Complex Digital Citizen Services in Coronavirus Age

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Abstract. *Digital transformation has proven itself to be of utmost importance for citizens' participation in political activities and their need for a timely and quick provision of services. Despite the recent coronavirus pandemic, we are all witnessing the true power of the European Commission's digital governance policies and actions. Changes that have occurred in a timely manner are clearly driving development and implementation of new set of citizen digital services. They represent a logical step towards digital society, considering the always-developing information and communication technology and society threats and opportunities. The aim of the paper is to present public e-services that emerged during the COVID-19 pandemics in Croatia to show efficiency of modern e-Government solutions, and to introduce some fundamental aspects of complex digital services architecture needed to level up entire digital public sector.*

Keywords. COVID-19 pandemic, digital governance, complex digital services architecture, e-Government, e-Citizen

1 Introduction

During the Croatian Presidency of the Council of the European Union, two EUPAN meetings were scheduled for April and June 2020. EUPAN meetings are a unique platform for Director Generals responsible for public administration in the Member States to exchange knowledge, experience, and best practices. In guided workshops, participants discuss solutions to common challenges faced by most public administrations of Member States. For a two days program of plenary sessions with presentations and keynote speeches, followed by the workshops, the part of agenda covered in these findings was set to tackle the development of complex digital services for citizens and businesses.

2 Going Digital

Making a transition from traditional to digital services has many benefits. Going digital, i.e. providing electronic delivery of information, reduces costs and time to market, it improves efficiency, provides higher transparency and provides full auditability joint with better customer service (Fadi, 2015). It is so important that Europe fit for the digital age[1] becomes one of six top Commission priorities for 2019-24. Empowering people with a new generation of technologies such as artificial intelligence (AI) and big data aim to encourage businesses to work with these new technologies helping to achieve its target of a climate-neutral Europe by 2050.

Making a transition from traditional to digital services in Europe started in the '90s when the general public began using the internet on a larger scale. For instance, the e-Commerce Directive, adopted in 2000, aimed to achieve the objective of freedom to provide online services across the Single Market by offering a flexible, technology-neutral, and balanced legal framework. It is a long, never-ending journey, because the European approach to digital transformation means empowering and including every citizen, strengthening the potential of every business and meeting global challenges with European core values.[2]

Nowadays, in the era of Industry 4.0, with so many technological breakthroughs and challenges, choosing, adopting and implementing right governance strategy for Sustainable Digital World is main priority of policymakers within various national governments, European Commission and international organizations like United Nations (UN) and Organization for Economic Co-operation and Development (OECD). In June 2017, at OECD Ministerial Meeting in Paris, three overarching governance options for sustainable digitalization emerged: (i) a laissez-faire, industry-driven approach; (ii) a precautionary and preemptive strategy on the part of government; and (iii) a stewardship and "active surveillance" approach by government agencies to reduce risks derived from digitalization while promoting private sector innovation (Linkov et al, 2018:441). At the level of United Nations, no matter which model or combination of models particular government choses, clear set comprising of 17 goals and 169 targets or objectives

[1] European Commision. Commission priorities for 2019-24. Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024_en

[2] European Commision. Strategy, Shaping Europe's digital future. Retrieved from https://ec.europa.eu/digital-single-market/

are formulated as Global Sustainable Development Goals.[3]

In Europe, European Commission dedication and commitment towards digital society is also visible not only with common set of criteria, but also by the implementation of regular monitoring and encouraging progress of every single EU Member State. Indicators of digital competency are published yearly, staring in 2016 with Digital Progress report (EDPR), lately transformed to Digital Economy and Society Index (DESI). A composite index that summarizes five relevant progress indicators: (1) Connectivity (*Fixed broadband take-up, fixed broadband coverage, mobile broadband, and broadband prices*), (2) Human capital (*Internet user skills and advanced skills*), (3) Use of Internet (*Citizens' use of internet services and online transactions*), (4) Integration of digital technology (*Business digitization and e-commerce*) and (5) Digital public services (*e-Government*). A relative overall index of all five indicators for the last DESI 2020[4] report is presented in Fig. 1.

