cable retransmission
- Digital single gate
- European high performance computing joint undertaking
- Digital content directive
- Free data flow
- European accessibility act
- Copyright directive
- Contract law – directive on the sale of goods
- “.eu” domain name regulation
- Public sector information directive
- Platform and reseller balanced relation regulation.

Measures under discussion (as of 22 March 2019):

- Privacy and electronic communications regulation
- Cyber security package
- Digital economy taxation package

---

<sup>63</sup> European Commission, Digital Single Market, [https://ec.europa.eu/commission/priorities/digital-single-market\\_en](https://ec.europa.eu/commission/priorities/digital-single-market_en) (22.3.2019)

## Annex 3: Overview of Digital Strategies for Advanced Countries

The strategies of Finland, France, Singapore and the United Kingdom have been chosen due to their visionary aspect, very good acceptance by the professional community and the preliminary successful results in practice. AI orientation has been chosen as the AI belongs currently to the priority technology and has a major impact on the possibilities for digital transformation. However, this overview is not final and, in implementing the recommendations of this Strategy, we will focus on other relevant and inspiring strategies of other countries that are in the process of being, or will be, developed.

### Finland

#### Introduction

Finland has expressed its ambition to be the leader in AI development within the EU. In 2017, the Ministry of Economy and Employment developed the *Finnish Artificial Intelligence Age: Turning Finland into a Leading Country in the Application of Artificial Intelligence strategy*<sup>64</sup>.

#### Problems and Priorities

Nowadays, it may seem that the AI is all around us; it is expected to bring a revolution into a number of areas of public life in the near future, such as transport, industry, healthcare and everyday life. The increased interest in AI as observed is based primarily on the ever-evolving computing technology, readily available data, and data that can be used for various purposes. One of the tasks of AI is to allow machines and devices to function reasonably according to the current situation. However, the existence of AI as such is not enough; to bring benefits, it needs a number of other technologies and data sources.

To secure a prosperous Finland in this area, the priority is to define three main issues to be addressed:

1. How can we ensure that the potential offered by the AI can be used to its full potential, and the competitiveness and economic growth of business is ensured?
2. How can we ensure that the public sector can take advantage of the possibilities posed by the AI and produce quality public services thanks to it?
3. How can we ensure that social structures can adapt to the changes that have arisen in connection with AI and that Finland will continue to be able to provide a well-functioning society and well-being for its citizens?

Economic growth that is based on the capital, labour and productivity growth is undoubtedly an area that could pose potential obstacles in providing the quality public services and a well-functioning society. In a country like Finland that has a small internal market, capital growth and labour can be a problem. The space for economic growth is thus in the development of technology and its ability of applying them in the private and public sectors.

#### Objectives

A country like Finland has perfect preconditions to use and apply the AI. The objectives set ensure that the value of the country's economic value will double by 2030. Therefore, it will be necessary for Finland to invest in the technology development, while also gaining scientific support. The potential that the country has in this area will therefore be exploitable in both, the private and public sectors.

However, the widespread application of AI also brings with it the potential threats and uncertainties associated with the loss of job vacancies of citizens. It is not easy to anticipate the future and, at the same time, we see that the debate conducted in this matter is oriented in two areas, namely the amount of work, i.e. how many people will have jobs, and the quality of work in the future, i.e. the different ways, in which work will change. The most common predictions of the future say that the number of jobs will decrease and

---

<sup>64</sup>Ministry of Economic Affairs and Employment, Finland's Age of Artificial Intelligence, [http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap\\_47\\_2017\\_verkkojulkaisu.pdf](http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap_47_2017_verkkojulkaisu.pdf)(30.9.2018)

the meaningful content of jobs will fall, making the labour market uncertain for employees. However, the experience so far has shown the opposite, as the amount of work done through automation has increased, and the work tasks become more meaningful thanks to AI.

### Proposed Measures

The measures are focused on eight areas named as Eight Key Actions for Taking Finland Towards the Age of AI (AI Task Force Recommendations):

- We will increase the competitiveness of companies through the use of AI:
  - Ecosystems that assist in the application of AI
  - Incentives to use AI solutions
- We will use data across all sectors:
  - Accumulation and enrichment of Finnish data sources
  - My Data will be available to citizens
  - Pilot projects for data providers: How can data be transformed into a product?
- We will accelerate and simplify the AI acceptance:
  - AI accelerator will be introduced to help us get started
  - Space of free and open AI for experiments and experimentation.
- We will ensure the highest level of expertise and attract top experts:
  - Establishment of the Finnish Artificial Intelligence Research Centre
  - Extending the experience with AI and its applications
  - We will try to attract international AI experts to Finland
  - The Master of Artificial Intelligence study programme will provide more expertise
- We will make bold decisions and investments:
  - Financing research and innovation to support recovery:
- We will build the world's best public services:
  - “Aurora” citizen assistant
  - Different data must work together
- We will create new cooperation models:
  - New age of PPP cooperation
- Finland will set trends in the AI age:
  - Finland as a “driver” in developing the European agenda for AI

### Financing and Cooperation

The measures will be financed from the state resources and public-private partnerships.

### Inspiration for Slovakia

In particular, Finland can inspire in securing sufficient data and deploying the My Data service (and supporting the data providers' ecosystem).

