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COVID-19 pandemic boost to digitisation of the Czech society

The research focused on four digital technology areas (digitisation of common citizens' lives, telemedicine, digitalised education and additive production) for which the pandemic COVID-19 opened a window of opportunity. The objective of the research was to assess if the temporal dominance of the digital technologies changed the attitudes of the citizens and norms and institutions of the society towards their further expansion when the pandemic restrictive measures phase out.

In the analysis, we explored the actors' COVID-19 pandemic experience and investigated the resulting changes in the sociotechnical landscape. The followed foresight assumed that these changes would determine the extent and speed of the diffusion of the selected technologies in the future.

Generally, it is expected that digital technologies will temporarily step down from their sociotechnical dominance as a counter-reaction to their rather involuntary use during the pandemic restrictions. However, gradually they will develop in hybrid systems, keeping some features of the current systems, while a vast majority of operations will be carried out electronically. Digital technologies will save time and costs, and enhance the quality of goods and services tailored to the customer's character. Technological optimism dominated in expert panels and workshops while only a narrow range of risks were emphasized: loss of closer social contacts and loss of necessary habits, discipline and motivation in education, home office or even in telemedicine, physical and mental health risk and digital divide.

We provide two sorts of policy recommendations: the first one follows the instrumental perspective where the policy should (a) concentrate on mitigating digital divide and (b) regulate negative impacts and risks. The second one reflects the common perception of digital technologies as "necessary evil" to survive. It is mainly because users were little involved in their development. To address it, the government should promote transdisciplinary research and co-creation.

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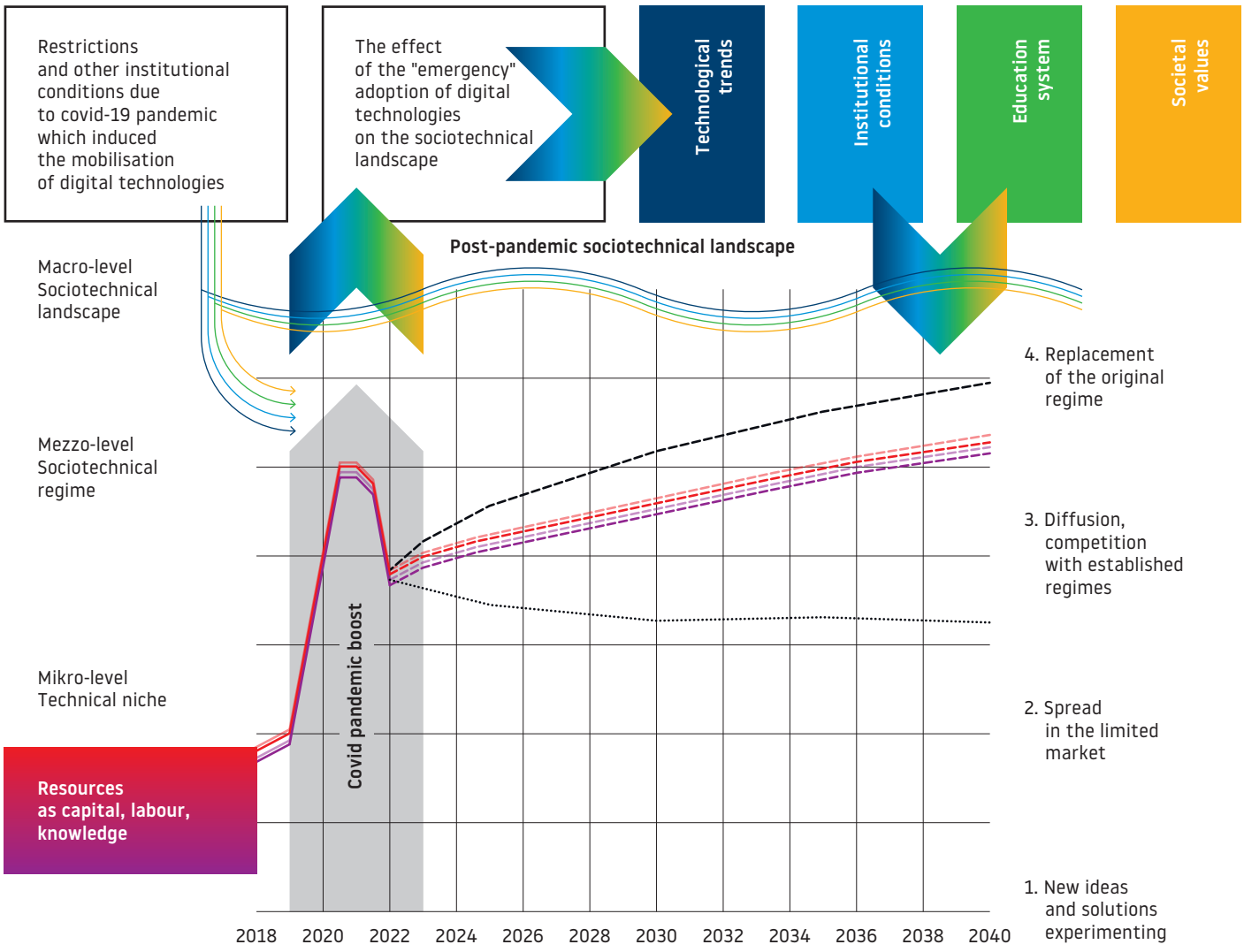
Introduction