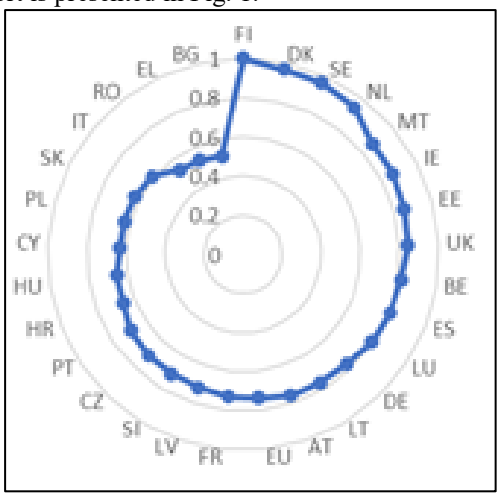

Figure. 1. Normalized composite sum of indexes of all five DESI indicators by max value of sum, Diagram by author

In the context of the development of complex digital services, regarding DESI 2020 report, it is indicative to compare the indexes for the two indicators related to adoption of Digital Services by businesses (4) and citizens (5).

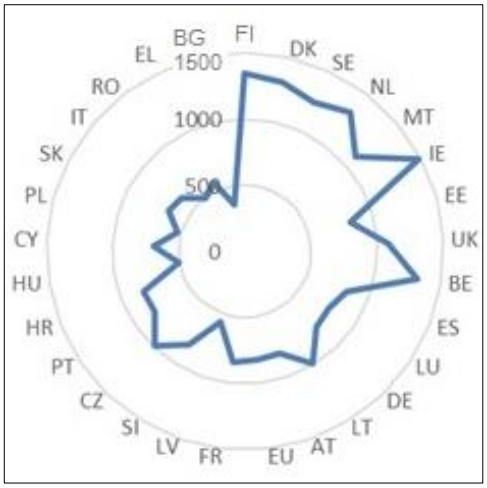

Figure. 2. DESI Indicator (4) - Integration of digital technology, Diagram by author

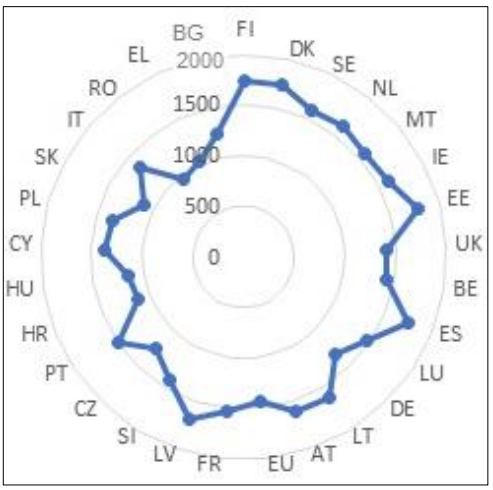

Figure. 3. DESI Indicator (5) – Digital Public Services, Diagram by author

A comparison of these Spider diagrams shows that the EU countries on the right side of the diagram have better score compared to the countries on the left side of the diagrams. However, it is interesting to see that in countries with the best scores there is a difference when compared by the above indicators (4 and 5). In the field of Digital Public Services, the EU countries Estonia, Finland, Denmark and Spain have the best scores, and in the field of Integration of Digital Technologies by businesses, top scores have EU members Ireland, Finland, Belgium, and the Netherlands. This indicates that even top scorer countries are still in phase of growth, needing to spread their own solution portfolio across public and business sector.

The report[5] states that „the data on the integration of digital technologies by businesses showed large

[3] United Nations, Department of Economic and Social Affairs. Sustainable Development, Transforming our world: the 2030 Agenda for Sustainable Development. Retrieved from https://sustainabledevelopment.un.org/post2015/transformingourworld

[4] European Commissions. The Digital Economy and Society Index (DESI). Retrieved from https://ec.europa.eu/digital-single-market/en/digital-economy-and-society-index-desi

