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**Scientific foundations training and entrepreneurship activities in the domain of ICT-enabled Governance**

# Report for Electronic Governance research and practice worldwide

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| **Document description:** | The innovative and emerging directions of Electronic Governance research worldwide are discussed and summarised along the most important directions. Definition of Government 3.0 is proposed. |

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# Executive Summary

The expectation of more responsive and customised public services drives the demand for changes in the public sector, therefore public services need improve by adopting new technologies and approaches. Disruptive technologies enabled by Big Data and Cloud Computing can contribute to more responsive, more efficient, personalised services. Technologies like Blockchain, Augmented and Virtual Reality has potential to revolutionise provision of government services and are already changing the e-Government landscape.

In this report, through literature analysis of the core e-Government topics, the authors aimed to describe and define a new emerging stage of e-Government: Government 3.0. This is done by delineating Government 3.0 from previous stages of e-Government evolution, describing the core characteristics of the new stage, its aim and methods, and the role of different technologies aiding to achieve the goal of addressing societal problems with the help of data-driven and evidence-based decision making.

The research presented in this deliverable was conducted using a three-step approach. First, the preliminary literature review allowed to describe Government 3.0 in relation to the previous stages of digital government evolution and create a basic understanding of the new stage and its properties. Then on the second step, the Government 3.0-related keywords were identified, and references were collected to measure and assess the use of the keywords in the e-Government domain. After that, the keywords were further analysed using literature review methodology to understand the level of maturity and implementation of the technology or concept within the domain. The focus of the literature review was to identify the connections between the concepts and their contribution to shaping the emerging Government 3.0 domain. The analysed concepts included disruptive technologies (Machine learning, NLP/ Sentiment analysis, Blockchain, Virtual reality, Augmented reality, Internet of Things), enabling technologies (Big, Linked and Open Data, Data Analytics, Cloud Computing, Service Modules), paradigms (Service Co-Creation, Crowdsourcing and Customised public service provision), and notable realisation of the Government 3.0 technologies (Smart City, Community Awareness Platforms, Once Only Principle, eID and e-Identity).

As the result of the literature analysis, the following definition of Government 3.0 have been proposed:

> *Government 3.0 refers to the use of disruptive technologies (AI, ML, IoT, NLP, VR, AR and big data technologies) in combination with established information and communication technologies (distributed technologies for data storage and service delivery) and the wisdom of crowd (crowdsourcing and co-creation) towards data-driven and evidence-based decision and policy making and provision of relevant smart customised public services for decision support of citizens and enterprises.*

The proposed definition views Government 3.0 as the result of application of new disruptive technologies in public services, recognizing that such technologies are connected to and enabled by established technologies, primarily those of big data analytics and cloud computing. Finally, the definition includes the ultimate goal for application of these technologies: data-driven and evidence-based decision and policy making and provision of smart personalised services for decision support of citizens and enterprises.

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# LIST OF TERMS AND ABBREVIATIONS

| Term/Abbreviation | Definition |
|---|---|
| AI | Artificial Intelligence |
| AR | Augmented Reality |
| BC | Blockchain |
| BOLD | Big Open Linked Data |
| CAPs | Community Awareness Platforms |
| DUK | Danube University Krems (Austria) |
| EC | The European Commission |
| eIDAS | electronic IDentification, Authentication and trust Services |
| FP7 | 7th Framework Programme |
| G2B | Government to business |
| G2C | Government to citizen |
| G2G | Government to government |
| GS | Gaming-based Simulation |
| ICT | Information and Communication Technologies |
| IoT | Internet of Things |
| ISA | Interoperability Program for European Public Administration |
| LC | Lisbon Council (Belgium) |
| ML | Machine Learning |
| NEGZ | Das Nationale E-Government Kompetenzzentrum (Germany) |
| NLP | Natural Language Processing |
| OOP | Once Only Principle |
| OWL | Web Ontology Language |
| P2P | Peer-to-peer |
| PwC | PricewaterhouseCoopers (Greece) |
| RDF | Resource Description Framework |
| RDFS | Resource Description Framework Schema |
| RQ | Research Question |
| SA | Sentiment Analysis |
| SC | Smart City |
| SiLo | Singular Logic (Cyprus) |

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| | |
|---|---|
| SKOS | Simple Knowledge Organisation System |
| SPARQL | SPARQL Protocol and RDF Query Language |
| TOOP | The Once-Only Principle Project |
| UAEGEAN | University of the AEGEAN (Greece) |
| UiA | University of Agder (Norway) |
| UNU | United Nations University (Portugal) |
| URI | Uniform Resource Identifier |
| VR | Virtual Reality |
| WP | Work Package |

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# 1. INTRODUCTION

## 1.1 Purpose and Scope

The present report is an outcome of task 1.1, which aimed to examine the status of electronic government research with the aim to identify and describe the most important areas and technologies that lead to the emergence of and define the scientific area of Government 3.0.
Work package 1 intends to set a worldwide baseline for the entire project in terms of knowledge already generated in the field of the Information and Communication Technologies (ICT)-enabled governance and, with the help of the network of affiliated public organizations, in terms of needs that the training material developed will have to target. The present deliverable addresses the first task of the Work Package, namely by mapping the status of Electronic Government research and practice worldwide.
The aim of the mapping of the status of the e-Government research is addressed by answering three research questions (RQs):

1. What is Government 3.0 and how it is different from the previous e-government generations?
2. What are the concepts relevant in Government 3.0 and how do they interrelate?
3. How the different technologies and paradigms contribute to the realisation of Government 3.0 goals?

## 1.2 Approach and Structure of the Deliverable

The research presented in this deliverable was conducted using a two-step approach. First the Government 3.0-related keywords were identified, and references were collected to measure and assess the use of the keywords in the e-Government domain. After that the keywords were further analysed using literature review process to understand the level of maturity and implementation of the technology or concept within the domain. The methodology is described in more detail in section 2.3.

This report is divided into five sections. The present section (section 1) deals with the scope, methodology and structure of the deliverable. Section 2 describes the results of preliminary literature research identifying three stages of e-Government evolution and providing first definition of Government 3.0, based on existing literature (delineating Government 3.0 from previous generations). Third section details the result of the data collection along the keywords and describes data sources used to build the references list, used for main literature analysis. Further summaries of the selected areas are elaborated to present the understanding of the evolution and maturity of the concepts in e-Government domain in section 4 with subsections describing each individual technology and trend, relevant in the context of Government 3.0. Along each of the subsection the use of a term in e-Government is explained based on the literature review and the term’s definition is outlined. The methodology for workshops and their results are described in section 5. The synthesis of the findings is presented in section 6, where the definition of Government 3.0 is proposed (RQ1), based on the analysis conducted in previous sections, interrelations between the concepts are described (RQ2) and the model for decision making in Government 3.0 is suggested (RQ3). Finally, section 7 contains conclusions, briefly summarising the report and explaining the connection of the findings of WP1 to the roadmapping activities planned in WP2 of the project.

# 1.3 Relation to other Work Packages and Deliverables

The current work package is an important pre-requisite for the WP2, WP3 and therefore all later work packages as well. The collected data and references, described in this report together with the report on the outcomes of Task 1.2 (e-Government training needs) are further used to roadmap the area of electronic government in WP2 and subsequently develop course curricula and modules on Government 3.0 in WP3, based on the areas described in this document and in the roadmap.

