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DIGITAL SOCIETY – OPPORTUNITY OR THREAT? CASE STUDIES OF JAPAN AND THE CZECH REPUBLIC

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Abstract

Digital technologies, autonomous systems, and artificial intelligence are seen as mater-of-course parts of the world today. Japan, as one of the leading countries in technological innovations, is the most advanced in terms of approach to digital society. Japanese society and government have been working on a new concept of life where all the digital technologies will communicate through the internet. Society organised in this way is called Society 5.0 – super Smart society. In Japan, this concept is centred about seventeen sustainable goals (United Nations, 2018). Society 5.0 is a reaction to the fundamental technological revolutionary changes known today as Industry 4.0. Thus, Society 5.0 is the consequence of a technological revolution that will eventually affect not just the production but all parts of today's life as well.

The new technologies evoke some fundamental philosophical and existential questions. How can technological advances improve the prosperity and functioning of society? What about the privacy and security of all the users? The present paper compares Japan and the Czech Republic from the perspective of digitalization of society based on three main aspects: government programs supporting digital technologies, number of technically educated experts and investments in science and research. The objective is to find out how much the Czech Republic has advanced towards preparations for digital society.

Keywords: Society 5.0, Japan, Czech Republic, digital society

INTRODUCTION

Over the recent years, society has made considerable progress thanks to innovations and new technologies. Minor and more efficient processor units as well as major database centres provide us with huge amounts of data. These are being accumulated from many devices and sensors all around the world. Through smart phones with smart applications, people send anonymous data, which are then are used for further functions of applications. Now, what happens once all the data are concentrated in a single central database to be processed by artificial intelligence? Recently, a new concept of society has been shaping up. This is digital society integrating all smart systems through digital technologies. Born in Japan, this concept is

called Society 5.0. The paper is concerned with this type of society.

Society 5.0, sometimes dubbed Super Smart Society, represents the fifth stage of society in the history of humankind. It is a system that uses the potential of digital technologies, digital devices, and the internet to improve the quality of life (Prasetyo, 2017).

The Japanese government has divided society advancement into several parts with each change, such as innovation of instruments, agriculture, industry, and use of technology to share information representing a step forward (Cabinet Office, 2017).

The first successful human adaptation was hunting and gathering (Society 1.0) taking place 1.8 million years ago. The main objective of this society was survival. This community survived mainly because it was capable of gathering and using shared forces in hunting. Almost 90% of people were actively involved in the evolution of this society. Innovations at this stage, had already improved hunting through improved instruments and communication (Lee and Richard, 1999).

About 10,000 years ago, society evolved into a new, agricultural phase (Society 2.0) growing plants to produce food. This society was based on crop production and agricultural land. People started to use new technologies to irrigate and cultivate fields (Smelser, 2001).

Along with the growing population, new innovations necessarily appear making it possible to pass from small local productions to mass production meeting the demand of the market. Industrial society (Society 3.0) uses external energy resources such as fossil fuels to speed up and extend production. The key technological revolution consisted in assembly lines invented by Ford in 1913 when the first line was installed to assemble an entire automobile (Ford Motor Company, 2019).

As the volume of innovations grows exponentially in the world, there is a growing need of information sharing and communication, too. Information revolution has created the present society (Society 4.0) with the production, distribution, use, and manipulation of information being the major driving force of the life of companies (Cabinet office, 2017).

The next stage of the revolution of society is Society 5.0, with its main objective being the integration of cyber-physical systems with large data centres and artificial intelligence to achieve human-centred society. It will outbalance economic advances by solving social problems. The system is based on gathering large amounts of information from many sensors in the physical space such as factories, smart phones, smart cars, shops, and others. Such information (large amounts of data) will concentrate in a cyberspace to be analyzed by artificial intelligence. The results of such analyses will be used as feedback in different forms (Cabinet office, 2017).

Japan has created a strategic concept of preparing such society based on a partial strategy for each industry sector. Their concepts are based on particular steps inspired by the sustainable goals of development (United Nations, 2018). Each such partial step has its real anchor in the financial support, defined milestones, and preparedness of people. This holistic approach promises success in implementing their visions.