[5] European Commission. Integration of Digital Technology by Enterprises. Retrieved from https://ec.europa.eu/digital-single-market/en/integration-digital-technology-enterprises

variations depending on the company size, sector and also the Member State“. Enterprises were becoming more and more digitized („8.5% of large companies relied already on advanced cloud services and 32.7% were using big data analytics“) than SMEs where only 17% of them using cloud services and only 12% big data analytics.
This shows clear trend, set by business usage of cloud services and big data analytic, which is expected to be followed by public sector within delay period of 5 – 10 years. But, from public sector governance policy standpoint, both trends are in center a of very long public debates. First one, on data sovereignty, started with Government Cloud Computing and National Data Sovereignty dilemma (Irion, 2012), and second is coined as paradox of “being able to gather unprecedented amounts of information, but being largely unable to turn this information into insight and effective action and problem-solving” (Misuraca, Viscusi, 2014:440).
Those delays may finally be resolved because; on February 19th 2020 European Commission released its brand new Digital Strategy, which particularly outlines fundamental elements for the creation of Digital Europe. “It include a five-year policy roadmap, a White Paper on Artificial intelligence that outlines plans for new legislation on transparent, traceable and human-controlled AI systems and European Data Strategy, a proposal for the creation of an European single market for data”[6].

3 COVID-19 Pandemic

As World Health Organization announced COVID-19 outbreak as a pandemic on March 11th 2020, it was clear that governments across the globe besides “usual” healthcare measures need to utilize existing digital potential in order to prevent escalation. Again, similar to various options in choosing governance strategies for sustainable digital growth, each country and regions have chosen their own paths, without preparation time or clear set of indicators to follow. Everything escalated quickly and simultaneously.

3.1 Digital Paradigm Shift

Some prescriptions to set quick and comprehensive strategy of digital transformation is known from business arena. On a strategic level, according to Gartner Group, world's leading research and advisory company, digital business leaders must account for three crucial factors when trying to estimate the timing of markets and digital changes: technology progress**,** cultural evolution**,** and regulatory developments (Raskino, & Waller, 2016:41).
With the business aspect of market creation/growth in mind, they prescribe: “When all three come into alignment, new markets are created, and they often grow suddenly and rapidly. The leader's task is to estimate when that will happen and to be ready to take advantage when it does … It will be important to identify and work on all three tipping points: In technology, take care not to underestimate or be caught out by the nonlinear pace of change. In culture, evaluate social acceptability and keep testing its boundaries without crossing the "creepy line”. With regulation, innovate because of it or in spite of it, treating it as a potential source of opportunity, not just an obstacle.” Recent COVID-19 pandemic situation fully confirmed their prescription:”The best digital leaders work to nudge one or more of the three tipping points in their favor” (Raskino, & Waller, 2016:41). Translated into corona pandemic and e-government context, in order to make digital paradigm shift, governments should not be conservative in usage of emerging technologies such as big data, AI or distributed ledger. Technologies, very few governments used on larger scale before. Governments by definition have very good understanding of cultural boundaries, they should not force or break, like stronger privacy concerns in Western world. Finally, they are almost absolute owners of legislation changes, third component needed for successful transformation.

3.2 Response to COVID-19 Pandemic Situation

Facing the massive coronavirus crisis, European Commission was ready to quickly adopt its new Digital Strategy. “The strategy gains renewed importance as the Commission deploys digital tools to monitor the spread of the virus, research and develop vaccines and treatments, and ensure that European citizens can stay connected and safe online to keep on learning, socializing, and working. Trusted services, such as e-Signatures, e-Seals and electronic authentication services for businesses, e-Government and eHealth ensure continuity and availability of public services while trusted security systems protect our identities online and make sure that our activities remain private”.[7]
Most governments’ solutions needed quick regulatory interventions in order to move life online, such as education, which has adopted the e-learning paradigm in most of Europe. The same occurred with most administrative tasks where temporary regulation changes, due to the pandemic circumstances, enabled

[6] Data Governance in the EU: Data Sovereignty & Cloud Federation, Center for Media, Data and Society, Mach 23rd, 2020. Retrieved from https://medium.com/center-for-media-data-and-society/data-governance-in-the-eu-data-sovereignty-cloud-federation-f26d44032d63

[7] European Commission. Live, work, travel in the EU, Digital technologies – innovative solutions during the coronavirus crisis. Retrieved from https://ec.europa.eu/info/live-work-travel-eu/coronavirus-response/digital-solutions-during-pandemic_en

most of the digital communication to become legitimate. Many administrative tasks were at least partially digitized, thus slashing the need for administrative personnel, freeing them to work on epidemic fighting tasks like interviewing infected citizens trying to isolate coronavirus outbreaks. Therefore, adopting the regulation to use digital communication and existing services was one of the quickest, thus most effective solutions governments found.