In the projects 4TECH of the Programme ETA of the Technology Agency of the Czech Republic (TA CR, 8/2020 – 7/2022) and STRATIN + (MEYS, 2021 – 2024) we focused on four technologies or technological systems (digiti-sation of citizens' lives, telemedicine, digital forms of distant education and additive production) for which the pandemic COVID-19 opened a window of opportunity due to restrictions on personal contacts. The ultimate objective of the research was to assess if the temporal dominance of the digital technologies changed the attitudes of the citizens and norms and institutions of the society towards further expansion of these technologies even when the pandemic restrictive measures would be phased out.

Approach

To capture the complexity and dynamics of the diffusion of digital technologies in business and everyday life of citizens we use the multilevel innovation concept (Geels, 2002 and Geels, 2006) in which the new technology applies first only in limited market/space (micro-level), gradually spreads and competes with other technological regimes at the mezzo-level, and eventually establishes in the sociotechnical landscape (macro-level) see Figure 1. We aim at changes in four areas of the sociotechnical landscape (technological trends, institutional conditions, learning processes / educational system and societal values – see the top part of Figure 1. In the analytical part of the project, we first explored secondary sources referring to the use of selected technol-

Figure 1: Multilevel innovation concept



Source: Own concept based on Geels (2002), Geels (2006)

ogies during the COVID-19 pandemic crisis (Work Package /WP1) and then we collected the experience and opinions of actors providing services with these technologies (WP2). In the third work package, we carried out a survey among the households – the final customers of digital services. The sec-ondary sources included various statistics of the Czech Statistical Office and professional organisations as well as scientific literature. They constituted the knowledge base upon which we identified information gaps and designed the questionnaires for the interviews with stakeholders; the number of interviews and characterisation of experts are presented in Table 1. Both WP1 and WP2 fed the design of the household survey in WP3; semi-random quota sampling with 1518 respondents for more details see Table 2.

These three work packages enabled us to understand the resulting changes in the above mentioned four areas of the sociotechnical landscape, i.e. in norms, institutions and actors' positions in the sociotechnical landscape (showed in the top part of Figure 1). Then we carried out foresight assuming that these changes would determine the extent and speed of the diffusion of the selected technologies in the future (up to 2040). In the foresight, we worked with four technological expert panels (general digitisation, telemedicine, digitalised education and distributed additive production) and we organised three interactive workshops with stakeholders and experts. The workshops were adhered to the two project dissemination conferences and one international scientific conference and thus the participants recruited from the respective conference audience. The panels included 4 to 8 experts; the experts were selected from the list of stakeholders (representatives of these stakeholders) gathered in the first two work packages. The national (online) workshops attracted more than 10 participants thus we split the participants into two groups of up to 6 experts and stakeholders in order to facilitate better discussion on scenarios. We used Miro online white boards to easy communication among experts and stakeholders. It helped to visualise interactions among various factors determining the future diffusion of the selected technologies.