## France

### Introduction

In recent years, the AI has entered into a new era, raising thus many expectations. New applications have emerged in areas, such as transport, healthcare, and so on, thanks to the sophisticated algorithms for improving the computing technique and data machine generation. Such progress in AI is taking place in a context that affects all sectors of society and the economy.

France and Europe must be able to ensure that their views are heard and that they must do their utmost to remain independent. There is also competition in this area and we see that the United States and China are at the forefront, and their investments are significantly higher than investments in Europe. Therefore, it will



be necessary for France to propose a coordinated action on AI at the European level. As a first step to achieve it, they have designed their own *AI for Humanity* strategy at the national level<sup>65</sup>.

### Problems and Priorities

The European data ecosystem talks about data availability as a starting point for any AI-based strategy. In spite of all, only a few large operators are currently benefiting from the data and, therefore, it seems necessary to make data more evenly available and to extend such benefits to the public authorities, but also to smaller economic operators or public research. In order for this to happen, public authorities must introduce a systematic way of creating, sharing and managing data in order to become also socially useful. This method should encourage economic operators to share and combine their data, with the State being a credible third party on this issue. In any case, there is a need for a number of reforms to be adopted in Europe to ensure greater access and wider data transmission.

However, such a data policy should be designed to protect sovereignty, and it is therefore essential that France and Europe maintain a strong stance on the transfer of data outside the European Union, while the AI must be based on the General Data Protection Standards (GDPR).

### Objectives

Today, France has all the prerequisites and the necessary means to gain a valid position at an international level, but local companies suffer from a lack of visibility both in Europe and overseas. Large trading companies sometimes choose to rely on the dominant global players in a given sector, instead of entrusting their data to the domestic market. This is either because they do not know about this potential in their country or rather prefer a very cautious approach. Therefore, the aim of the French AI players is to gain a unique position and a strong brand that would include awards and innovations in the field of AI to attract potential bidders. However, the approach thus defined needs to be set along with a more organized approach to the demand for AI, which would include creating a contact point for the potential candidates to outline their requirements.

### Proposed Measures

The need to exploit the comparative advantages of the French economy is proving to be inevitable and, at the same time, there is a need to strengthen the French and European AI ecosystems. In this context, four key sectors are defined that need to be focused on. These are health, environment, transport mobility and defence security. All these areas are important from the point of view of public interest and, therefore, require a strong impetus from the State. The business strategy of each of these sectors must allow for the creation and organization of ecosystems based on the challenges in major industries.

The goal of developing AI is not just developing itself, but it must be geared towards a practical application that helps improving the economic performance, while contributing to the public interest. These include, for example, early detection of diseases, healthcare, and removal of medical deserts or emission-free urban transport. These and similar questions can be found in every sector.

The second key point of this strategy is the creation of the joint industrial platforms to ensure the access of different actors of different ecosystems, i.e. researchers, companies, public authorities and so on. As part of a public-private partnership, these platforms must allow stakeholders develop new features that are tailored to the individual characteristics or needs of each sector.

The necessary steps to streamline the AI innovation path include:

- Temporary mitigation of certain regulatory restrictions in order to provide innovation
- Supporting participants in meeting their responsibilities
- Resources to use field tests.

The state plays a key role throughout this system, and it is therefore essential that it be a driving force in these various areas of transformation. Public authorities must provide both human and material resources to help the AI to address public issues.

---

<sup>65</sup>Cédric Villani, *AI for Humanity: For a Meaningful Artificial Intelligence*, [https://www.aiforhumanity.fr/pdfs/MissionVillani\\_Report\\_ENG-VF.pdf](https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf) (19.12.2018)

## Financing and Cooperation

Indeed, such a transformation requires time; different ministries and government bodies show varying degrees of progress in terms of AI. Therefore, the establishment of an inter-institutional coordinator to implement a strategy thus defined with the support of a dedicated centre, consisting of around thirty employees in charge of carrying out advisory functions for different government bodies seems to be appropriate. At the same time, there is a need for a re-evaluation of public procurement, as the budget of the state, public and local authorities estimated at €70 billion each year is not geared towards innovation.

### Inspiration for Slovakia

The example of France's strategy inspired Slovakia mainly in the inclusion of AI development measures and its incorporation into the economic areas, where the AI appears to be an opportunity for innovation and growth.

## Singapore

### Introduction

Ambition of Singapore, one of the world's most advanced economies and one of the Asian economic tigers, is to invest in the extensive AI research and, with its help, to address the major societal and economic challenges, boost the growth of the new local talents, and expand the use of the AI in industry. Singapore wants to become a global AI research site and use it in various areas of the economy and the public sector. For this purpose, the *AI Singapore*<sup>66</sup> strategy was developed in 2017, i.e. a national AI programme to strengthen the digital economy and the society.

### Problems and Priorities

The main priority of the Strategy is to harness the economic and technological potential of Singapore to address the country's major challenges, including in particular the adverse traffic situation and the aging population. It is also a priority to adjust the AI research to the world class, namely to join a new AI wave of scientific innovation and to use machine-learning and AI in industry as much as possible.