The goals of the sustainable development are officially defined and can be found at the UN official website:

„*The 17 sustainable development goals (SDG) are the best blueprint of the world to build a better world for people and our planet by 2030. The sustainable development strategies adopted by all the UN member states in 2015 are a challenge for all countries – poor, rich, and mid-income ones – to support prosperity while protecting the environment. They acknowledge that the end of poverty must go hand in hand with strategies that build economic growth and address a number of social needs such as education, healthcare, equal opportunities, while dealing with the climate change and work on the preservation of our oceans and forests*. "(United Nations, 2018).

Japan wants to achieve such 17 goals by adopting super smart solutions such as:

- Smart Food Chain Systems,
- Energy Value Chains,
- Intelligent Transportation Systems,
- Disaster Prevention and Reduction Systems,
- Hospitality Systems
- Manufacturing Systems
- And others.

Digital technologies can be found in any advanced country. In the Czech Republic, a country with the second largest share of industry in gross value added among the EU countries (Eurostat, 2016), adopting new technological solutions will be a key to get the edge over its competitors in the future. So far, Society 5.0 has only been mentioned as part of speculations and futuristic visions in the Czech Republic. The Czech government cannot offer any particular blueprint for Czech digital society. At present, a development plan called Digital Czechia is being implemented and the ministry of industry

1: *Smart solutions in Society 5.0. Source: Cabinet office, 2017*

and trade supports new production trends related to Industry 4.0. Multinational corporations such as Siemens, Škoda, ABB are leading in production computerization and popularization of the new production forms. We know that comparing two countries each at a different stage of technology requires some methodological restrictions. Being dependent on exports to developing countries, the Czech Republic will have to deal with production policies and, in general, efficiency of society. The present paper's objective is to find out how much the Czech Republic has advanced towards preparations for digital society.

MATERIALS AND METHODS

Society 5.0 is a new concept born in Japan in 2016. It reflects the future that the youngest generation of children will no doubt live in. The work method is based on the current limited resources.

The paper is based on a literature search that, in terms of information on Japan, mostly uses the Cabinet Office 2017 resource officially disseminated by the Japanese government. In addition to strategy, this website offers the official budget of each particular plan analysing the risks. Japan has built the strategy on 17 areas of sustainable development as defined by a UN strategy (United Nations, 2018). These areas of life are elaborated on in much detail with concrete deadlines and binding budgets. This approach by Japan represents an elaborate system to be implemented systematically.

The paper involves a content analysis and comparison of both countries by selected criteria.

The content analysis includes papers from 6 research databases: Scopus, Springer, ScienceDirect, IEEE Explore, Emerald, and Ebsco. Society 5.0 was selected as the basic search term. Based on the content analysis, a concise presentation is made of the Japanese digital society blueprint.

Based on the below criteria, a comparison is made between this Japanese blueprint and the preparedness of the Czech Republic for society digitalisation.

1) Government programmes supporting digital technologies.
2) Number of technically educated experts.
3) Investments in science and research.

Society 5.0 is a future involving human activities and it is evident that the number of factors monitored cannot be finite. The methodology has been conceived using secondary data based on official statistics and government programmes of Japan and Czech Republic. Further research may update the current state in the years to come.

RESULTS

Implementing content analysis, 6 scientific databases were searched for the keyword "Society 5.0" relating to the period 01. 01. 2016–27. 11. 2018. The search results are listed below in Tab. I.

The results suggest that society 5.0 is becoming a topic reflected by the scientific community. The number of papers on society 5.0 is likely to grow in the years to come. It will be interesting to watch the scientific community approaching the society 5.0 phenomenon topic that will undoubtedly change the lives of people in all areas. In personal life, in labour market, in architecture, services, education, and many others.

It will be interesting to observe when society 5.0 will become a research topic and a real issue. The following research will analyse the situation in both Japan and Czech Republic.

Analysis of the preparedness of Japan and Czech Republic for digitalizing society

Japan

1) Government programme for the support digital technologies – Japan

A view of Society 5.0 (Super Smart Society) is defined in the book Reconstruction of the Public Sphere in the Socially Mediated Age:

"Society 5.0 (The Super Smart Society)" goes beyond "INDUSTRIE 4.0: Smart Manufacturing for the Future" in that, while the latter focuses only on "manufacturing (producing goods)," the former has the whole society in its scope. As discussed in more detail later, there is an urgent need to carefully examine the social evaluation of "science and technology," or more precisely, the relationship between "science and technology" and society, as well as the future of human kind in contemporary society, which finds itself in "late modernity." In this regard, "Society 5.0 (The Super Smart Society)" has implications that supersede "INDUSTRIE 4.0: Smart Manufacturing for the Future." It is here that the true value of "interdisciplinary research integrating arts and sciences" can be found." (Endo, K., 2017).