The foresight exercise was organised in three steps (Summary report 4, 2022). First, the experts identified critical conditions and drivers of the diffusion of the digital technologies in question. Second, they depicted the future in two scenarios - a Proscenario (optimistic),

when most of the critical conditions develop in favour of the diffusion), and a Sceptical one (assuming some substantial barriers to the technology adoption). The second step comprised the description of the effects on the life of firms and citizens, and geographical and social differentiations of these effects too. Finally, we conducted workshops with the stakeholders and experts to verify the outlined futures and to identify the need for public policy interventions.

Table 1: Number of interviews and characterisation of experts. In case studies (thematic areas, technologies) in WP2

No.	Case study	Number of interviews	Characteristics of experts / stake-holders
1	Digitisation	6	Representatives of service providers (digital infrastructure, e-commerce, e-government, artists, dramaturgs etc.)
2	Additive production	4	Researchers/academia and entrepreneurs in additive production
3	Telemedicine	6	Doctors, telemedicine promoters
4	Online education	6	Teachers and representatives of their associations

Source: Own description

Table 2: Characteristics of the household (final consumer) survey sample (HWP3)

Age	18–25 (9.7 %) 26–35 (17.5 %) 36–45 (21.3 %) 46–55 (19.2 %) 56–65 (16.3 %) 66–75 (15.8 %)
Gender	Male (50.0 %) Female (50.0 %)
Education	Basic (7.3 %) Secondary without A level (31.7 %) Secondary with A level (38,2 %) Tertiary (22.8 %)
Regional class (Perlín et al, 2019)	Developed (45,7 %) Socially disadvantaged (13.4 %) Socially and geographically disadvantaged (14.4 %) Geographically disadvantaged (13.4 %) Other (13.2 %)

Source: Own description

Research results

Analysis

The results of the analytical part can be summarised in five blocks: 1) Technical capacities of providers and consumers of digitised services; 2) Learning and change of stakeholders' attitudes; 3) Institutions and the respective mechanism governing the adoption of digital technologies; 4) Overcoming the disadvantages of the rural areas and digital divide (see Summary Report 2, 2021). In this part we combine information from secondary and primary (interviews with actors and household survey) sources and draw conclusions on the processes and changes determining diffusion of the selected technologies

Technical capacities

The pandemic showed to the actors that their seemingly good digital capacities and infrastructure might be insufficient to cope with the challenges of the extensive demand for digitised (contactless) services. The most dramatic jump in the digital world happened in the education system neither grammar and secondary schools nor universities were used and equipped for online teaching in sufficient extent. In spite of the rapid expansion of e-commerce already before the pandemic, most of the large retailers like IKEA were not technically prepared for the transition to almost exclusive online shopping. However, the lack of technical equipment limited the use of these services only in the first wave of the COVID-19 pandemic, the actors invested in the technologies and improved their technical capacities very quickly (before the autumn wave in 2020) as it resulted from the interviews with stakeholders.