### Objectives

The proposed priority objectives as set out in the AI strategy Singapore measures are as follows:

- Use the AI to address the major issues affecting society and the economy:  
AI has vast possibilities of uses, ranging from the peak traffic volumes to addressing the most serious health problems in the population. Healthcare is currently both a knowledge-based and a human resource-intensive industry. Along with the advances in the healthcare electronization in Singapore over the past years, the AI could be used to improve Singapore's population health. Specifically, the AI could play a major role in the process of prevention, diagnosis, treatment plans, or drug production.
- Invest in capabilities for the next wave of scientific innovation:  
The intention is to encourage the allocation of funds of the next-generation AI systems, which show more human skills, as well as to the related technologies, such as computing architecture and cognitive sciences. It will also include the local talent training in AI.
- Expand the use of AI and machine learning in the economy:  
Under the programme, the state entities will work with the companies in deploying the AI to increase productivity and translate and commercialize lab solutions to/on the market. The goal is to bring one hundred meaningful AI projects to solve problems for the end users. There is a particular potential in sectors, such as finance, health and city administration.<sup>67</sup>

<sup>66</sup> AI Singapore, <https://www.aisingapore.org/about-ai-singapore/> (30.9.2018)

<sup>67</sup> National Research Foundation, Prime Minister's Office Singapore, AI Singapore <https://www.nrf.gov.sg/programmes/artificial-intelligence-r-d-programme> (30.9.2018)

## Proposed measures

The AI Singapore programme consists of six key programme measures:

1. **Basic Research:** Focuses on supporting the AI scientific research projects, especially machine-learning, computervision, natural language processing, and how the AI works with people. Suggestions should focus on the methodology and algorithms rather than the domain-specific solutions.
2. **Big Challenges:** Supports the work of multidisciplinary teams that provide the innovative solutions to the major challenges that Singapore and the world faces. Currently, the programme focuses on the healthcare, urban solutions and finance. The aim is to promote bold ideas and apply the innovative AI technologies to address these challenges.
3. **Hundred Experiments:** The measure finances the scalable AI solutions for problems identified in the economic sector.
4. **AI apprenticeship:** This is a 9-month structured talent-supporting programme in the AI in Singapore.
5. **AI for the Economy:** The aim of the programme is to enable the technology-oriented people to understand and use the AI appropriately, and to teach them to programme the basic AI and data applications.
6. **AI for Everyone:** The measure is intended to help anyone interested in the AI and the latest AI technologies and applications to identify the potential uses in their businesses and everyday lives.

## Financing and Cooperation

AI Singapore is a nationwide partnership involving six different organizations: National Research Foundation (NRF), Smart Nation and Digital Government Office (SMART), Economic Development Board (EDB), Infocomm Media Development Authority (IMDA), and SGInnovate and Integrated Health Innovation Systems. The NRF is expected to invest up to \$150 million in AI Singapore over the first five years. Thus, AI Singapore will connect research institutions, start-ups, and AI-based companies seated in the country. Even individual enthusiasts can participate in the programme through the network events and hackathons. The country promises such a form of collaboration will expand knowledge, tools and talent that are crucial to linking Singapore's AI efforts.

### Inspiration for Slovakia

Singapore's approach to defining the country's AI strategy is an inspiration for Slovakia in the following aspects:

- Singapore seeks to support local potential; it focuses on start-ups, companies and individual talents seated in Singapore;
- Singapore wants to build the success of the Strategy on partnership and cooperation;
- Singapore places great emphasis on AI research and understanding.

## United Kingdom

### Introduction

The UK is one of the leading European states in the digital field. The country has a long history of developing digital innovations and is the cradle of many inventions. For example, its scientists participated in the birth of the first computers or developed the World Wide Web. Britain aims to develop its digital tradition and ensure that the country is one of the top destinations for launching and developing digital business and research into new technologies.

### Problems and Priorities

In this respect, the priorities of the country's *UK Digital Strategy*<sup>68</sup> main strategy, in the information technology topic, include a completion of the development of the first-class communications infrastructure

---

<sup>68</sup> UK Government, Policy Papers, UK Digital Strategy, <https://www.gov.uk/government/publications/uk-digital-strategy> (13.8.2018)

and support of regulations. Well-developed technology infrastructure and easy access to the high-speed internet throughout the country is key for the new innovations, projects and businesses.

Ensuring that every individual and every business has the skills to take advantage of the digital age is an equally important challenge. To do so, the state needs to strengthen the ICT-related education, not only by improving the curriculums and materials for pupils and students, but also by providing special training for employees and seniors.

Internet security is another area that London wants to improve in order to provide the first-class and secure online services and activities. They approach the Internet in the sense that they want to make full use of the liberal values that strengthen connectivity but, at the same time, want to combat the threats it poses.

### Objectives

The basic objectives of the UK digital strategy include the use of new technologies to enable every citizen to access the most advanced digital services that help him/her in everyday life, facilitate duties, simplify work, improve health, and connect him/her with his/her family and friends.