In fighting the epidemic outbreaks, some more complex digital solutions were needed. In order to respect data security and EU fundamental rights such as privacy and data protection, on April 8th the Commission adopted a recommendation to support COVID-19 containment measures through mobile data and apps. Based on this recommendation, the Member States, supported by the Commission, developed an EU toolbox for the use of mobile applications that reflects the best practices in the use of mobile contact tracing and warning apps to tackle the crisis.[8] With this example of respecting and counting on existing cultural standards and differences, EC proved in practice the importance of Gartner's cultural strategic pillar. To achieve a successful deployment of massive digital solutions, the Government needed to take into consideration established cultural norms. In Europe or the USA, no effective solutions used in some other countries with lower individual privacy rights could be successfully applied. South Korea, for instance, implemented a full tracking system for all quarantined people, and China deployed individual QR codes that share information about the personal health status and travel history of each citizen. These codes need to be scanned before boarding buses and trains or entering airports or offices, controlling access even to their own housing complexes.[9]

3.3 Croatian Examples and Challenges

Prior to Corona pandemic Croatian e-Government, as it can be seen from Fig. 3, is among laggards. Croatia ranks 25th out of 28 EU countries. Moreover, it is component 5. Digital public services pulling down entire Croatian DESI index.

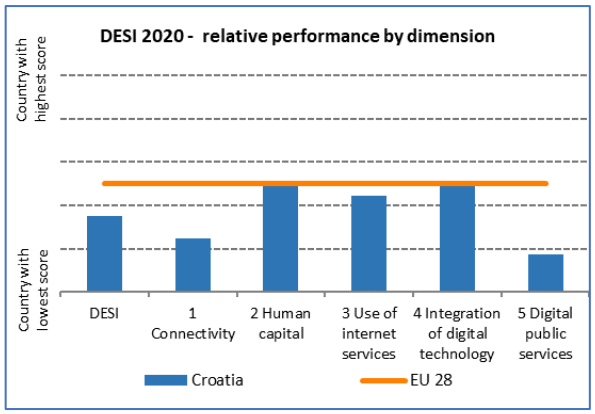

Figure. 4. Croatian DESI 2020 relative performance by dimension[10]

Indicators 2 and 4, which are around average EU28 indicators, are showing potential, and this is exactly what had happened during Corona pandemic. With excellent identity and authorization infrastructure - NIAS (National Identification and Authentication System), as confirmed in DESI chapter "The role of digital to manage the COVID-19 pandemic and to support the economic recovery, Croatia responded promptly. Croatia has taken a large number of targeted measures in digital to deal with the COVID-19 crisis. Several solutions are in the process of being developed to monitor and report persons who are in self-isolation, to minimize contagion and to support the health system".

Solution 'e-Propusnica' (*'e-Pass'*), is a typical example of simple, intuitive and effective e-Government solution for issuing and tracking people travel permits. Solution was created and deployed just a week from the Government's "Decision about the prohibition to leave the place of residence".[11]

The solution is integrated to the existing 'e-Građani' (*e-Citizens*) services infrastructure, so existing public service backbone infrastructure is utilized, exchanging necessary data from all involved stakeholders: Ministry of the Interior, Ministry of Finance - Tax Administration, Croatian Pension Insurance Institute and Ministry of Health. Thus the Civil Protection Headquarters of the Republic of Croatia was able to manage the criteria for travel permissions depending on pandemic situation practically on a daily bases. Citizens would just submit simple on-line form, and in a matter of minutes request would be resolved weather was work/health/private related travel, and all the need-to-know stakeholders were informed. Especially

[8] European Commission. Press corner, An EU approach for efficient contact tracing apps to support gradual lifting of confinement measures, April 20th 2020. Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/ip_20_670

[9] Deutsche Welle, coronavirus tracking apps: How are countries monitoring infections?, DW News, April 27th 2020. Retrieved from https://www.dw.com/en/coronavirus-tracking-apps-how-are-countries-monitoring-infections/a-53254234

[10] Digital Economy and Society Index (DESI) 2020 - Croatia, Retrieved from https://ec.europa.eu/digital-single-market/en/scoreboard/croatia