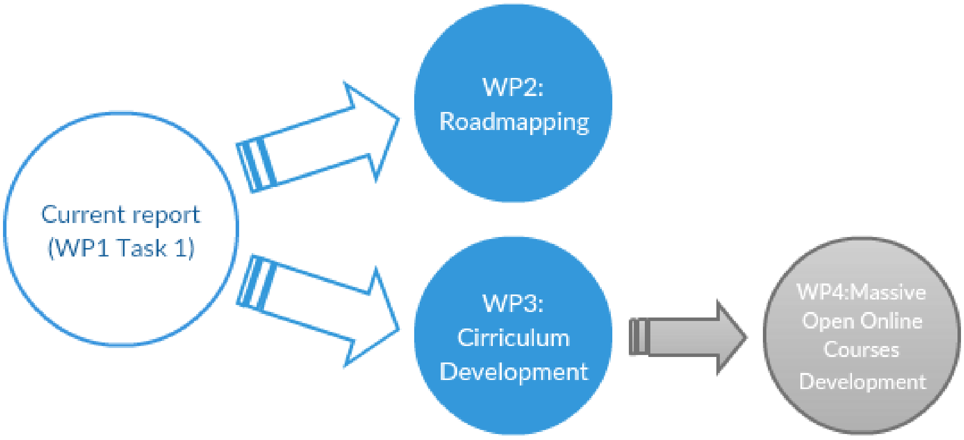


**Figure 1. Relationship of the report to the other work packages in the project**

The relation of this report to other work packages and deliverables is shown in Figure 1. For WP2 the report will be used as a basis for roadmap activities by identifying important connections between e-government technologies and trends and allowing to develop future scenarios that depict the interplay between different connected concepts in public domain.
In WP3 the report will be used to orient curricula content production and together with deliverables from Tasks 1.2 and 2.1, identify the key subjects and areas vital for the new state of the art course curricula and modules on Government 3.0. Literature review conducted for this task will allow to form the basis for recommended literature lists for the WP3 modules.

# 2. THE RESEARCH AND PRACTICE IN THE DOMAIN OF DIGITAL GOVERNMENT

Compiled by: *Zoi Lachana, Charalampos Alexopoulos, Euripidis Loukis, Yannis Charalabidis (UAEGEAN)*

## 2.1 Background

The objective of Electronic Government research and practice has been the provision of ICT-based services to public servants, citizens and businesses, aiming at efficiency and effectiveness improvements of the internal operations of government agencies, as well as enabling electronic transactions of citizens and businesses with government (mainly through the Internet). As the expectations and needs of citizens and societies in general are changing and growing, and also the capabilities offered by ICTs are evolving, it is inevitable to observe a shift in e-Government focus, and relevant ICT-based services provision. The evolution of e-Government is influenced on one hand by its wider external environment (such as the economic, political and social environment), and on the other hand the technological environment (emergence of the new ICT). It is also subjected to emerging patterns of incremental improvements or more radical innovations that governments attempt to adopt, either by transforming the already existing services or by adopting new ones (Janowski T., 2015).

This evolution can be viewed as a continuity of several e-Government generations, driven by societies' problems and needs in combination with technological developments. Numerous authors have been providing different definitions for these e-government generations, focusing on different characteristics of each generation (Basu, 2004; Maumbe et al., 2008; DiMaio, 2009; Baumgarten and Chui, 2009). Although there is an enormous frequency of use of the term "e-Government", there is still not a clear and consistent understanding of the concept among practitioners and academia, and different meanings are assigned to it, with most of them focusing on the features of one of the e-Government generations that emerged in its evolution. Only a limited number of studies investigated and began to systematically consider questions related to the evolution of the domain (Karpchuk, 2017).

In many important economic and social activities, new ICTs, or new ways of exploitation of some existing ICTs, have caused important discontinuities and even disruptions (e.g. see literature on digital disruption, such as Christensen et al. (2015), leading to the necessity of distinguishing between several distinct generations of these activities. The most widely debated and influential examples include the electronic content publishing (the Web) (O'Reilly, 2005; Choudhury, 2014; Rudman & Bruwer, 2016; Akhilesh Sharma, 2017), and the industry (Lasi et al., 2014; Stock & Seliger, 2016; Roblek et al., 2016; Lu, 2017), where we can observe emergence of different generations: Web 1.0, Web 2.0 and Web 3.0 for the former, and also Industry "1.0", "2,0", "3.0" and occasionally "4.0" for the latter.

In, particular, in the area of electronic content publishing we can distinguish three generations, which have been driven mainly by the evolution of related technologies (O'Reilly, 2005; Choudhury, 2014; Rudman & Bruwer, 2016; Akhilesh Sharma, 2017). In the first generation of the world wide web (Web 1.0) also called the "Web of Documents", the published content has the form of interlinked through hypertext documents that contain text, images and videos, accessed via the Internet, which aim to be consumed and understood only by humans, who can only read this content and have limited capabilities of interacting with it. Since 2004, the term "Web 2.0" has been used to describe the new generation of electronic content publishing, also called the "social web", where social media and networking sites hold a prominent place, allowing users not only to consume (read) content developed by producers, but also to generate and publish their own content, which could be distributed in the emerging (social) networks. These capabilities have had profound consequences, as they had given rise to the new participatory, collaborative and distributed practices in many social and economic activities. The most recent generation, Web 3.0, is based on semantically structured documents, aiming to be consumed not only by humans but also by the machines. It is about a 'semantic' web of data, which through the semantic annotation of the data contained in a page, provides enhanced data search and link capabilities, allowing this web of data to interface

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better with itself, and also to feed data to the web applications. Web 3.0 technologies are the response to the ever-increasing amounts of data generated by the users and organizations, and the need to search and exploit these data more efficiently.

In the area of industrial manufacturing we can distinguish four generations, with the two most recent ones being driven by the ICT (Lasi et al., 2014; Stock & Seliger, 2016; Roblek et al., 2016; Lu, 2017). Its first generation, Industry 1.0, introduced the concept of mechanical mass production, by using water- and steam-powered machines, while Industry 2.0 utilized the power of electricity, at the same time developing the new methods for increasing the efficiency and effectiveness of manufacturing facilities. Industry 3.0, also known, established through 'third industrial revolution', was based on the development of electronic hardware and software, which improved planning of industrial operations, as well as extended automation of previously manual production tasks. The most recent generation, Industry 4.0, refers to the advanced digitalization of both the production processes and the products themselves, the use of the 'Internet of Things' (IoT), big data, and analytics' technologies within factories, in order to generate new production-related information, which can be used for further increasing the production efficiency. Among the core characteristics of Industry 4.0 are: cyber-physical systems (physical systems with a variety of sensors transmitting wirelessly information about them to digital systems, which process this information, and then control through actuators the physical systems), smart products (with a variety sensors, which generate valuable information about their context, as well as their use, and transmit it to central digital systems, or to the other objects, driving new forms of value creation for the consumer), and products/services extensive customization and personalization at mass production costs with the use of big data. Similar evolution can be observed in many enterprise-level activities. A typical example is the customer knowledge management, in which we can distinguish four generations, KM 1.0 to KM 4.0 (Roblek et al., 2016) that have been driven by the evolution of ICT. Here the data was first collected through the Customer Relations Management (CRM) systems, later by using social media and finally in the most recent generation (KM 4.0), businesses collect data from sensors installed on the products used by their customers (IoT) and analyse it through advanced big data analytics' techniques.

Since ICT have such profound consequences on many important economic and social activities, leading to the emergence of new generations of them, it is necessary to investigate their effect on e-Government in more detail, exploiting the relevant knowledge obtained from the ICT-induced evolution and emerged generations in all these activities. It is important to gain better understanding the different generations of e-Government, and the role that some disruptive ICT had played in its evolution, particularly technologies such as the social media (very influential for the evolution of the electronic content publishing and the customer knowledge management), the IoT and the big data analytics (influential for the evolution of the industrial manufacturing and the customer knowledge management).