Specifically objectives are based on the “Building our Industrial Strategy: Green Paper“:

- Science, research and innovation: Britain wants to become a more innovative economy and more to commercialize its leading science base in the world, which can bring more economic growth for the country;
- Skills: The country wants to help people and businesses develop their technological skills needed in the modern economy by building a new technical education system;
- Infrastructure: The government wants to improve performance in the digital, energy and transport infrastructure and to better align infrastructure investment;
- Support for start-ups and growing businesses: At this point, the aim is to ensure that favourable conditions are created to enable companies to invest in the long term;
- Procurement policy: Strategic public procurement can bring innovation and enable the development of supply chains;
- Trade and investment policy: The government wants to increase productivity and growth in the economy by increasing competition;
- Affordable energy and green growth: The objective is to ensure the economic benefits of transiting to a low carbon economy;
- Sectoral policies: Britain wants to help develop new economic sectors in the country;
- Disseminating growth across the country: In this respect, the objective is to create a functional framework to help disadvantaged and less economically efficient regions so that the disparities between regions are gradually lost;
- Creating the right institutional framework: Creating new institutions or strengthening the existing ones – be it local education institutions, business associations or financial networks.

### Proposed Measures

The UK Digital Strategy is based on seven pillars that will underpin the related policy actions and reforms:

#### 1. Connectivity

For the businesses to develop and grow, the government needs to create conditions and a framework for large infrastructure investments. The communication infrastructure is a crucial part of this solution: digital connectivity is extremely important; its lack significantly complicates citizens' lives, whether at work or at home. Connectivity increases productivity and innovation and is a physical support for the digital nation. Building the 5G technology is part of this pillar.

#### 2. Digital skills and inclusion

To increase overall welfare, minimum and average wages, as well as to create more opportunities, it is essential to increase state productivity. In a digital economy, this means ensuring that everyone has the digital skills and competences they need for their professional and personal growth.

### 3. Digital sectors

Each strategy should include the identification of the country's strengths and reflecting on them. Britain wants to build on its strengths (the birthplace of innovation; the presence of major influential enterprises and technology clusters, etc.) to become the best place to start and develop a digital business.

### 4. Wider economy

The UK's global competitiveness will increasingly depend not only on a thriving digital sector, but on all businesses that use digital technology and data to support innovation and productivity. The state therefore needs to help all businesses become productive and competitive – in doing so, adopting digital technologies will be crucial. To ensure that businesses have the knowledge and resources to access technology, the state will seek to focus existing initiatives and fill gaps wherever specific problems occur.

### 5. Secure cyberspace

Safe cyberspace is a fundamental requirement for an inclusive and prosperous digital economy. It gives people the confidence to be part of the digital world, while giving the country a significant competitive advantage.

### 6. Digital government

From the personalized healthcare services to safer home care for older people – digital tools, techniques and technologies give more opportunities to improve the important public services. In addition, since the creation of GDS in 2011, Britain has been a world leader in informatization of the governmental services.

### 7. Data

Data is the foundation of the digital economy and its effective use must be based on trust. Britain has the ambition to become a leader in data-driven economy, in which data combines the economic and social opportunities, and people can trust that their data are used in a responsible way.

## Financing and cooperation

*UK Digital Strategy* and the related measures will be funded from both, the state budget and various public-private partnerships. The public authorities will also work intensively with the private and academic sectors to implement the actions.

### Inspiration for Slovakia

*UK Digital Strategy* is a great inspiration for Slovakia, mainly in its ambitiously-outlined goals and pillars, which emphasize the satisfaction and success of each individual, as well as the building of a functioning communication infrastructure, from which all citizens and businesses operating in the country will benefit.

## Annex 4: Slovakia's position in the DESI Index

The **Digital Economy and Society Index (DESI)** provides the best and most effective comparison of Slovakia's performance with the other twenty-seven EU Member States in a wide range of areas. It is a composite index that is annually evaluated by the European Commission, which monitors the progress and level of development of the digital economy and society in the Member States upon thirty-four relevant digital performance indicators in five main areas of measurement, upon which the Commission assesses progress across the Union.<sup>69</sup>