The 56th IEEE conference was on Japan and its strategies in 2016 when it started the 5th scientific and research plan approved by the Cabinet to combine the cyber and physical spaces in an effort to build super smart society. Apart from the industrial sphere, such super smart society is also about energy, food, healthcare, regional administration, infrastructure, disaster prevention/impact mitigation, climate change, and others. Although the fusion of cyber and physical space may jointly bring major changes in industry as well as in entire society, the society paradigm grows and will depend on the situation in society, culture, on people's worries, etc. In particular, Society 5.0 focuses on implementing super smart society creating super smart platform of social services, new values through cooperation among diverse systems, planning to standardize data formats, models, system architectures, and developing the necessary human resources. In addition, improvements in the development of intellectual property, international standardization, IoT technology building, large scale technology data analyses, artificial intelligence technologies, etc. will provide Japan with a competitive edge in a super smart society" (Hayashi, 2017).

At a 2017 conference on information and innovation systems, internet communication was presented as very important for innovations. It is necessary to build a platform providing the necessary information communication to mobilize communities and groups. To this end, smart societies will be able to meet such needs in the years to come (Prasetyo, 2017).

I: *Search results in scientific databases*

Database	count
link.springer.com	9
sciencedirect.com	5
scopus.com	10
ieee.org	6
emeraldinsight.com	2
ebscohost.com	6
Total	**38**

At an international conference on the application of agents and multi-agent systems held in 2018, the conception was discussed of autonomous AI systems for an adaptive management of resources based on multi-agent technologies. They are equipped with a multilevel model of virtual market and a method for conflict resolution and search for adaptive consensus-based management of resources. Such systems provide solutions for supplies of autonomous AI solutions managing vehicles and factories, mobile teams, supplier chains, aviation, and railways. The efficiency of corporate resources is significantly improving. Knowledge from industrial applications is used with further AI improvement to solve extremely difficult problems of adaptive resource management (Skobelev, 2018).

Below are examples of smart solutions in three key areas:

New value in the field of mobility

The new value for mobility in Society 5.0 is implemented, for example, by offering trips tailored to user preferences and designing optimal routes taking into account weather, traffic jams, etc. Optimal routes are found using user interfaces with navigation systems, public transport systems, and shared-vehicle systems. They also involve autonomous driving systems reducing the number of road accidents.

These solutions may help decrease CO_2 emissions while supporting regional rehabilitation and fuels saving. (Cabinet Office, 2017).

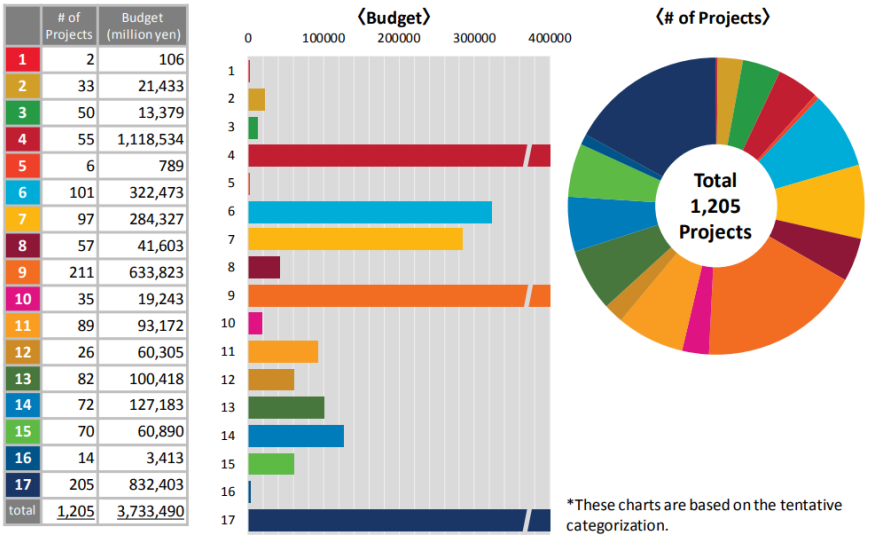
New value in the fields of healthcare and care-giving

In healthcare, support will be given for healthy life style and early disease detection by domestic robots and online examination. Optimum treatment will be provided in any place by sharing physiological a medical data and robots will help decrease healthcare load. These solutions may cut the social costs of healthcare and care-giving helping address problems with labour shortage in healthcare facilities (Cabinet Office, 2017).