# 2.2 Understanding E-Government Generations

## [redacted] Methodology

The objective of this section is the identification and better understanding of the different generations of e-Government. In order to define the necessary elements/perspectives of each generation to be examined and analysed we developed an analysis framework, based on Charalabidis et al. (2011) science base creation method, which has been used for the scientific foundation of the interoperability domain. This method has been adapted to the needs of the current study. Each analysis element/perspective was converted into a research question. Table 1 presents the different analysis perspectives we used to investigate the major characteristics of each generation along with its detailed orientation.

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**Table 1. Analysis framework and research questions**

| # | Main Perspective | Research Questions | Detailed Description |
|---|---|---|---|
| **1** | Main Goal | What is every generation aiming to achieve? | The result that each generation of e-Government aims to achieve. |
| **2** | Main Method | How can their goal(s) be achieved? | An established, prescribed, or logical, practice or systematic process of achieving the main goal with accuracy and efficiency based on a credible approach. |
| **3** | Usual Application Level | Which is the targeted government level? | Related environment of offered services |
| **4** | Key Tool | Are there any factors in accomplishing their goal(s)? | A determining factor in accomplishing or achieving the main goal. |
| **5** | Key Obstacle/ Risk | Are there any obstacles? | A determining factor capable of preventing the main goal to be achieved. Could be a policy or the users' resistance to change. |
| **6** | Key ICT Area | Which technologies are being used? | Key enabling technologies allowing the deployment of the main method and the development of the key tool. |
| **7** | Most Needed Discipline, beyond ICT | Which are the important scientific discipline(s) to be leveraged? | Identification of the most important scientific discipline(s), beyond ICT, for the achievement of the major goal each generation, for the interdisciplinary field of e-government. |

As a second step, we proceeded with the identification of the main literature that contains the available definitions for the different generations of e-government. From a preliminary search we found that previous e-government literature distinguished three main generations of e-Government, referred to as “e-Government 1.0”, “e-Government 2.0” and “e-Government 3.0”, or even using terms such as “Government 1.0”, “Government 2.0”, and “Government 3.0”. The first step aimed at answering the research questions of the analysis framework, by searching the EGRL (V. 13.5) and Google Scholar using the above terms as keywords, as well as “e-Government definition” search term. The aim was to use these initially discovered keywords (without taking for granted any specific definitions or features of them) to distinguish between the three e-Government generations (by addressing the seven mentioned perspectives), based on the relevant literature, and the existing definitions of them. In total 17 papers were found, which do not include sufficiently detailed information to provide all the necessary answers to the above seven research questions defined in the analysis framework (see above Table 1). However, they provided a list of more detailed keywords for conducting a second round of more extended literature search. These keywords where used in the second round of extended literature search in order to answer the above seven more specific research questions. Scopus library was also included to this second round, in addition to the previously used EGRL (V. 13.5) and Google Scholar ones. We collected 126 papers, from which initially the abstracts were examined, in order to select the most appropriate ones for answering the above research questions. Finally, 35 papers were selected as more relevant to be thoroughly analysed.

As a last step we proceeded to the description of the above mentioned seven main perspectives of each e-government generation, answering the relevant research questions, based exclusively on the analysis of these 35 collected research papers. The results of the analysis were later used in section 3 to come up with the search keywords for more profound literature review of the technologies and trends related to Government 3.0.

## [redacted]Characteristics of the e-Government Generations

This section presents the different generations of e-government, along with their major characteristics as they are obtained from the papers found in both rounds of literature review. Table 2 briefly presents the key outcomes along the seven previously defined perspectives.

Table 2. Generations of e-Government – main characteristics

| # | Perspective | e-Gov 1.0 | e-Gov 2.0 | e-Gov 3.0 |
|---|---|---|---|---|
| 1 | Main Goal | Better Services (Millard, 2004; Silcock, 2001), internal efficiency (Lee et al., 2005; Von Haldenwang, 2004; Chen et al., 2006) | Openness (transparency) & Collaboration (Bonson et al., 2012; Khan et al., 2014; Charalabidis & Koussouris; 2012). | Societal problem-solving (Hogan et al., 2017), citizen well- being (Bounabat, 2017), optimization of resources (Nam, 2013; Shin 8. Lee, 2015) |
| 2 | Main Method | Interoperability for Connected Governance (Gottschalk, 2009; Guijarro, 2007) | Open & Collaborative Governance (Bonson et al., 2012; Charalabidis & Koussouris; 2012). | Smart Governance (Linders, et. al, 2015) & data-intensive decision making (Ojo & Millard, 2017; Nam, 2013) |
| 3 | Usual Application Level | National (Chadwick & May, 2003; Maumbe et al., 2008) | National & Local (Bonson et al., 2012). | Local to International (Pereira et al., 2018; (Ojo & Millard, 2017; Nam, 2012; Nam 2015) |
| 4 | Key Tool | Portal (Ebrahim & Irani, 2005) | Social Media (Bonson et al., 2012; Baumgarten & Chui, 2009; Boughzala et al., 2015) | Ubiquitous Sensors/Smart Devices/ Apps (Scholl, 2012) |
| 5 | Key Obstacle/ Risk | Public Sector Mentality (willingness to adopt; insufficient knowledge; lack of strategy)<br>Business Mentality (siloed solutions; non-conformance to standards)<br>Citizens Mentality (accessibility, digital divide)<br>(Carter, & Belanger, 2005; Carter & Belanger, 2004; Choi, 2017) | Public Sector Mentality (willingness to adopt)<br>Business Mentality (siloed solutions; non-conformance to standards)<br>Citizens Mentality (trust, digital divide)<br>(Bertot et al. 2010; Osimo, 2008; Picazo-Vela et al., 2012; Khan et al., 2014) | Public Sector Mentality (willingness to adopt)<br>Business Mentality (non-conformance to standards)<br>Citizens Mentality (digital divide)<br>(Sang, 2014; Nam, 2015) |
| 6 | Key ICT Area | Organizational Infrastructures (Dittrich et al., 2003) | Social Media & Open, Linked and Big Data (Bonson et al., 2012). | Artificial Intelligence & IoT (Pereira et al., 2018) |
| 7 | Most Needed Discipline, beyond ICT | Management (Ebrahim & Irani, 2005) | Social and Political Sciences (Nam, 2012; DiMaio, 2009; AGT, 2009) | A wide variety of disciplines concerning the domains of government activity, such as economic, environmental, behavioural sciences (Pereira et al., 2018) |

The analysis revealed both similarities and difference between the generations. The main identified obstacle was the same for all of the three generations of e-Government, emphasized in all relevant papers: public sector mentality, which does not favour risk taking and innovation. Public servants and politicians seem to be reluctant to be early adopters of new technological advancements in order to achieve the main goal of each generation.

Apart from the similarity between all generations regarding the obstacles (perspective 5), remarkable differences have been identified between the three generations in all the other examined perspectives examined. For the research question 1, we can conclude there is an apparent shift of the main goal/scope in e-Government through the years. While e-Government 1.0 pursues higher internal efficiency of government agencies and better transactional services by them, for both the businesses and the citizens, e-Government 2.0 offers capabilities towards increasing citizens' participation, openness and accountability of governments, and thus enhancing democracy. Finally, e-Government 3.0 comes as the logical response to the deluge of data produced from the first and the second generation of e-Government (mainly large

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quantities of numerical data from complex internal information systems (IS), and also textual data from various social media sources), as well from new technologies (sensors, IoT, etc.); it is aiming to exploit these data for policy-making, societal problem solving, citizens' well-being (e.g. for citizen-level decision support services) and data-intensive decision making (policy informatics).