[11] Deloitte. Decision about prohibition to leave the place of residence and permanent residence in Croatia, March 2020. Retrieved from https://www2.deloitte.com/hr/en/pages/about-deloitte/articles/odluka-zabrani-napustanja-mjesta-prebivalista-stalnog-boravista.html

effective was integration inside Ministry of Interior, as the Police patrols controlling the roads were informed instantly as well, in a form of QR code. As they are equipped with QR readers, there was no need for any manual administrative procedure, se there were no traffic congestion, which saved quite a lot of productivity hours for both businesses and citizens.
In a period of only six weeks of its usage, it became sixth e-Government application with almost half of all registered citizens using it. It provided a total of 2.576.719 individual permits. Total number of unique citizens using e-Citizen services in period 1.6.2014 to 31.5.2020 is shown in Fig. 5.

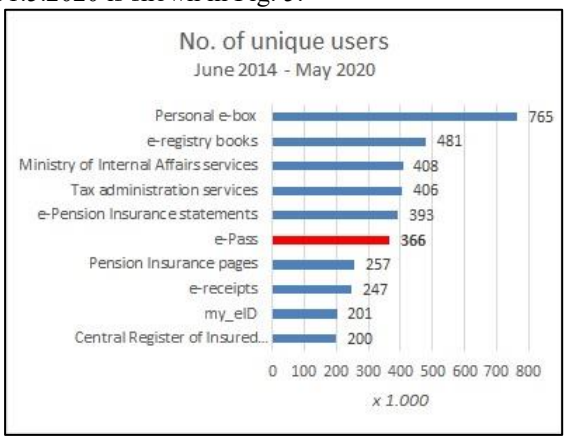

Figure. 5. Top 10 Croatian e-Citizen services[12]; Diagram by author

Second solution example is very different. Using latest AI technology, serving Citizens in time when a myriad of semi-information was circulating, helping them to obtain educated answers and at the same time alleviating the pressure from health professionals. In cooperation with the Croatian Institute of Public Health and private entrepreneurs on April 14th, First COVID-19 Digital Assistant named *'*Andrija*'*[13], was launched. It is a virtual assistant (chatbot), named after Andrija Štampar, distinguished scholar in the field of social medicine, founder of the School of Public Health in Zagreb in 1927. "He" is based on AI that can advise people how to diagnose and manage suspected COVID-19 infections, thus freeing congested COVID hotlines and gathering citizens' information valuable to control possible outbreaks.
In this particular case, partnering with Ministry of Public Administration established trust towards the citizens, Minister Ivan Malenica himself presented this solution as best practice example during High Level Virtual Policy Summit "Post-COVID-19 Europe´s digital Health future - from sharing to empowering", held in Zagreb, on June 26th 2020. Apart from citizen self-assessment, reporting symptoms in the household, and important telephone numbers, 'Andrija' also communicates list of current epidemiological measures in an understandable way, provides instructions for visitors and employees of nursing homes, as well as to all tourists coming to or leaving Croatia. Despite short and successful first wave in Croatia, 'Andrija' has played an effective role contacted directly by 82.817 unique users, answering more than 857.000 questions with customer satisfaction percentage of 87% (users confirmed 'Andrija' actually helped them).

Simple comparison analysis clearly points out the differences between fully integrated, efficient '*e-Pass'* and AI based 'Andrija*'* solutions. Both are quickly deployed, very valuable for all citizens during the COVID-19 pandemic, serving different people's needs. The first one is providing digital travel permission instead of the paper one, reducing administrative burden, saving everyone's time and most importantly - possible exposure to the virus. The other is typical next generation service, based on AI, with WhatsApp interface with medical (virtual) experts. Its primary purpose is to provide personalized expert opinion about ones possible medical status, providing suggestions and next steps to take. From the internal view, first ones complexity is hidden in a workflow connecting five internal government entities using existing government e-Citizen infrastructure, from National identification and authentication system (NIAS) for authentication and authorization, with inherited most of security, availability and privacy mechanisms. On the other hand, *'*Andrija*'* is full of security and especially privacy issues, which often arise when new technology like AI and proprietary interface like WhatsApp is used. There are plenty of open questions, and the most important one is - Are the obvious risks (going live into uncharted technology solutions) worth solution benefit?