New value in the field of Agriculture

Innovations in agriculture in Society 5.0 may help increase food production to stabilize the offer, resolve the problem of labour shortage in agricultural regions, reduce food waste and stimulate demand. This may be achieved using big-data analyses involving varied information such as weather data, crop growth data, market conditions and trends, and food consumption (Cabinet Office, 2017).

A highly economical and efficient smart agriculture can be achieved by automating agricultural work and saving labour force by using robotic tractors, automatic collection of data on crops by drones and optimizing water management based on weather forecasts and data on rivers. This involves planning customized crops, optimizing work schedules using weather forecasts, sharing experience and expertise, and improving customer care. Agricultural produce can be supplied to customers as needed in autonomously driven vehicles (Cabinet Office, 2017).



	# of Projects	Budget (million yen)
1	2	106
2	33	21,433
3	50	13,379
4	55	1,118,534
5	6	789
6	101	322,473
7	97	284,327
8	57	41,603
9	211	633,823
10	35	19,243
11	89	93,172
12	26	60,305
13	82	100,418
14	72	127,183
15	70	60,890
16	14	3,413
17	205	832,403
total	1,205	3,733,490

2: *Total budget broken down into individual targets of sustainable development.*
Source: Cabinet Office, 2017

Japan has set up detailed plans along with budgets and deadlines. As an example, below are budgets for sustainable development objectives:

How about the safety and privacy of the data collected? This is one of the key questions concerning cyber-physical systems. No universal answer exists as every country has its own unique data protection rules.

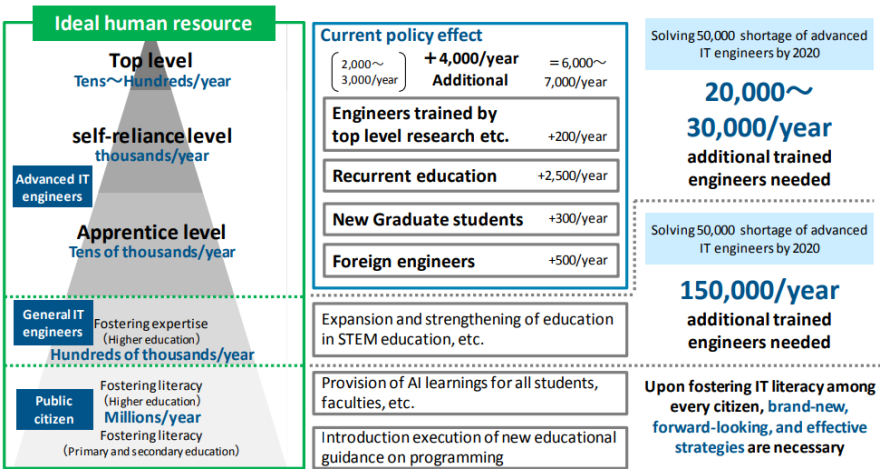
2) Human resources

Japan thinks that, in digital society, a large number of people will have to be creating new systems and managing smart devices. Japan is expected to have about 50,000 advanced IT engineers and 300,000 general IT engineers. There are estimates that another 2,000 to 30,000 advanced engineers and 150,000 general engineers yearly will have to be trained (Cabinet Office, 2017).