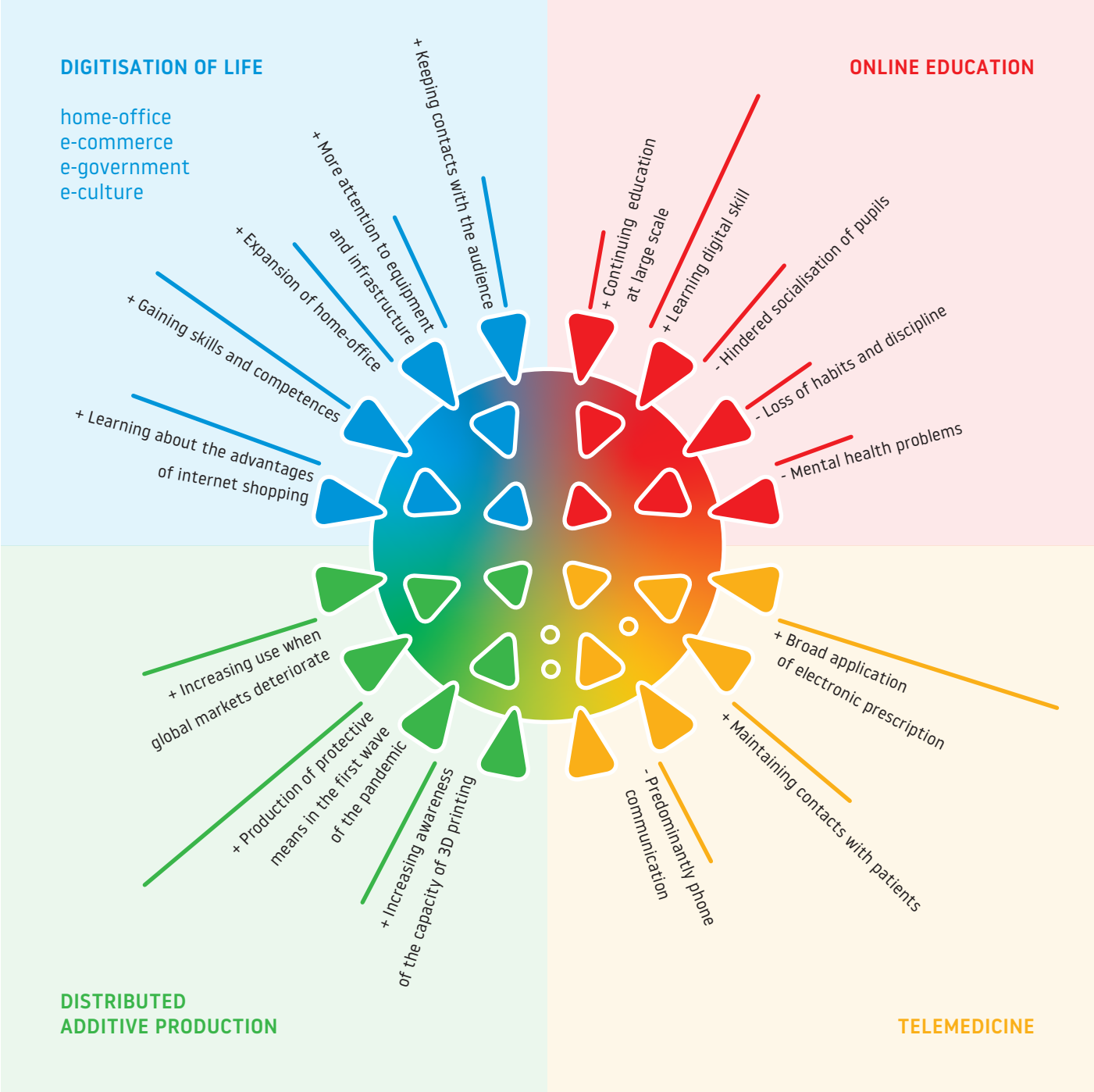
Learning and change of stakeholders' attitudes

The sudden (emergency) transfer into the online space required rapid and intensive learning to acquire the necessary digital skills and to understand functioning of the digitalised society. A great deal of improvisation featured this trans-fer particularly in the first wave of the pandemic. It was learning by doing, resulting eventually in actors' enhancement of knowledge, and shifts in lifestyle and values. According to the experts, these shifts are likely irreversible (WP2 – Summary Report 2, 2021), despite common declarations of the project survey respondents that households would like to limit digitalised services in the future (WP3 - Summary Report 3, 2023). The survey also showed considerable digi-tal competences (at the scale proposed in Van Deursen et al., 2014) of households concerning the use of ICT, social networks and information sources. Undoubtedly, the length of lockdowns contributed to breaking mental blocks and changing actors' attitudes. Two years of tough restrictions on social contacts gave time to all actors to understand new possibilities of digital technologies, test them and verify their benefits. Coping with challenges of the pandemic emer-gency required mobilisation of many skills and resources, and openness to new approaches and solutions. On the other hand, a number of actors feel to be forced to change their attitudes and habits, and thus a counterreaction (a temporary refusal of the digital technology use) can be expected.

Institutions and the respective governance mechanism

The adopted innovation concept (Figure 1) assumes that new technology converts in the sociotechnical regime only under favourable institutional conditions. The interviews with experts and key stakeholders indicated that such a change of institutions had happened since the outbreak of the COVID-19 pandemic or it at least triggered a debate on needed changes of legislation, norms and other rules. The legal right on capacity internet connection can be mentioned as an example. The progress was made by accepting the wellestablished bank identity as suitable identity verification for e-government services. Moving teaching from classrooms to online conferences raised question as if such education is still compulsory. It is important to stress that online education changed the distribution of responsibilities between the school and parents. In spite of the fact that online education was well managed (given the circumstances) and had grad-ually improved, the quality varied among schools, which turned attention to the need for standards and guidelines. The Act on Healthcare Electronisation (2021) provided an important legal framework for the development of telemed-

Figure 2: The adoption of the technologies during the COVID-19 pandemic critical period 2020–2021



Source: Own illustration based on Summary Report 4 (2022)

icine, but most of the institutional challenges including the rights for telemedicine care and its financial coverage will need to be resolved in the future.