### Components of the Digital Economy and Society Index:

- **Connectivity (25 %)**

Fixed and mobile broadband and broadband prices

- **Human Capital (25 %)**

Use of the Internet, basic and advanced digital skills

- **Use of Internet services (15 %)**

Use of Internet content, communication and online transactions by citizens

- **Digital technology integration (20 %)**

Informatisation of business and e-commerce

- **Digital public services (15 %)**

EGovernment and eHealth

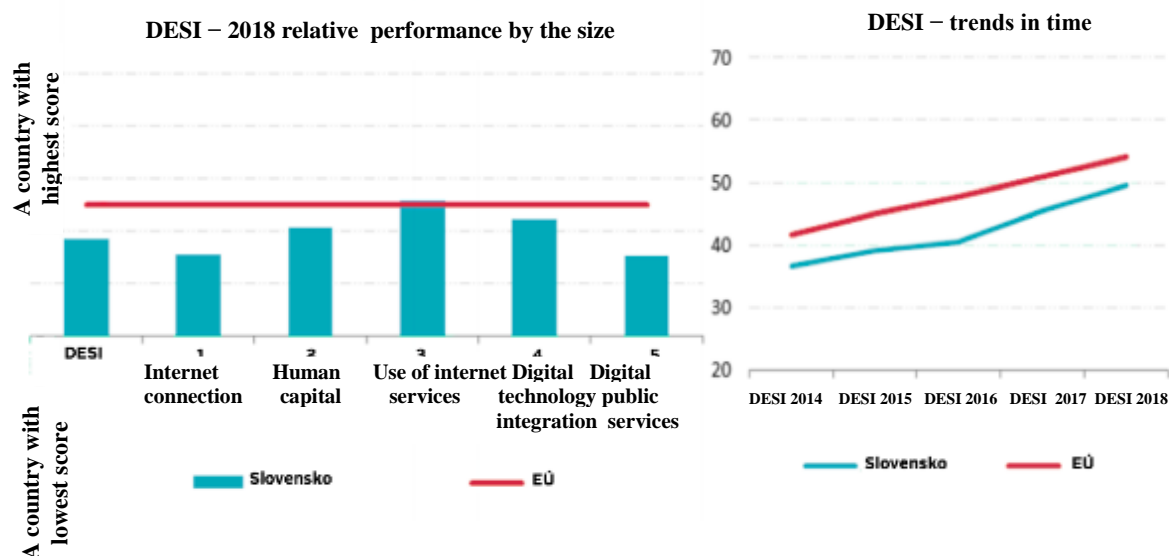


Chart 1: DESI 2018 Index – Slovakia vs. EU average

Data source: <https://digital-agenda-data.eu/datasets/desi/visualizations>

The objective of the index assessment is not only to compare the performance of countries and to identify the current situation but, above all, to help the individual EU countries identify areas that require the priority investments. In this way, it is intended to help more effectively to adjust the differences between countries and to improve the digital performance of all Member States in view of successfully building a digital single market. The index provides an in-depth assessment of how the EU and Member States are progressing in digital development, while recommending possible steps to improve the digital performance of individual countries. Thus, the index is a very important **starting point for identifying priority areas of concern** that

<sup>69</sup> European Commission, The Digital Economy and Society Index (DESI), <https://ec.europa.eu/digital-single-market/en/desi> (23.9.2018)



Slovakia should devote to in order to improve its digital performance. The graphical representation of Slovakia's position upon the DESI measurements from 2017 and 2018 is presented in Table 3 and in Charts 1 and 2.

Table 3: DESI 2017 and 2018 index – Situation of Slovakia

Data source: <https://digital-agenda-data.eu/datasets/desi/visualizations>

	Slovensko		Skupina	EÚ
	Poradie	Skóre	Skóre	Skóre
DESI 2018	20. miesto	49.5	43.5	54
DESI 2017	20.miesto	45.5	40.4	50.8

Slovensko – Slovakia  
Skupina – group  
Skóre – score  
Miesto – ranking

In the DESI 2018 index, Slovakia ranked 20<sup>th</sup> out of the 28 EU Member States. Overall, **Slovakia belongs to a group of countries with weak results** – except Slovakia, the group includes Bulgaria, Cyprus, Greece, Croatia, Hungary, Poland, Romania, and Italy.

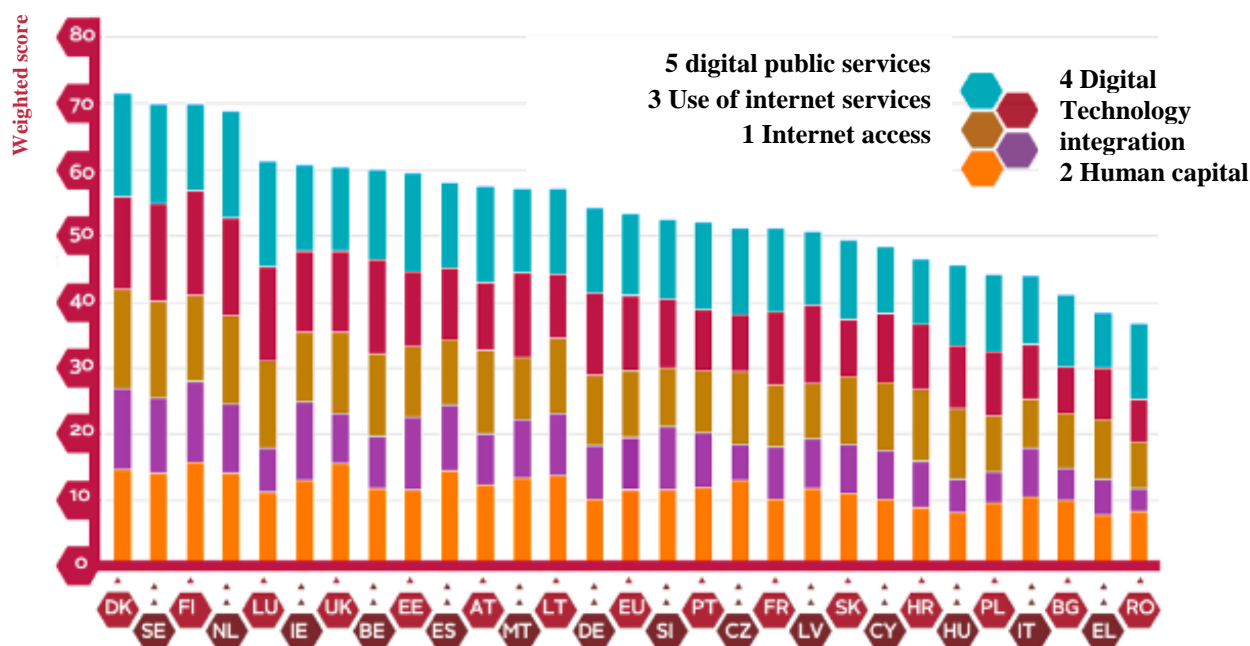


Chart 2: DESI 2018 Index – Position of Slovakia

Data source: <https://digital-agenda-data.eu/datasets/desi/visualizations>

Slovakia in the DESI index for 2018

The 2018 index of the DESI brought the following results for Slovakia in the five indicative areas<sup>70</sup>:

## CONNECTIVITY

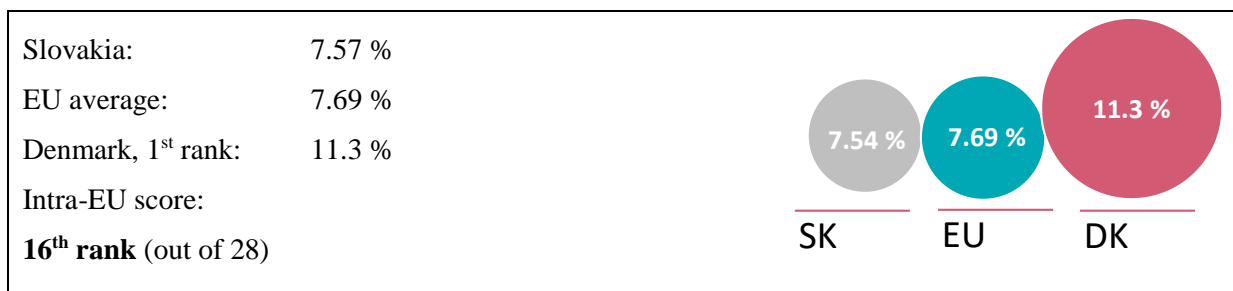
<sup>70</sup> Digital Economy and Society Index (DESI) 2018, Country Report Slovakia, [http://ec.europa.eu/information\\_society/newsroom/image/document/2018-20/sk-desi\\_2018-country-profile\\_eng\\_B4415E7E-9154-E26E-7B403212919F3F7C\\_52238.pdf](http://ec.europa.eu/information_society/newsroom/image/document/2018-20/sk-desi_2018-country-profile_eng_B4415E7E-9154-E26E-7B403212919F3F7C_52238.pdf) (17.1.2019)



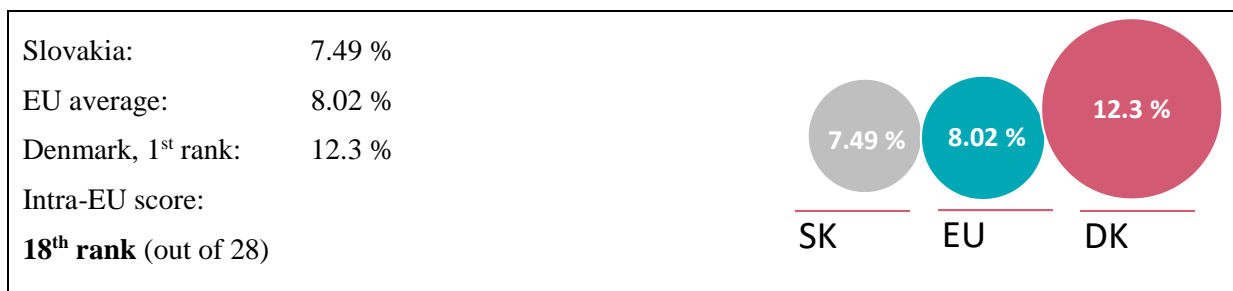
## HUMAN CAPITAL



## USE OF INTERNET SERVICES



## DIGITAL TECHNOLOGY INTEGRATION








## DIGITAL PUBLIC SERVICES



The current results of the DESI 2018 index, as well as the development of the digital agenda in Slovakia for the measured period of 2014 to 2018 (Table 4) indicate that the country **is stable** in the area of

informatization of the economy and society, **but is still beyond the EU average**. In 2014 and 2015, Slovakia ranked 20<sup>th</sup>; it fell to 22<sup>nd</sup> place in 2016, and again ranked 20<sup>th</sup> in 2017 and 2018. In this respect, Slovakia is performing poorly in the DESI Index compared to other EU countries and continues to belong to the group of the lowest-performing countries. Thus, the process of informatization in the country is progressing slowly compared to most EU Member States. Of course, this is an overall summary of the country's performance in all five indicative areas – the country's concrete performance in each out of thirty indicators has made here and there more progress. Overall, we can see that Slovakia's performance has improved slightly from 2014 to the present, and we are getting closer to the EU average in specific indicators, although, in four years, we have been able to reach the European average, eventually outperform them in just a few out of thirty indicators.

Table 4: Location of Slovakia in the DESI 2014 to 2018 index  
Data source: <https://digital-agenda-data.eu/datasets/desi/visualizations>

Rok	2014	2015	2016	2017	2018	Umístění Slovenska – ranking of Slovakia Miesto – rank
Umístění Slovenska						
	20.miesto	20.miesto	22.miesto	20.miesto	20.miesto	

## Annex 5: The steps taken so far towards the digital transformation of Slovakia

The evaluation of the current state of Slovakia in the area of digital agenda also provides an analysis of the current activities and participatory processes developed for the identification of problems and priorities in the digital area in Slovakia, as well as a survey of the related strategic documents at the national level.