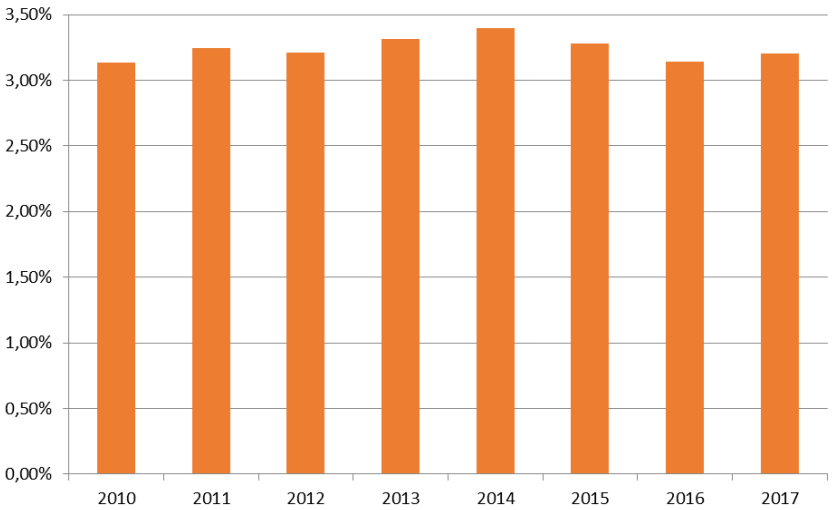
What can other societies do to arrive directly at digital society? Countries wishing to stay in the digital trend of Society 5.0 will have to face the same HR challenges in the IT sphere. Preparation may be a solution. Preparing education for a highly skilled IT engineer, organizing conferences and seminars to inform people on the new digital era and get ready for a major change in the living conditions.

3) Science and research spending

Japan is one of the countries with the highest GDP proportion of investment. In 2017, the government spent 3.2% of the gross domestic product on science and research. Over the last 20 years, Japan has kept the spending at about 3% of GDP.



3: *IT-human resource development for society 5.0.*
Source: Cabinet office, 2017



4: *Gross domestic spending on R&D in Japan (2010–2017)*
Source: OECD, 2019

Czech Republic

The Czech Republic is the most industrialized European country with industry accounting for 37.5% of its GDP, which is more than the world's average of 29.9%. The bulk of the Czech industry is represented by the production of machines and cars forming 54.5%. The Czech industry is among the traditional drivers of the domestic exports, which is important particularly because exports accounted for 80.3% of the Czech 2017 GDP (World Bank, 2017).

This rather narrow strategy focus of the exports is balanced by efforts to strengthen those industry branches that have a high percentage of value added. Thus, technical education becomes a key factor of boosting the knowledge economy. Over the past five years, the Czech Republic, like the whole of Europe, has been experiencing a period of economic boom.

The unemployment rates in the Czech Republic and Germany are the lowest in the EU. The labour needs thousands of additional workers, mostly technical professionals including both blue-collar workers and highly qualified experts such as in the IT or mechanical engineering industries.

While significantly restricting further business activities, this present lack becomes a limiting factor of further economic growth of the Czech Republic (in Putnová *et al.*, 2018)

1) Government programme supporting digital technologies – Czech Republic

The Czech government follows the worldwide trend realising the necessity of preparedness for the far-reaching technological changes. To a large degree, such changes have been designed by a strategy called Digital Czechia.

"*The digital module of 19th May 2010 can be viewed as the first flagship of the Europe 2020 strategy for the role and use of ICT in removing all kinds of electronic barriers in Europe. The main focus of this strategy is on the application of ICT to solutions of the global problems society is facing such as climate change and population ageing. Based on the 2010 initiative, European Information Society for Growth and Employment, the new strategy covers virtually all areas of life thanks to its horizontal aspect. The digital module envisages about 100 subsequent measures with 31 being of legislative character. These measures aim to build a unified market with no barriers for the member states.***"** (Ministry of the Interior, 2019)

Rational use of information and communication technologies increases productivity and competitiveness. This is closely related to the concept of digital economy and society. Several different problem areas have to be addressed at the same time with examples listed below:

- Electronic healthcare (eHealth, Health 4.0)
- Electronic education
- Electronic culture (eCulture)
- Innovations, research and development 4.0
- Industry 4.0
- Civil engineering 4.0
- SMART Region/City/Village concept (Sedlák, 2018)

Czech society and the industrial lobby realize the necessity of digitalizing the Czech Republic to keep it competitive. The truth is, however, that the present efforts are only focussed on high-speed internet and full coverage of the Czech Republic.

More advanced analyses and detailed blueprints as in Japan are not among hot issues. This means that, although Czech society is concerned with new technologies connected with the new era, this is only reflected in visions without any particular deadlines, responsibilities, or budgets.