One of the most critical institutional challenge is finding the balance between extensive digitisation of the services and prevention of the exclusion of those who have reservation or lack of financial resources, capacities and skills to manage electronic means and digital applications. The technical digital divide occurred mainly in the first wave of the COVID-19 pandemic in spring 2020. The public administration intervention and the assistance provided by civil society organisations reduced it substantially. The most serious problem arose in the area of the application of the technical means. It appeared that some groups of citizens had difficulty to cope with new settings given by extensive use digital technolo-gies in order to bridge pandemic restrictions. In contrast, it created new opportunities for some social groups and indi-viduals. The socially conditioned digital divide is an important phenomenon, which needs to be explored more (see also Beaunoyer et al., 2020).

Overcoming the disadvantages of the rural areas and digital divide

The interviews with stakeholders (Summary Report 2, 2021) showed that the investigated technologies had and would have capacity to moderate disadvantages of some rural regions - particularly significantly rural regions according to the OECD classification (OECD, 2011) and to integrate them more with urban areas. Pandemic of COVID-19 boosted home office, otherwise very limitedly used in the Czech Republic before (Grossmann et al., 2021). The (temporary) migration from metropolitan to rural areas appeared in regions with good internet connection. On the other hand, digitisation might not help (or bring only marginal benefits) in remote regions since low density of customers limits the private sector to provide services (high speed internet connection, delivery of online purchased products, etc.) at acceptable price. The problems might then allocate to otherwise weak social group in the "digitally" disadvantaged regions. We can call it sociogeographically conditioned digital divide. In contrast, geographical differentiation (based on the typology given by Perlín et al, 2019) of opinions and attitudes was not confirmed as statistically significant in the household survey (WP3 -Summary report 3, 2022) It has probably two reasons:

- It was an online survey, thus those completely excluded were missing in the sample.
- In the typology itself which does not reflect important parameters relevant to digitisation.

There are significant differences in the extent and ways of the adoption of the investigated technologies during the most critical period (spring 2020 – spring 2022) of the COVID-19 pandemic in the Czech Republic. These are illustrated in Figure 2. While online education and online shopping (in some segments) completely replaced the conventional technology, digital means in culture, public administration or medicine aimed primarily at keeping contacts and providing information.

Most of the "telemedicine" consultations happened on phone, since there were no specific telemedicine platforms avail-able and the both parties (i.e. doctors and patients) were not used to apply available conference systems efficiently. On the other hand, the electronic prescription, electronic registration and digital vaccination certificates were used extensively.

There is a specific story of additive production. It demonstrated convincingly the advantages of flexible distributive production in the time of the critical shortage of protective means. Although it was later replaced by cheaper mass production (plastic injection), additive production attracted attention of industry. With disruptions in the global market following the COVID-19 pandemic, 3D print has become deployed still more in the production of various spare parts or components, which are used in low numbers.

Foresight (WP4)

The critical conditions on which builds the foresight exercise mirror to large extent the above mentioned analytical findings. They comprise: (i) Technical conditions including the development of digital instruments for the interactions among actors or the control of processes as well as their availability for actors; (ii) Institutional conditions which de-termine anchoring the technical advances in the sociotechnical landscape: in legislation and technical and societal norms. (iii) Financial conditions which determine the use of digital instruments (it might be particularly important for the diffusion / use of telemedicine); (iv) A specific issue is to secure skilled ICT professional in the public sector; (v) Symbolic recognition of the digital technologies (like online education, telemedicine or digital culture) to be equivalent alternatives to the established systems were stressed especially by educational experts. The importance of these critical conditions for the diffusion of the investigated technologies is shown in Table 3.