In order to achieve the identified goals, in e-Government 1.0 the most common method is ensuring the interoperability between IS of government agencies, as well as towards central electronic "one-stop shops" and national portals. In e-Government 2.0, social media and the capabilities offered by them play an important role for the development of new governance models, characterised by more participation of and collaboration with the society (individual citizens, communities, stakeholder groups, firms, professional and business associations), with the most advanced governments adopting this new way of communication with the citizens, allowing better citizens' participation in governmental decision making. Moreover e-Government 2.0 emphasises the opening and release of public data, by developing national and local open government data portals, towards greater transparency. In e-Government 3.0 the increased use of sensors and smart devices producing big data (e.g. concerning various infrastructures of cities), ranging from human text to sensor data, combined with advanced analytics and modelling, and possibly ubiquitous services, enables the smart governance and data-intensive decision making.

The key ICT area of e-Government 1.0 are organizational infrastructures, while for e-Government 2.0 it is social media, citizens' involvement, open and big data; e-Government 3.0 focuses on analytics, modelling, artificial intelligence and Internet of Things. Finally, in order for all the above to be achieved the most needed "complementary" discipline, beyond ICT, is management for e-Government 1.0, social and political sciences for e-Government 2.0, and a wide variety of disciplines for Government 3.0, concerning the multiple domains of government activity, including economic, environmental and behavioural sciences.

Generally, it is clear that e-Government 1.0 focuses on informational and transactional services delivery, based on static ICTs and Web 1.0, while e-Government 2.0 uses the concepts of Web 2.0 in combination with various social media management tools and technologies, as well as textual data analysis techniques, for improving the transparency and openness in government, and at the same time for collecting useful information and knowledge from the citizens ('citizen-sourcing'). Following the obvious linkage of its predecessors, e-Government 3.0 is a concept connected to the Web 3.0 concept, utilising the web of data in such a way that permits societal problems solving and better-informed policy making. E- Government 3.0 combines e-Government's 1.0 and e-Government's 2.0 capabilities, with the power of the emerging innovative technologies, such as AI and IoT, aiming at a substantial contribution towards better government decision support and policy making.

# 2.3 Three e-Government generations

Summarizing the above-mentioned characteristics of these three e-Government generation, the definition of each of them can be formulated as follows:

- Government 1.0 (or e-Government 1.0) refers to the utilization of ICTs and other web-based technologies for improving or enhancing the efficiency and effectiveness of public service production and de- livery to citizens and enterprises.
- Government 2.0 (or e-Government 2.0) refers to the use of the collaborative tools and approaches of Web 2.0, as well as to the opening of public information, in order to achieve more open, accountable and responsive government.

- Government 3.0 (or e-Government 3.0) refers to the use of new disruptive ICTs, in combination with established ICTs, and taking advantage of the wisdom of crowd, towards data-driven and evidence-based decision and policy making.

While these three definitions are seen as an evolution of e-Government, it should be noted that despite the emergence of new generations of e-Government, there is a continuing research interest in the previous ones as well, as they are extensively used by government agencies (absorbing bigger parts of their ICT budgets than the more recent ones), and pose important research questions that have to be investigated (for instance the IS for supporting the internal operations of government agencies, as well their electronic transactions with citizens and firms, of the first generation e-Government 1.0, are critical infrastructures for their everyday functioning and absorb most of their ICT budget, so it is highly important to conduct research analysing their performance, the problems they face, and possible improvements). In other words, the 1.0 and 2.0 generations of e-Government services have not stopped to produce solutions on the European, national and local levels. The advent of Government 3.0 just refocuses the target on the policy making.

The definitions presented above, as well as the initial literature analysis of Government 3.0 were used to develop a method (section 3) employed for the understanding of the interplay of specific technologies relevant for Government 3.0, analysed in detail in section 4 this report. The more profound literature analysis described in section 4, allowed to come up with a justification of the definition of Government 3.0 as a new stage of e-Government evolution, presented in section 5.

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# 3. METHOD AND DATA SOURCES

*Compiled by: Alexander Ronzhyn, Maria Wimmer (NEGZ)*

## 3.1 Government 3.0

The Government 3.0 definition presented in section 2 needs to be expanded and each part of this definition needs to be examined in detail to find crucial aspects necessary for understanding this next stage in the evolution of e-Government. The definition itself depicts an interplay of three issues depicted in Figure 2.


**Figure 2. Government 3.0: process**

In order to understand this new paradigm, we need to address all the elements of this equation. First, we need to look at the disruptive technologies and see what technologies these are and what makes them valuable in the context of electronic government services. Secondly, we need to examine the existing technologies and understand what role they can play in conjunction with the disruptive ICTs. Thirdly, it is necessary to understand the role of the citizens in the process and how this role changes, affected by the changes in technology. Finally, we should critically assess the criteria for the data-driven and evidence-based decision making in government and describe the way the decision processes can be improved compared to the previous e-Government generations.

Within this report these tasks are addressed through a systematic literature review of the e-Government literature. The data sources used for the review are described in section 3.2, while the selection of the keywords for the analysis and the methodology are provided in section 3.3.

## 3.2 Data Sources

The main database used in the collection of references was Google Scholar. Other databases included Scopus, Web of Science (WoS), Springer Link, IEEE Explore, ACM Digital Library and several minor university-based libraries. Collected data included article name and abstract, year, article type, type and name of publication, language, author keywords, citation counts in Google Scholar, Scopus and WoS, URL and presence in e-Government Reference Library (eGRL). Numbers of articles per data source are presented in Table 3.

**Table 3. Databases used and number of articles collected**

| Name of the database | Number of articles[1] |
|---|---|

[1] For some articles information was collected from more than one database.

| | |
|---|---|
| Google Scholar[2] | 515 |
| Springer Link[3] | 155 |
| Scopus[4] | 137 |
| Science Direct[5] | 104 |
| IEEE Xplore[6] | 99 |
| ACM Digital Library[7] | 70 |
| Web of Science[8] | 41 |
| Other | 69 |

The suitability of each article for inclusion in the reference dataset was evaluated by the researchers after perusing the article's abstract and keywords and often a quick review of the article's full text. Citation numbers (especially in Scopus and WoS) were taken into account when evaluating the impact of the article. Inclusion of a particular article in the eGRL was also considered as an indication of the quality of article, as the eGRL is a manually edited and highly regarded database of the e-Government research.

## 3.3 Research Keywords and Methodology

The initial list of keywords was developed as a result of extensive discussions between partners involved in the project, based on the provisional definition of Government 3.0, presented in section 2. Preliminary literature review of the suggested keywords further narrowed the list. Finally, the references were collected by partners and the research terms summarised into this report. Research terms presented here were organised into several themes as the result of similarity and connections found in the literature.

The review of the search keywords was conducted adopting the following steps:

- Step 1: Definition of search keywords.
  The list of terms, based on the internal project consortium discussions, workshops and preliminary literature analysis was defined and agreed upon.
- Step 2. Identification of relevant databases and search engines.
  Relevant databases were selected as sources for queries on the policy fields investigated (see section 3.2).
- Step 3. Database Search.
  The defined keywords were used as queries for the search in the databases and repositories selected as well as in the policy documents and practitioner-generated reports.
- Step 4. Refinement of search results.
  The items collected were validated using selection (inclusion-exclusion) criteria, to select references relevant to the issues under investigation. The reference dataset was produced and made available for the further research within the project.
- Step 5. Evaluation and synthesis of relevant findings.

[2] https://scholar.google.com/
[3] https://link.springer.com/
[4] https://www.scopus.com/
[5] https://www.sciencedirect.com/
[6] https://ieeexplore.ieee.org/
[7] https://dl.acm.org/
[8] https://www.webofknowledge.com/

Items selected were reviewed in detail for relevance of content regarding the research objectives, including information related to both the research questions and the identification of potential candidate initiatives for the mapping.