The *Single Digital Market Action Plan – Opportunity for Slovakia* was set up in 2017 and defines the priority topics in the field of informatization of Slovakia, identifying, which objectives are most important for the country, and setting the ambitious legislative and non-legislative steps to implement these topics. This document not only highlighted the need for new activities, but also pointed at all existing strategies, plans and projects that need a new dimension to be added to.

The following successes have been achieved in practice since the creation of the Action Plan:

- The *National Concept of Public Administration Informatization/New Action Plan for eGovernment* were developed and Government Cloud built;
- The first activities of the Data Office were launched with a focus on better use of data in the public administration and on the implementation of the "My Data" concept;
- The first activities of the Behavioural Innovation Office were launched;
- A systematic assessment of the impact on innovation and the digital economy is embedded in the national Better Regulation strategy, as well as in the DPMII's *IT Better Regulation Platform project*; the reform project from the *Effective Public Administration Operational Programme* is being implemented;
- The national *Improving Public Policies in Transport, Innovative Transport Capacity and Promoting Partnership in Introducing Smart Mobility project* was launched;
- *Research and Innovation Strategy for Smart Specialization* was developed;
- *Intelligent Industry Action Plan* was developed;

- The following acts were adopted: Copyright Act, Electronic Commerce Act, *Act on Postal Services/Digital Broadcasting/Broadcasting and Retransmission/Electronic Communications*;
- *The national IT Academy – Education for the 21<sup>st</sup> Century project* was implemented;
- *The national Improvement of Public Policies in Transport, Innovative Transport Capacity and Promoting Partnership in Introducing Smart Mobility project* was approved;
- *Action Plan for implementation of the Cyber Security Concept* was developed;
- *Analysis of the Collaborative Economy* was developed at the Ministry of Economy of the Slovak Republic;
- *Strategy for Introducing Terrestrial Digital Radio Broadcasting* was developed;
- A group of educational specializations 25 Information and Communication Technologies was developed.

A series of **workshops and consultations with the professional public** took place to create a creative atmosphere for finding common solutions, share their opinions and expectations, and thus defining the acceleration of the digital market formation in Slovakia. These workshops and meetings have identified the following areas as the most problematic ones, which hinder the development of the digital agenda in Slovakia and should therefore be addressed as quickly as possible:

- Lack of workforce with digital skills and lack of experience in technology use;
- Insufficient communication between public authorities and the private sector;
- Insufficient financial support for science and research, especially for young scientists;
- Low international collaboration in science and research and poor school engagement in IT projects;
- Inefficient curriculum that does not reflect digital times;
- Lack of quality IT teachers;
- Lack of systematic education policy and absence of pedagogy research to identify educational problems;
- Underfinanced education and problematic social status of teachers;
- Poorly developed e-government and insufficient eGovernment capacity;
- Insufficient communication and cooperation within the state sphere;
- The low level of confidence of citizens in the state sector;
- A poorly set up system for obtaining euro-funds in informatization.

In addition, other strategic documents that have been developed at a national level also address the digital agenda to varying extent and intensity. These are:

- *Intelligent Industry Action Plan*;
- *Learning Slovakia Strategy*;
- *National Investment Plan for 2018-2030*;
- *RIS3 Strategy Val*;
- *Action Plan for Open Governance Initiative in the Slovak Republic for 2017 – 2019*, adopted by the Slovak Government No. 104/2017;
- *Proposal of State research and development programmes for 2019-2023 with a view to 2028*.

The common main findings of the documents in question include the following information on the state of the digital agenda in Slovakia:

- Digital transformation is not an option; it is an irreversible process, which requires a sensitive approach to the extent, to which it would be needed for small businesses, taking into account the fact that it is dependent on the type of profession – there are professions that can do without it, but also professions that are more connected with physical work, where it is less needed;
- Trends indicate that digital technologies and robotics will be integrated into all areas of life, causing some professions to disappear, but new ones to emerge. Therefore, in the future, all should dispose of the digital skills;

- The problematic concept of the teaching profession and the function of the school, as well as the below-average social status of the profession in question, are shown as a significant obstacle to improving the digital skills of the population;
- Science and research struggle with underfunding and the associated low level of international engagement and cooperation in the long term;
- Gaps in education and a systematic approach to education in view of ICT;
- Small businesses can see digital technologies and robotics not only as a problem; they are primarily an opportunity for them;
- Small businesses suffer from a significant lack of awareness of the overall progress of these processes and, therefore, they need a continuous and extensive access to the sources of information in view of what these processes will mean for them in the future;
- Insufficient coverage of the area by up-to-date ICT networks and mobile and fixed broadband connections constitutes a serious obstacle to the development of the Digital Agenda;
- The weakly developed electronization and eGovernment capacities remain a big problem. Likewise, there is a lack of communication and sharing of data and knowledge among the public authorities towards the private and civil sectors, as well as within public administration (i.e. between ministries and other public authorities);
- Ongoing technological anxiety and lagging behind in the competitiveness index in the regional and European comparison.

## Annex 6: Resources and Method for Developing the SWOT Analysis

The digital topics-concerning main strategic documents and action plans of Slovakia, which this strategy links to, have been identified as sources for developing the SWOT analysis. Furthermore, the analysis is based on the results of Slovakia in the prestigious European and international analyses, rankings and indexes, as they provide an impartial and highly professional view of the country's initial situation in areas of measurement. The EU institutions' studies have also provided a relevant and necessary basis for developing the analysis. Last but not least, they have provided valuable conclusions for the SWOT analysis, the professional discussion with the academic and professional representatives in Slovakia.