Generally, it is assumed that digital technologies will step down temporarily from their sociotechnical dominance as a counterreaction to their rather involuntary use during the COVID-19 pandemic restric-

Table 3: Critical conditions

	Digitisation	Telemedicine	Digitalised education	Additive pro-duction
Critical internal factors	**x**	**xx**	**xx**	**x**
Available technical equipment	x	xx	x	xx
Development and availability of hardware	x	xx	xx	x
Training and education of actors	xx	xx	xx	xx
Specific legislation	x	xx	xx	x
Setting up standards and norms	x	xx	xx	xx
Convenient financial conditions	x	xx	x	x
Critical external factors	**x**	**xx**	**xx**	**x**
General progress in hardware and software	x	xx	xx	xx
Digital technology oriented education	x	xx	xx	xx
Suitable general legal framework	xx	x	x	x
Favourable conditions for IT specialists in public administration	xx	x	xx	
Symbolic recognition of the technology		xx	xx	x

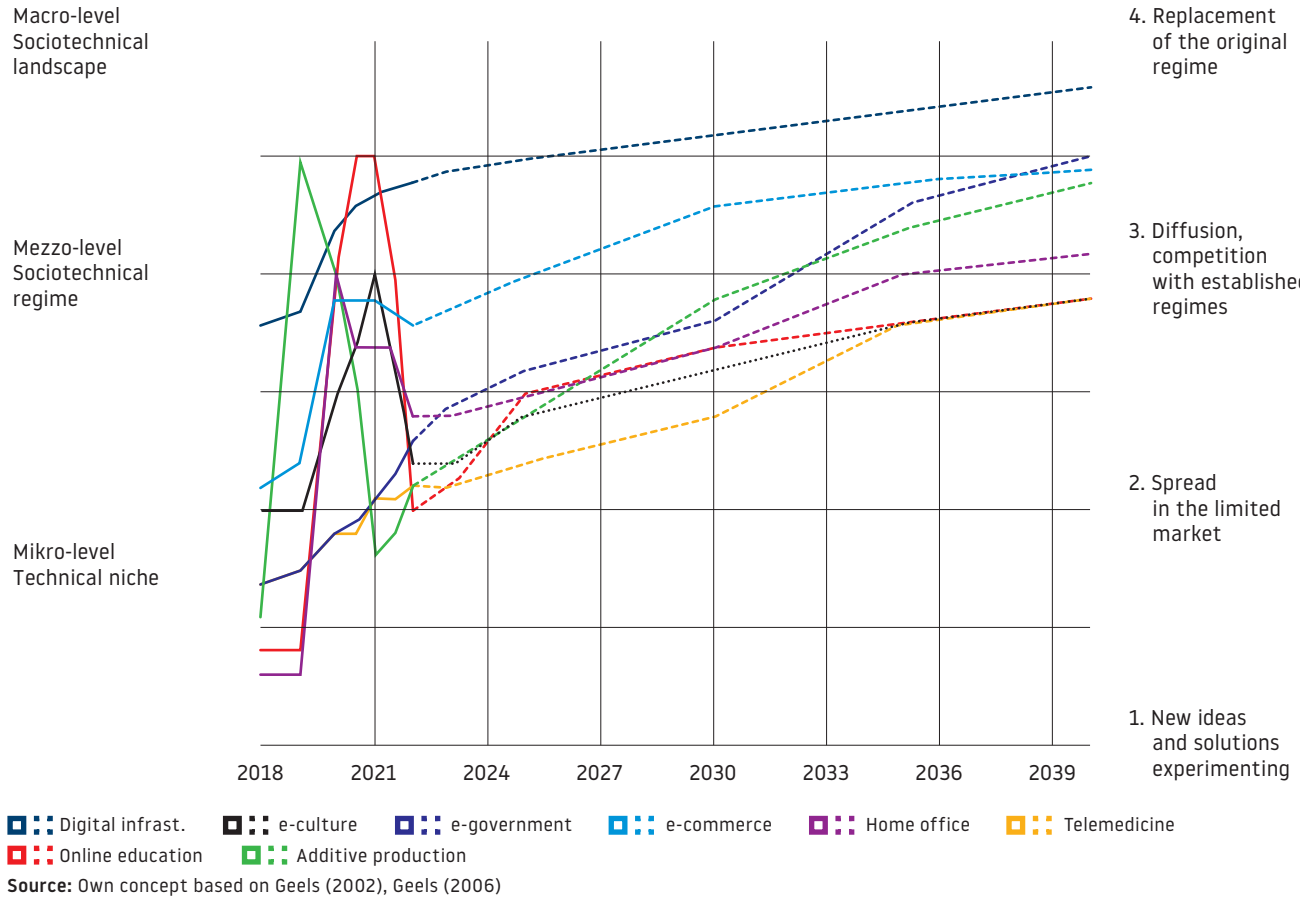
Source: Own illustration based on Summary Report 4 (2022)