## [redacted] Definition of search keywords

The report of the European Commission on public sector innovation (2013) served as a starting point for formulation of the keywords. In the report the EC identified the following technological enablers of innovation in public services:

- Social: social networking offers new ways to deliver public services and to enable citizens to participate;
- Analytics: big data and predictive analytics offer new service opportunities for citizens and businesses;
- Mobile: the advent of the smartphone enables citizens to access public services from anywhere at any time;
- Cloud: Cloud-based solutions, public and private, can transform interoperability and service provision;
- Open and big data paradigms: new public services, transparency/democracy, economic growth potential (European Commission, 2013, p. 49).

All the technological paradigms mentioned remain critical five years after the publication of the report. These five enablers served as a basis for the new technologies, arising over the last several years. To further specify the enablers, we can also view crowdsourcing and service co-creation as more result-oriented aspects of the "Social" enabler of innovation.

These enablers foster innovation in public services and allow the appearance of a group of technologies that have potential to significantly change the way public sector functions, disrupting it. Termed "disruptive technologies", in this diverse group we include machine learning, natural language processing, sentiment analysis, blockchain, virtual and augmented reality, internet of things, gaming-based simulation and policy modelling technologies. These technologies are on different stages of maturity cycle, however their cumulative effect and influence on e-Government warrants us to talk about the new stage in the evolution of e-Government services. Each of the enabling paradigms and disruptive technologies are described in section 4 of the present report, providing the justification to the claim of why it is possible now to speak of Government 3.0. Furthermore, it is necessary to look at the practical realisations of the new Government idea by looking at some of the implementations. For that reason, smart city governance, Once-only Principle, community awareness platforms, e-identity and e-signature are also included in the list of the search terms.

## [redacted] Identification of relevant databases and search engines

The databases used for the search included Google Scholar, Scopus, Web of Science, Springer Link, IEEE Explore, ACM Digital Library. See section 3.1 for the detailed statistics regarding the number of collected articles.

## [redacted] Database Search

The final list included 34 search terms, presented in Table 4. A total of 1039 references were collected during January-April 2018. The collected references encompass the 2015-18 period, limited to English-language journals and conferences. Consequently, the number of the relevant research directions were outlined based on the collected dataset.

**Table 4. Search terms and number of collected articles**

| Search terms | Number of articles[9] |
|---|---|
| Augmented Reality | 23 |
| Big Data | 293 |
| Blockchain | 11 |

[9] Some articles were identified to have multiple keywords as their main research focus.

| Search terms | Number of articles[9] |
|---|---|
| Cloud Computing | 38 |
| Community awareness platforms | 7 |
| Crowdsourcing | 38 |
| Customised Public services | 16 |
| Data Analytics | 77 |
| e-identity | 12 |
| e-signature | 4 |
| Gamification | 64 |
| Gaming-based Simulation | 9 |
| Government 3.0 | 6 |
| Government 4.0 | 1 |
| Internet of Things | 19 |
| Linked Data | 46 |
| Machine Learning/ AI | 40 |
| Natural Language Processing | 116 |
| Once Only Principle | 40 |
| Open Data | 62 |
| Personalised Public Services | 8 |
| Policy Modelling | 7 |
| Proactive services | 7 |
| Reusable open source software | 1 |
| Semantic e-Government | 59 |
| Sentiment Analysis | 16 |
| Service co-creation | 47 |
| Service modules | 16 |
| Smart City Government | 27 |
| Smart Governance | 72 |
| Smart Government | 53 |
| Social bots | 22 |
| Transparency and trust | 1 |
| Virtual reality | 9 |

## [redacted] Refinement of search results

The creation of the database of references allowed us to further narrow down the relevant research topics. Considering the low number of collected references for some keywords, some search terms were incorporated as an aspect of a larger topic. “Reusable open source software”, “transparency and trust” and “proactive services” were used as a part of the literature reviews for other topics and were not discussed separately. Terms concerning cross-cutting topics like “Government 3.0”, “Government 4.0”, “Policy modelling” were used as an aspect described in the literature reviews of the

other concepts. “Policy modelling” for example was often discussed in the context of Gaming-based simulation and seldom within Smart City paradigm.

Some search terms were combined and described together. For example, there have been significant overlap between “Smart governance”, “Smart city government” and “Smart government” references, so in the final report there is one section (4.17 Smart City government) were all three subtopics are discussed. For the same reason, “Personalised public services” and “Customised public services” are analysed together in section 4.6. Data analytics have been incorporated as a part of the Big data discussion (4.1) as in this case a significant overlap between references collected for these keywords was observed. Finally, e-signature had being predominantly discussed as a subtopic of e-identity and was analysed as such in 4.20. At the end, a total of 21 topics in four categories were chosen to be described in this deliverable’s section 4.

## [redacted] Evaluation and synthesis of relevant findings

Literature review was used as a method to further describe and define the different concepts and technologies within Government 3.0. The descriptions include the definition of each keyword and the literature review of the most significant research conducted on the keyword. The important focus of the literature review were the connections between the concepts and their role in shaping the emerging Government 3.0 domain. This time the references included in the analysis were not limited to the 2015-18 time period and included all relevant sources. The concepts reviewed included disruptive technologies (Machine learning, NLP/ Sentiment analysis, Blockchain, Virtual reality, Augmented reality, Internet of things, policy modelling), enabling technologies (big, linked and open data, data analytics, cloud computing, service modules) and paradigms (service co-creation, crowdsourcing and customised public service provision) and notable realisation of the Government 3.0 technologies (smart city, community awareness platforms, Once-only principle and e-identity).

As the result of the literature reviews of individual concepts, broader patterns were established, which helped to identify main properties of the new domain. Further input was collected during the discussion with the experts from both academia and public service during the two workshops, described in detail in section 5. The opinions of the workshop’s participants were useful in adjusting the structure of section’s 4 subsections and validating the search terms. Input of the experts involved in the workshop for example highlighted the need to look deeper into the ethical issues associated with each research area and consider Responsible Research and Innovation as an important factor in the development and implementation of the new technologies.

Ultimately a narrative emerged that helped to better understand the developments in the e-Government research domain and frame these developments as the emergence of the scientific domain of Government 3.0. The final proposed definition of Government 3.0 is outlined in section 6.

# 4. EGOVERNMENT RESEARCH: ANALYSIS

## 4.1 Big Data

*Compiled by: Christina Kappatou, Nikolaos Kousantas (PwC)*

### [redacted] Definition

There are several definitions of big data, ranging from simple to sophisticated. According to Laney (2001) big data are the sets characterized by the three V's: big volume, velocity and variety. These three characteristics often demand new technologies for data storage and analysis (Ward & Barker, 2013). This definition, while simple, is adequate for general purposes and is widely used (US Executive Office of the President, 2014).

### [redacted] Implementation

Big data methods may be used in three approaches (Maciejewski, 2017):

1. Historical – where data show the state of affairs at a given time in the past. In this model, a public body gains knowledge and makes decisions on the basis of information from the past.
2. Real-time – where data show the present state of affairs (this model includes situations where data show the state of affairs as they currently are or with a delay of minutes or a few hours). In this model, a public body gains knowledge and makes decisions based on current information.
3. Predictive – where data show what will happen in the future, and a public body makes decisions based on future projections.

The choice of model should influence the way in which a public body acts based on the information generated. With the predictive model, actions taken by the public body should be more cautious, because predicting a future situation is always a matter of probability. As already mentioned, big data methods may deliver predictions with a high level of probability, but uncertainty is still a factor. On the other hand, actions taken on the basis of historical or, even better, real-time, information, may be performed with a higher level of confidence (Maciejewski, 2017).