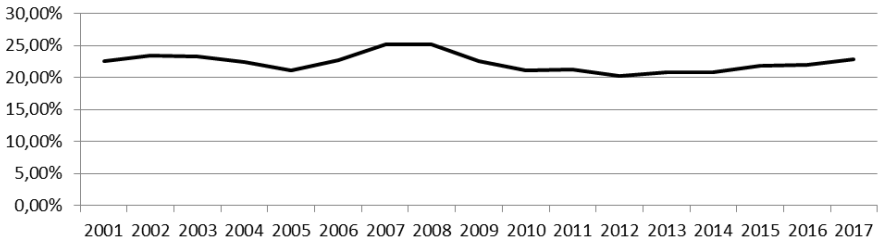
2) Human resources

There is a myth in the Czech Republic that interest in studying engineering has been steadily waning. By the below diagram, the percentage of engineering graduates ranges between 20 and 25. Universities are trying to attract students by offering them scholarships and grants. There is no official subsidy policy to help young people select a suitable field of study. There is even a general aversion to supporting activities encouraging students to select engineering fields. This reluctance may be due to the previous central planning in the communist era. The simple truth is that there are no strategic plans in the Czech Republic for increasing the number of graduates in engineering fields.

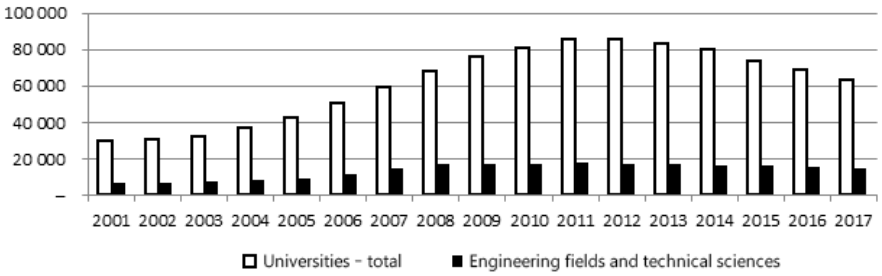
The below diagram is based on the demographic curve, which is unfavourable for the Czech Republic. The increased demand for technically educated people will have to be coped with by recruiting foreign experts.

3) Government spending on research and development

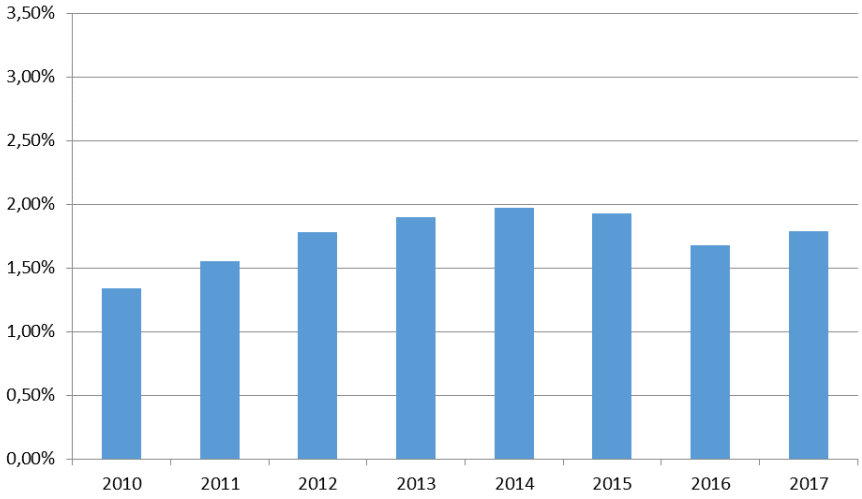
The below graph shows the development over the last eight years. It is obvious that the R&D spending has not been increasing, especially in the years of the Czech government concentrating on the Digital Czechia strategy. This is, no doubt, one of the reasons why this strategy is being implemented at a very slow pace.



5: *Percentage of graduates in engineering fields.*
Source: Ministry of Education, 2019



6: *Graduates in engineering fields.*
Sources: Ministry of Education, 2019



7: *Gross domestic spending on R&D in the Czech Republic (2010–2017)*
Source: OECD, 2019