4 Further Challenges and Recommendations

Previous chapter shows practical example of European Commission governance principles and actions to respond to COVID-19 pandemic threats. From the solution side, two Croatian example services are presented, illustrating how specific governments can quickly and efficiently respond to crisis. Further use of more similar scenarios, adopting emerging technologies like big data, AI or even distributed ledger is expected. Like in *'e-Pass'* solution, many more backend services will be consumed, probably in much complex workflow. They should be intuitive and easy to use for civil servants, and especially citizens. The next generation of services will be real complex digital services.
Apart from usual concerns on services availability, usability, reliability, interoperability, responsiveness,

[12] Open data portal of the Republic of Croatia, e-Citizen statistics. Retrieved from http://data.gov.hr/dataset/e-gradjani-statistika/resource/177888d5-1aec-4c85-9e92-eaf7da8f82f8

[13] Total Croatia news. Croatia Launches Andrija, First COVID-19 Digital Assistant, April 14th 2020. Retrieved from https://www.total-croatia-news.com/lifestyle/42877-digital-assistant

security, privacy, technology to use, deployment issues, etc., the focus of this paper is on fundamentals – services architecture. Proper architectural design is fundamental prerequisite of any successful digital solution, especially building one solution on another, like most e-Government systems are constructed.
Again, there is plenty of experience in the business world, many business digital services are already deployed in various industries in all kind of scenarios.

4.1 Complex Digital Services Architecture

At the architectural level of building complex digital services, many business/technical advisors can be considered, but one among esteemed experts is Jeanne W. Ross.[14] In times of increased confrontation with digital disruption of businesses and considering digital transformation wave, she published a study "Designing digital organizations" which includes case studies of over 40 companies from many industries discussing the challenges and recommendations of digital transformation. She repentantly insists that digital transformation is never about technology (Ross, et al., 2016:2). It is about redesigning a company, through these postulates:

(i) An effective digital strategy - zeroes in on one of two opportunities that are associated with digital disruption—customer engagement and/or digitized solutions.

(ii) Operational excellence is essential for digital strategy execution and sustained success. Successful companies will rely on capabilities that have been built into a powerful operational backbone.

(iii) Rapid innovation and responsiveness to new market opportunities are equally essential. To facilitate this kind of agility, successful companies will rely on the capabilities of a powerful digital services backbone.

(iv) Existing organizational designs are not well suited to building and leveraging both an operational and a digital services backbone. An ongoing organizational redesign that includes structures, processes, roles, partnerships, and skills is essential to execute a digital strategy.

4.2 Digital Services Backbone and Millennials

What needs to be pointed out is a need to design and develop a second, digital services backbone. While the operational backbone provides seamless end-to-end standard business processes optimized for "regular" business activities, the digital services backbone should be Lego brick style, innovation-driven; providing infrastructure services, data access, identity management, analytics engines, and powerful 24x7 processing enabling constant stream of loosely connected digital innovations to be quickly delivered and easily replaced or discarded. Because of the nature of new customer engagement scenarios and need for rapid solutions, a very important recommendation is also that a company would need a completely different type of people designing, running and operating this new digital services backbone, most preferable millennial generation that truly understands the nature of digital world and services (Ross, et al., 2016:10).
In context of building the new government digital services backbone and hiring Millennials, governments are not having good reputation on attracting quality workforce, especially Millennials. In Croatia, even as there is a shortage of ICT workforce, and youngsters are not so eager to join government institutions, there is very easy solution, which requires just one administrative change. Croatian government should just lower qualification ramp for hiring them from EQF level 7 to level 6. By that, applying simple administrative policy, young bachelors working on digital services would get immediate opportunity to learn and master their knowledge, at the same time resolving the lack of qualified ICT workforce in public sector.

4.3 Connecting Europe Facility Building Blocks and Digital Service Infrastructures

Surprisingly, in European e-Government realm, some services are already available, waiting for member countries to utilize them. In Government digital services space, beneath each EU Member State existing e-Government operational backbone, a set of common Building Blocks exists. On the EU level, the Commission has set up initiatives, programs, and priorities, such as the Connecting Europe Facility (CEF)[15] to facilitate the development of high-quality digital services by creating reusable digital building blocks to facilitate the delivery of digital public services across borders and sectors. It is underlying Digital Service Infrastructures (DSIs) composed of core service platforms and generic services. Core Service Platforms (CSP) are central hubs that enable trans-European connectivity, managed, implemented, and operated by the Commission, and Generic Services (GS) are the link between national infrastructures to the core service platforms managed, implemented and operated by the Member States. Currently, there are eight Building Blocks available: Big Data Test Infrastructure, Context Broker, eArchiving, eDelivery, eID, eInvoicing, eSignature, and eTranslation.