In public supervision, big data are used to detect irregularities. In the case of regulation, big data can be used for general observation of the state of affairs in the regulated area. Gathered knowledge allows regulation to be improved and better regulatory decisions to be made. It also helps decision-makers to better understand the social impact of decisions taken by the authority and to draw better conclusions from social feedback. For public services delivery, big data may be used to improve public services and to create new ones. Another possibility of using big data in this area is to verify eligibility for social services, which can also be considered a form of detection of irregularity (Maciejewski, 2017).

### [redacted] Big Data in government

A review of the literature (Adrian, 2011; Chen et al., 2014; Davenport et al., 2012; Gantz and Reinsel, 2011; Hota et al., 2015; Janssen and Kuk, 2016; Mayer-Schönberger and Cukier, 2013; OpenTracker, 2013; Simon, 2013) suggested the following five differentiating characteristics of big data:

1. Use and combining of multiple, large datasets, from various sources, both external and internal to the organization
2. Use and combining of structured (traditional) and less structured or unstructured (non-traditional) data in analysis activities
3. Use of incoming data streams in real time or near real time
4. Development and application of advanced analytics and algorithms, distributed computing and/or advanced technology to handle very large and complex computing tasks

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5. Innovative use of existing datasets and/or data sources for new and radically different applications than the data were gathered for or spring from

The public and private sectors have now become more and more aware of the fact that the data availability and new methods of its use may be utilized for the public benefit. Public administrations in some countries have adopted big data strategies or policies (Australian Government Information Management Office, 2013; UK Department for Business Innovation and Skills, 2013; US Executive Office of the President, 2014). Big data, and methods for their use, are an emerging phenomenon in the management landscape that brings very good (and sometimes surprisingly good) results in terms of efficiency and efficacy (Maciejewski, 2016).

One public sector example is that of the US Securities and Exchange Commission, which uses big data methods (combined with natural language processors and network analytics) to monitor and detect banned transactions (Helms, 2015), when analysing detailed transaction records. The system also links information from the Complaints Center that is able to gather more data than the previous e-mail-based system (Rapp and Anderson, 2013). Another example is the US Medicaid administration, which uses big data derived from claims in order to process medical taxonomies and expected diagnoses quickly and efficiently. This has resulted in a new decision-making process, allowing better and quicker identification of suspected fraudulent disability claims (Helms, 2015).

*Benefits*

Big data can help governments improve their efficiency, effectiveness and transparency (Milakovich, 2012), which have long been among the main goals of public sector ICT (Information and Communication Technologies) use (Cordella and Bonina, 2012; Heeks, 1999; Weerakkody et al., 2011). For example, big data can enable better decision support information, more informed policymaking (Janssen and Kuk 2016), faster and richer images of evolving reality, and improved services based on better insight into citizen demands and needs (Chen and Hsieh 2014). Such benefits can be a potent tool for solving lingering social problems, such as transport congestion, healthcare provision and sustainable energy production, thus contributing to the practice of smart governance (Scholl and Scholl 2014).

*Challenges of using Big Data in Government*

The application of the Big Data (BD) to e-Government is associated with some challenges: privacy, security, data & information sharing, cost/operational expenditures and data ownership.

- Privacy: BD poses significant privacy concerns. Huge investments have been made in BD projects to streamline processes; however, organizations are facing challenges in managing privacy issues, and recruiting data analysts, thus hindering organizations' progress in their efforts towards leveraging BD (Krishnamurthy & Desouza, 2014).
- Security: Security is a major issue identified by Lu et al. (2014), who argue that if security challenges are not appropriately addressed, then the phenomenon of BD will not receive much acceptance globally.
- Data and Information Sharing: Sharing data and information needs to be balanced and controlled to maximise its effect, as this will facilitate organizations in establishing close connections and harmonisation with their business partners (Irani, Sharif, Kamal, & Love, 2014). However, where organizations store large scale datasets that have potential analysis challenges, it also poses an overwhelming task of sharing and integrating key information across different organizations (OSTP, 2012). Al Nuaimi et al. (2015) also state that sharing data and information between distant organizations (or departments) is a challenge.
- Cost/Operational Expenditures: Researchers assert that cost minimization is an emergent challenge (Irani, Ghoneim, & Love, 2006; Irani, 2010), with Gu et al. (2015) explaining the challenges of processing BD across geo-distributed data centres. Advocates of BD search for cost-effective and efficient ways to handle the massive amount of complex data (Sun, Morris, Xu, Zhu, & Xie, 2014). The cost of data processing and other operational expenditures of the data centre are a sensitive issue that may also impact in the way organizations adopt and implement technological solutions (Al Nuaimi et al., 2015).

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- Data Ownership: Besides privacy, Web (2007) asserts that ownership of data is a complex issue – as big as the data itself – while sharing real time data. Kaisler et al. (2013) also claim that data ownership presents a critical and continuing challenge.

## [redacted] Big Data Analytics

Data analytics (DA) is the process of examining datasets in order to draw conclusions about the information they contain, increasingly with the aid of specialized systems and software. DA technologies and techniques are widely used in commercial industries and public sector to enable organizations to make more-informed decisions and by scientists and researchers to verify or disprove scientific models, theories and hypotheses. DA are indispensable when dealing with Big Data, which is due to its complexity is impossible to be analysed using manual analysis.

According to Gartner (Maydon, 2017), there are four types of DA:

- Descriptive Analytics is the examination of data aiming to answer the question of "What happened/happening?"
- Diagnostic Analytics is a form of advanced analytics that examines data to answer the question of "Why did it happen?". Data mining, data discovery, drill-down are techniques used in this type of data analytics.
- Predictive analytics is an approach to data analysis, which focuses on prediction. Usually performed quicker than traditional data mining (over hours and days).
- Prescriptive Analytics is a type of data analytics answering the question of "What should be done?" or "What can we do to make something happen?" This type encompasses techniques like simulation, recommender engines and heuristics.

Governments produce large volumes of data, which has very high potential value and if properly analysed can improve efficiency of government services and improve decision-making processes on all levels. Furthermore, descriptive analytics can help make government more transparent to the citizens, fostering accountability and improving trust. DA is already being used in different areas of government, such as healthcare, cybersecurity, and education, often with significant positive impact. (Daniel D. Gutierrez, 2017). International management consulting company McKinsey & Co. estimates (Moreno, 2014) that by creating the data (by digitizing information), sharing data sets publicly (as Open Data) and using Data Analytics for improved decision-making, governments around the world can potentially stimulate growth of more than 3 trillion dollars in economic value.

DA has significant potential to be used in the policy cycle by contributing to policy decision making. Höchtl, Parycek, & Schöllhammer (2015) write that DA can be used to (i) identify underperforming areas of public services and help with reallocation of resources for optimisation of public service provision, (ii) improve existing processes by providing solutions for the citizens faster and with less paperwork, (iii) be used to predict (through predictive DA) the future needs of the citizens. To achieve these benefits, it is however necessary to address the privacy and security issues arising from government handling vast amounts of citizen-related data (Höchtl et al., 2015).

## [redacted] Future prospects

Globally, the utilization of Big Data technology and analytics for government is not a theoretical debate any longer but is now in the early stages of a practical implementation (Moorthy, Lahiri, Biswas, Sanyal, Ranjan, Nanath, & Ghosh, 2015). According to IDC the "Worldwide Big Data and Business Analytics Market" or BDA, so analytics alone, was poised to grow from $130.1 billion in 2016 to over $203 billion in 2020 among others driven by a shift towards a data-driven mindset (forecast published on October 3rd, 2016).

Following the lead of larger corporations, national governments have started investing in Big Data and there is a growing awareness within the public sector that Big Data can provide significant support to policy making. According to the Tech

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America Foundation and SAP Survey (2013), 82% of public IT officials say the effective use of real-time Big Data is the way of the future.