Therefore, the SWOT analysis was based on the following sources:

1. *Digital Single Market Action Plan – Opportunity for Slovakia*
2. *Intelligent Industry Action Plan*
3. *Learning Slovakia Strategy*
4. *National Education and Training Development Programme (NPRVV)*
5. *National Investment Plan 2018-2030*
6. *RIS3 Strategy Val*
7. *Strategy paper for the area of digital services growth and next generation access network infrastructure (2014-2020)*
8. *DESI 2014 Index*
9. *DESI 2015 Index*
10. *DESI 2016 Index*
11. *DESI 2017 Index*
12. *DESI 2018 Index*
13. *Report on Slovakia 2019, European Commission*
14. *OECD World Economy Forecast 2019*
15. *United Nation's eGovernment Development Index 2018*
16. *Report of the Research and Innovation Observatory (RIO) 2017*

17. *IMD World Digital Competitiveness Ranking 2018*
18. Initiative Workshop “Digital Single Market in Slovakia: Expectations and Priorities”
19. *The Rise of Digital Challengers – How Digitization Can Become The Next Growth Engine for Central and Eastern Europe: Perspective on Slovakia* report, McKinsey, 2018
20. *The Global Competitiveness Report 2017-2018*, World Economic Forum
21. Digital strategies of selected countries: Finland, France, United Kingdom, Singapore
22. Selected Economic Statistics of the Statistical Office of the Slovak Republic
23. European Commission studies
24. Analyses and data provided by telecommunication companies operating in Slovakia
25. Analyses provided by IT companies and academic institutions in Slovakia

## Annex 7: Infobox: Recommendations for the Development of Artificial Intelligence in Slovakia

Infobox: Recommendations for the development of artificial intelligence in Slovakia
<p><b>Slovakia’s digital transformation strategy is designed to help Slovakia in the area of artificial intelligence development.</b></p> <p>The aim is to resolve regulatory aspects and help the development of AI in Slovakia:</p> <ul style="list-style-type: none"> <li>▪ Explore the possibilities to regulate the AI: suitable areas will be identified, in which it is advisable to use AI for decision-making to be able to accurately define the AI competences, its limits, as well as moral aspects and the question of responsibility and rights;</li> <li>▪ We will streamline and simplify the legal framework in the field of data, and prepare a new law on data;</li> <li>▪ We will be able to use smart contracts in practice and support their use;</li> <li>▪ We will explore the possibilities of resolving taxation in the data economy;</li> <li>▪ We will explore the possibilities of adjusting the Labour Code to the needs of the collaborative economy, the big economy (i.e. the shared economy, the platform economy) and greater labour market flexibility, while preserving workers’ rights and protection.</li> </ul> <p>We will provide enough quality data for the needs of algorithms and their learning:</p> <ul style="list-style-type: none"> <li>▪ We will find a suitable concept and establish a “public data trust”;</li> <li>▪ We provide data pools for the needs of AI: Therefore, we will systematically create pools of available data for the priority areas (first the transport, health and environment) that will be compatible with data pools in other EU countries;</li> <li>▪ We will provide trusted public data for use in the digital economy;</li> <li>▪ Possibilities of personal data will also be used to address targeted public services;</li> <li>▪ A pilot personal data-built personal assistant will be tested.</li> </ul> <p>We will support the introduction of innovations in the digital economy and create an ecosystem for deploying AI solutions:</p> <ul style="list-style-type: none"> <li>▪ We will support the innovative capacity, deployment of the solutions based on the AI and aimed at the support for the small and medium-sized enterprises: the digital innovation hubs emerged will therefore help to combine demand and supply, disseminate information on the use of new solutions in the digital economy, and develop digital transformation.</li> </ul>

- We will support new business models in the digital economy: therefore, we will focus on an effort to systematically enable new business models in the priority topics (such as transport, logistics, health and later education, and financial services). It means creating control sandboxes, introducing future-proof regulations, and redesigning permits for digital times. **Slovakia will serve as an incubator of new opportunities with a vision of expansion across the EU.** We will set up an investment fund to support such solutions.
- We will simplify the depreciation of AI-based investments in innovation.

Digital transformation of the public administration institutions will be driven by AI:

- We will set up a Public Administration Data Office and **Laboratory for Public Administration Innovation**, thus significantly supporting the organizational arrangement of public administration and its capability to implement new solutions;
- We will build a consolidated analytical layer and make the important analytical tools available to the needs of the public administration;
- We will implement the projects for better use of data in the public administration institutions (using AI methods), thus **generating the significant demand for new technologies over the next two years**, while significantly increasing the performance of public institutions.

We will allow the emergence of a domestic R&D capacity for innovation:

- We will support the business and academic activities in acquiring excellence in the development and application of artificial intelligence to develop the original research and collaborate with the leading institutes abroad;
- We will simplify the process of attracting top foreign experts to work in the AI sector.

In order for such an AI development strategy to work, the academic sector will need to be heavily involved, sufficient R&D talent provided and the modern methods of financial support put in place.