[14] Jeanne W. Ross is principal research scientist at MIT Sloan School's of Management Center for Information Systems Research (CISR), lead author of cornerstone book on enterprise architecture „Enterprise architecture as strategy: Creating a foundation for business execution".

[15] European Commission. CEF Digital, Connecting Europe. Retrieved from https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/C EF+Digital+Home

5 Conclusion

The COVID-19 pandemic situation, as life and business threatening as it is, with a timely and professional response in a way served as a catalyst to the digital transformation of Government e-solutions primarily towards citizens.

Prior to the crisis, and especially after WHO announced COVID-19 outbreak, as citizens and experts we witnessed true power of excellent European Commission digital governance policies and actions. Moreover, as solutions were bringing new, real value to citizens it pushed them to everyday use, thus enlarging the digital literate population, removing obstacles for further massive deployments.

In Chapter 3., two Croatian services are presented and discussed, showing different examples of citizen e-services. First one is 'pretty much' old style, efficient in resolving administrative burden, in the same time speeding flow of people, goods and services (*'e-Pass'*), and second one is modern (*'Andrija'*), mobile, user centric, with latest AI technology deployed. They are both quickly build, citizen centric and efficient, but, in services architectural sense, they are examples of very efficient, but still simple services.

Similar examples can be found in each Member State, which according to their own digital readiness and infrastructure, responded quickly and efficiently, with very concrete support from Commission level like EU toolbox form mobile solutions and many more initiatives, recommendations, and knowledge sharing from more advanced Member States.

From services architectural standpoint, obvious next step will be reinforcement of existing backbone infrastructure(s) and building second, flexible digital backbone, enabling constant stream of loosely connected digital innovations to be quickly delivered primarily to citizens. Build and operated by the Millennial generation that really understands the nature of new digital world and its services.

Funding of such big digital infrastructure investment should be, for instance, from recently announced EU investment of €26.6 million for 55 projects in the areas of Cybersecurity, eHealth, eProcurement, European e-Justice, Public Open Data and European Platform for Digital Skills and Jobs.[16] This particular investment is another example of efficient European Commission governance strategy. Not only delivering policy documents, like 2020 Digital Strategy, but also providing the funding for implementation.

On the other side, the rapid adoption of digital services should never compromise citizens' rights. Digital rights to control their own data and anonymity is an especially important continuation of work on the European Digital sovereignty initiative. With a unique, leading position in a World, this initiative is a true step towards a New System of Internet Governance.[17]

At the end, considering still active COVID-19 pandemic outbreak, there are very concise recommendations from UN Department of Economic and Social Affairs (UN/DESA) Policy Brief #61: 'COVID-19: Embracing digital government during the pandemic and beyond':

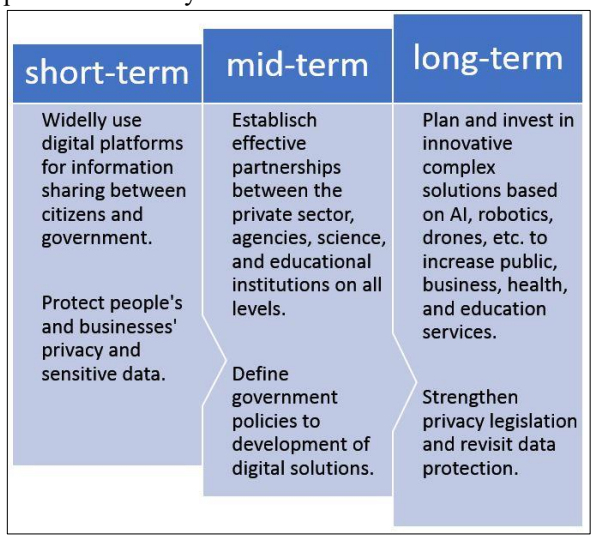

Figure. 6. Digital Government Policy Response to COVID-19[18]

Recommendations, which can be followed and/or modified in case of any new unexpected occurrence of similar catalyst phenomena.

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