### [redacted] Summary and relation to other concepts

Big data technologies are a crucial enabler of a number of e-Government technologies from smart cities to policy modelling. Insights gained from the analysis of collected large volumes of data if used effectively can lead to the creation of customised responsive public services and significant improvement in public service provision. At the same time Big Data requires the use of more advanced technologies for its analysis and storage. Techniques for the analysis of Big Data sets termed big data analytics and machine learning in particular, are among the fastest growing technologies, while cloud computing is extensively used in areas where big data is used.

Big data analytics can be used for policy modelling, contributing to evidence-based decision making. Policies developed on the basis of the available data correspond better to the actual needs of the citizens and contribute to the practice of smart governance.

## 4.2 Open Data

Compiled by: *Dimitrios Sarantis, Soumaya Ben Dhaou (UNU)*

### [redacted] Definition

Open Data Handbook (2017) provides the following definition of Open Data:

> "Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike"

Simply, the process of putting at disposal and making the data available free of charges results in creation of Open Data. The ultimate aim is to allow a free, open access to the available data without any restrictions or mechanism of control. The Open Data is following the same rational of the open source and all the other open system (open hardware, open content, open government, etc.).

### [redacted] Open Data in Government

Open Data varies extensively in terms of format and content. Usually it comes in textual or numerical format; however, it may also include non-textual formats such as figures, graphs, maps, genomes, chemical compounds, formulae, medical information and data, scientific, etc. Governments are among the largest producers of Open Data sets (Hardy & Maurushat, 2017). Proponents of the government Open Data argue that it allows more transparency and accountability, leading to a higher level of public scrutiny (Yu & Robinson, 2012). Open data can help to engage the citizens, that may use the datasets and add value to the data (Robinson, Yu, Zeller, & Felten, 2009).

The value of Open Data is dependent on the following characteristics (Vetrò et al., 2016):

- Quality of the availability and access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.
- The possibility to re-use and redistribute: the data must be provided under terms that permit re-use and redistribution including the intermixing with other datasets.
- Potential for a universal participation: everyone must be able to use, re-use and redistribute - there should be no discrimination against fields of endeavour or against persons or groups. For example, 'non-commercial' restrictions

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that would prevent ‘commercial’ use, or restrictions of use for certain purposes (e.g. only in education), are not allowed.

- Adequate quality: disclosing data without proper quality control may jeopardize dataset reuse and negatively affect civic participation

Open data and its use by different types of organizations and environment has increased rapidly over the recent years. According to Davies (2016), Open Data has already moved from being a niche interest, to being a part of the global policy mainstream. The use of Open data by government has also spread rapidly and Government-led initiatives is used to improve local and global relationships between different stakeholders and improve the governance.

The literature review highlights an important impact of Open Data on accountability, decision-making and transparency. It is also noted that more research is needed to implement and adopt the specific characteristics of Open Data given the difference of context, the country, the political will, etc. It requires research that can engage with both existing realities of decision-making in sectors, acknowledging the growing complexity of this process in an increasingly networked society.

More specifically concerning open Government Data, there are different schools of thoughts (Gray, 2014). One school argues that making government information available to the public as machine readable Open Data can facilitate government transparency, accountability and public participation. Some researchers support the claim that opening official information enhance technological innovation and economic growth by enabling third parties to develop new kinds of digital applications and services (Bates, 2014; Davies, 2010). Others point out that the Open Data itself has little intrinsic value, the value is generated through the use of the data (Janssen, Charalabidis, & Zuiderwijk, 2012). It is not enough to publish the available data and hope it will bring the benefits. The possible outcomes depend very much on the quality of data, feedback mechanisms and its availability to the possible users. In their review of benefits and barriers for the adoption of Open Data, Janssen et al. (2012) warn about an idealistic view on Open Data in government.

At the international level, the United Nations proposes an Open Data platform[10] sharing statistical data from Member States and UN Agencies. The World Bank published a range of statistical data relating to developing countries. The European Commission has created two portals for the European Union: the EU Open Data Portal[11] which gives access to Open Data from the EU institutions, agencies and other bodies, and the PublicData portal[12] that provides datasets from local, regional and national public bodies across Europe.

Several case studies are available in the literature. To name a few, Davies & Perini (2016) elaborated an in-depth study of 17 cases of Open Government Data (OGD) in 14 different countries, concluding that open data is a significant economic driver, particularly in the developing countries, where it also contributes to empowerment and social inclusion. Hellberg (2015) provides a detailed storytelling of a government effort in open government data, Nugroho et al. (2015) analysed case studies in UK and US, Gonzales and Heeks (2015) describe the case of OGD in Chile and Van Schalkwyk et al. (2015) propose a report on OGD for developing countries.

## [redacted] Summary and relation to other concepts

If used effectively, Open Data produced by the Government can improve the provision of public services, increase government accountability and transparency. However, the usefulness of the data depends significantly on the quality of the datasets.

Open Data can be analysed and processed using emerging technologies like Machine Learning, Natural Language Processing and be used for policy modelling and generation of augmented/virtual environments among other applications.

[10] http://data.un.org/
[11] https://data.europa.eu
[12] http://publicdata.eu

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# 4.3 Linked Data

Compiled by: *Dimitrios Sarantis, Soumaya Ben Dhaou (UNU)*

## [redacted] Definition

Linked Data is defined as: "a set of design principles for sharing machine-readable data on the Web for use by public administrations, business and citizens" (ISA, 2013, p.1). It is presented as the evolution from a "document-based web" of to the "Web of interlinked data" (Heath & Bizer, 2011). Linked Data have to follow certain Web standards such URI[13] and RDF[14], SPARQL[15] and vocabulary standards (RDFS[16], OWL[17], SKOS[18]). Linked data is about applying the principles of the web to sharing data and doing so at a deeper level than just publishing a full document or a file.

## [redacted] Linked Data in Government

The literature on the topic of linked data and e-Government is recent and remains in its infancy. The public services and government are among the most important data collectors, creators and providers (Attard et al. 2015). The objectives of the initiatives to open the data from the government perspectives is to create value for the public. As different public actors may have different concerns and values, Attard et al. (2015) provides a framework to assess the value creation and analyse the impact of the government data.

There is a clear link between Open Data, Big Data and Linked Data: researchers often use these three characteristics of data together talking about the Big Open Linked Data (BOLD). According to Janssen and Van Den Hoven (2015) BOLD is transforming the interactions between the government and the public, providing new opportunities such as the possibilities to analyse the behaviour of citizens, increase control, and address privacy issues (Janssen and Van den Ven, 2015). BOLD is also an important factor of an "open and transparent Government". Use of BOLD contributes to improving transparency, accountability and openness (Futia et al.2017), it is strongly connected to the concept of open Government (Mattheus and Janssen, 2015). However, the methodology to create meaning and value through BOLD is often discussed and criticized (Janssen and Kuk, 2016).

Significant number of papers dealing with Linked Data discuss the technical realisation of the concept, describing the protocol, format and data standards (Lane, et al.2015; Kalampokis, 2015; Zaveri et al. 2016; Yu and Liu 2015), while there is a lack of research on implications of Linked Data and its transformative effect on e-Government (Janssen and Van den Ven, 2015).