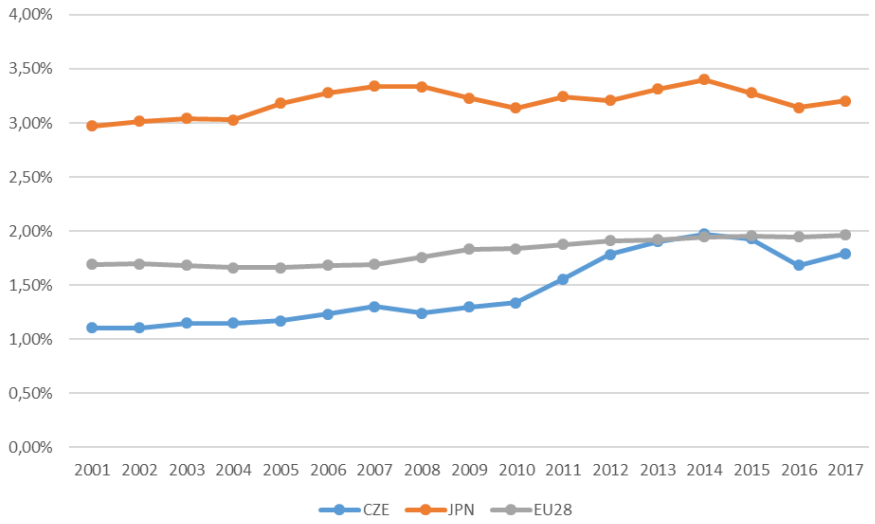
Graphic comparison of the government R&D spending in both countries

The below diagram shows the governmentR&D spending in Japan and Czech Republic along with the EU figures.

DISCUSSION

The advances of technology as currently presented by Japanese society will involve all advanced countries step by step. As an industrialised country, the Czech Republic should be prepared in this respect on changes in society induced necessarily by the new production technologies. From previous analyses, it is clear that Japan is aware of the necessity to set up a strategic blueprint for the people to adapt to the new living conditions. Japanese investment in science and research, detailed strategy and educated people make a good starting point for successful implementation.

It should be noted that, being strongly hierarchy-rooted, Japanese society can rely in its efforts on its traditions and inborn respect for the observation of given rules and regulations.



8: *Government R&D spending since 2001.*
Source: OECD, 2019

In this respect, the situation in Europe (including the Czech Republic) will be much more complex. Digitalisation and technological changes will undoubtedly transform the labour market causing uncertainties and conversions.

Unlike the Japanese government, the Czech one does not yet go into much detail on Society 5.0. Currently, it is concerned with the advances of industry in Industry 4.0 and the Digital Czechia programme. Technical education will be a great challenge for universities.

While in Japan, preparations are well under way to educate specialists for implementing the strategically important changes in all areas, the Czech Republic is still unprepared for this. Although it is evident that it will have to recruit foreign experts, the Czech government has not even a rough plan for how to do it and how to keep such specialists in the Czech Republic. This unclear vision is due to the absence of a long-term economic strategy with strong political support.

In the long-term context,R&D spending represents one percentage point less with respect to GDP, which, in terms of the previous development, will lead to the Czech Republic being not able to keep abreast of the development in the world's most advanced countries.

We see the topic of the present paper as a big challenge for Czech society and an appeal to the central authorities to pay attention to this situation. The authors are aware of the fact that they are comparing two different cultures with different histories and ways of life. We believe nevertheless that it is a valuable comparison since life in a global world will change in every European country. The three criteria selected may serve as benchmarks in evaluating the present situation.

CONCLUSIONS

As mentioned above, the topic of Super Smart Society consisting of autonomous systems, smart sensors in connection with digital technologies and artificial intelligence is in its early stage in Europe. In Japan, on the other hand, where this concept was born two years ago, it is already in the phase of preparations, plans, budgets, and case studies.

An opportunity not only for Europe is to catch up with these technological trends in the world. This, however, necessitates large-scale preparations and an analysis of the current environment, technological preparedness, and society itself.

The situation in the Czech Republic indicates that Industry 4.0-related digitalisation is generally seen as a prerequisite needed for the development of the technical infrastructure. Attention must be paid to the changes instrumental in adopting and using digital structures. This is a process that will result in a qualitative change not only in industry but in the labour market and the whole society as well.

By comparing two different cultures, this paper wants to provide inspiration for the important steps to be taken towards digital society. Being well aware of the difference between the Czech and Japanese mentalities, we still believe that success in the actual implementation is in both cases contingent upon sufficient spending on research and development, and better education of specialists in strategic areas.

In this sense, Japan is an inspiring example for the Czech Republic and the European Union.

No doubt, a broader discussion on this topic is also necessary. The sooner the academic sphere starts to take attitudes towards this phenomenon, the better. The future research should be directed at advances in the preparations for digital society in the Czech Republic. The present study might serve as one of the benchmarks.

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