tions. However, gradually the studied technologies develop in hybrid systems, which will still keep some features of the current (conventional) systems, while a vast number of operations will be carried out electronically. Experts stressed that digital technologies would save time and costs, and when integrated with Artificial Intelligence (AI) would also enhance the quality of services and goods and would tailor them to the character of customers. Technological optimism of the Proscenario dominated in expert panels and workshops. It would confirm that the society / sociotechnical landscape absorbed a lot from the pandemic digital experience.

issue). Physical and mental health risks were emphasized too, but in smaller extent in contrast to Varanauskas (2022) – who paid strong attention to these issues.

The technological optimism built on the assumption that digitation allows almost unlimited collection and processing of measurable data which will help improve diagnoses, estimate human behaviour and control processes/ treatments better than humans with limited capacities, and thus reduce uncertainty. Only few experts warned that absence of un-measurable information like emotions or trust in digital communication might in contrast increase the uncertainty and

Figure 3: Illustration of experts' projections of the diffusion of the investigated digital technologies



Source: Own concept based on Geels (2002), Geels (2006)

Conclusions and policy implications

Rather a narrow range of risks appeared in expert panels or in foresight workshops. First, it was a loss of closer social contacts due to digital technologies which might eventually lead to the problem of socialisation of certain social groups (e.g. pupils - similarly reported by Varanauskas (2022), or old people). Further, there was mentioned a loss of necessary habits, discipline and motivation in education as stressed by Sotoudeh (2022) for Austria, in home office work (see Grossmann et al. 2022) or even on the side of patients in telemedicine. The entire digitisation of private and public services will threaten disadvantaged social groups which members have no means, capacity or will to acquire necessary skills and knowledge (digital divide this might even amplify with larger adoption of artificial intelligence applications. Teacher or doctor thus might lose some important views on the subject of the treatment and the client the responsibility. In the effect, the education process or treatment might deteriorate. It will be very relevant to follow the experience from psychotherapy and psychological counselling where online sessions are rather common (Weinberg, Rolnick, 2019).

Two sorts of policy recommendations are provided to reflect research results: the first set of recommendations reflects technological optimism, thus determinism in which technologies are perceived as instruments for resolving problems (De Hond, Moser, 2022). That

what actually happened in the period of COVID-19 pandemic. From the instrumental perspective, the policy should (a) concentrate on mitigating digital divide by supporting purchase of the technology, training and advisory for individuals and small firms (in the accord with Beaunoyer et al. (2020); and (b) regulate nega-tive impacts and risks of digitisation, particularly, concerning privacy and security. The second set of recommendations refers to the fact that the technologies in the question attracted a rather limited part of the population while for the rest they were "necessary evil" to survive as it resulted from the household survey that respondents would like to limit use of digital instruments in the future. It is to large extent because users were little involved in the development of these technological systems. Thus, the government might consider addressing this problem by supporting transdisciplinary research and co-creation (Bijker, 1994). Institutionalisation of technology assessment (Hoppe, 2010, Ganzevles and van Est, 2012) in the Czech Republic will help the government to cover the both areas of policy recommendations.

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4Tech Project outputs (see *https://venkov3.cz/4tech/*, page Výstupy, only in Czech):

- Summary Report 1 (2021): Výzkumná zpráva V1: Rozsah a formy využívání vybraných technologií v souvislosti s opatřeními proti pandemii covid-19.
- Summary Report 2 (2021): Výzkumná zpráva V2: Výsledky případových studií o využívání vybraných technologií v souvislosti s opatřeními proti pandemii covid-19.
- Summary Report 3 (2022): Výzkumná zpráva V3: Výsledky kvantitativního šetření o využívání vybraných technologií v souvislosti s opatřeními proti pandemii covid-19.
- Summary Report 4 (2022): Výzkumná zpráva V4: Foresight 4 technologií, které dostaly impuls v době pandemie co-vid-19, a doporučení pro politiku.