Interoperability Program for European Public Administration (ISA) produced a report titled "How linked data is transforming e-Government"[19], which describes the future of Linked Data use in the European Union, citing benefits of the use of Linked Data for collaborations across governments, promotion of transparency and improved quality of decision-making. According to ISA, Linked data combines different types of advantages such as the data that is placed in context, each item has a web address through which it can be annotated and referenced, allowing explanations and implications to be linked back directly to the data; the linking of data (to its information model and to related data) enabling information to be combined across silos, enhanced by combination with third party data sources and contextualized. This is of particular value

[13] Uniform Resource Identifier
[14] Resource Description Framework
[15] SPARQL Protocol and RDF Query Language
[16] Resource Description Framework Schema
[17] Web Ontology Language
[18] Simple Knowledge Organisation System
[19] https://joinup.ec.europa.eu/sites/default/files/inline-files/D4.3.2_Case_Study_Linked_Data_eGov.pdf

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for the realisation of government services, where the information about citizens and their activity can be stored across numerous databases and needs to be cross-referenced to ensure efficient use, specifically for services that require timely decision-making. Additionally, the data in linked datasets is more accessible for automated algorithms, so the downstream applications can run from the live linked data more efficiently, ensuring the data they use is up to date. The concept is perceived as very relevant for transforming the e-government (Janssen and Van den Ven, 2015). However, a number of difficulties remain: the legal and regulatory aspect is still challenging (Rodríguez-Doncel, 2016); there is no consensus over the methodology (Janssen and Kuk, 2016); but some researchers are proposing a guiding methodology to support public organizations for the adoption and use of Linked Data (Radulovic et al. 2015).

### [redacted] Summary and relation to other concepts

There is a direct link between Big, Open Data and Linked data related to e-Government 3.0. Basically, as mentioned by ISA, Linked data has the potential to transform e-Government and public sector in general, increasing the quality and quantity of provided services. Linked Open Data (LOD) defines a vision of globally accessible and interconnected data based on the RDF standards of the semantic web. LOD has been proposed as the basis for open government and for solving many of the data integration issues. Compared to unstructured big data, linked data is much better readable by automated algorithms, so can be more efficiently used for automated data-based decision making.

## 4.4 Cloud Computing

Compiled by: *Jon Matthew Switters, Francesco Mureddu (LC)*

### [redacted] Definition

Mell and Grance (2011, p. 2) define Cloud computing as “a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.”

This concept is taken a step further by other definitions that go on to say that cloud computing ”encompasses any subscription-based or pay-per-use service that, in real time over the Internet, extends its existing capabilities.” (Knorr & Gruman, 2018) or “a broad array of web-based services aimed at allowing users to obtain a wide range of functional capabilities on a pay-as-you-go’ basis that previously required tremendous hardware/software investments and professional skills to acquire” (Kepes, 2011). These definitions suggest that cloud computing is the realisation of traditional computing whilst removing the worries of deployment and the technical complexity using a pay-per-use/pay-as-you-go basis.

### [redacted] Cloud Computing in government services

Previous literature on the adoption of eGovernment services has focused on traditional online services where the data or software is stored on the client and server. Now governments around the world are facing budget challenges of an increasing amount of computational data (in form of Big Data), which require finding new ways to deliver services to the public that would be cost effective whilst at the same time not compromising the quality of service provided.

Cloud computing and storage technologies can be implemented to solve some of the important government’s financial, infrastructure, legacy systems and integration problems. Cloud computing solutions present governments with greater collaboration capabilities whilst reducing Infrastructure needs and support costs of IT through the use of on-demand options.

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In future, governments will be driven towards using more hybrid and even public clouds due to continued budget pressures and more government - cloud service provider cooperation is expected (Elshabrawy, 2015). This push towards the use of cloud computing will also generate pressure on cloud service providers to create and deliver solutions that respond to public sector's requirements for interoperability, security, open data and integration between cloud systems. It is important that these critical issues for eGovernment projects are dealt with so that the use of cloud computing solutions in government can increase.

Following the recommendations of the European Commission's Cloud Strategy (2012) many EU countries have developed their own national Cloud strategies. However, few countries have backed these strategies up with the development of governmental cloud infrastructure to support the public administration, with the exception of a handful of countries like the UK, Spain and Denmark (Elena & Johnson, 2015).

*Geographical context*

There is a great deal of evidence that cloud technologies have become strategic for governments, not only in developed countries (e.g. UK, Japan and the USA) but also in developing countries (for example, Malaysia and the Middle East region). These countries have launched cloud computing initiatives to enhance the standardisation of IT resources, cost reduction and more efficient public services (Alkhwaldi & Kamala, 2017). Taking into account this trend in the implementation of cloud computing services in governments throughout the world, it should be noted that the detailed literature review carried out as part of the current project in relation to the term "Cloud computing in eGovernment" highlighted a distinct geographical bias of existing sources towards Asia (Taiwan, China, Malaysia, Nepal, Hong Kong, India) and the Middle East (Yemen, Jordan).

According to Mohammed et al. (2016) there are two main factors affecting the adoption of cloud computing services in e-Government: fit and viability. The degree to which cloud computing "fits" eGovernment tasks is affected by factors such as relative advantage, compatibility, trialability and security. However, it is not affected by the complexity of the technology involved. The viability of cloud computing in the eGovernment context is primarily influenced by the economic factors (return on investment and asset specificity) and technological readiness (IT infrastructure and IT policy and regulations).

*Fog Computing*

Related concept, fog computing refers to the use of edge devices (such as access points) for computation, storage and communication, extending cloud services to the edge of the network[20]. The properties of fog computing such as location awareness, geographical distribution and very large number of nodes make it especially useful for the realisation of the Internet of Things (Bonomi, Milito, Zhu, & Addepalli, 2012) and is seen by some researchers (Dastjerdi & Buyya, 2016; Yi, Hao, Qin, & Li, 2016) as a solution for some of the IoT's inherent problems.

*Benefits of cloud computing*

Cloud computing can be considered a revolutionary solution for IT and e-business in general with a particular focus on e-Government. The appearance of new information services and technologies, particularly in the area of mobile communications, internet of things and social media, has given way to the accumulation of large amounts of unstructured information. Forward thinking organisations are recognising that current data management solutions are becoming expensive and are failing to cope with the reality of the situation (Leung, Lai, Chen, & Wan, 2014). Big Data cannot be processed or analysed in the traditional way due to its complexity, heterogeneity and size (Suh, Vujin, Barac, Bogdanovic, & Radenkovic, 2015). The data problem needs to be solved in a different way, through the implementation of effective data governance. However, until recently, data governance has been quite informal, lacking structure and support from the wider organisation (Alruithe, Benkhelifa, & Hameed, 2016). In this sense, cloud computing services could provide a solution to big data storage and processing in e-Government contexts.

[20] https://blogs.cisco.com/perspectives/iot-from-cloud-to-fog-computing

The implementation of cloud computing in government organisation can provide many other benefits. Firstly, economic savings can be made by reducing the operating and maintenance costs of their hardware and software infrastructures. Secondly, cloud solutions can provide an increased capacity to test and purchase IT capabilities otherwise unaffordable. Thirdly, cloud computing services give government organisations the flexibility to manage their IT resources, with them being able to scale-up or scale-down capacity on demand and only pay for the real usage. Finally, the use of cloud platforms promotes the use of an agile development environment. This, in turn, makes it easier for professionals to develop and adopt applications more quickly (Mohammed, Ibrahim, Nilashi, & Alzurqa, 2016).

*Challenges*

At the same time, the challenges and risks associated with the adoption of cloud computing services by the government organisations should not be overlooked. The risks can be identified in four main domains: policy and organisational risks (such as data lock-in, loss of governance), technical risks (cyber-attacks, loss of data), legal risks (data protection and legal jurisdiction), and other risks (network problems, internet connection) (Elena & Johnson, 2015). There is a need for the development of a sufficient legal framework to address issues and legal action arising from governmental use of cloud computing that considers business needs and consumer fears.

### [redacted]Summary and relation to other concepts

The use of cloud computing is expected to become an important aspect of e-Government in the near future. Cloud technologies can help to solve some important government's financial, infrastructure, legacy systems and integration problems. Cloud computing solutions present governments with greater collaboration capabilities whilst reducing Infrastructure needs and support costs for IT with the use of on-demand options. Cloud technologies are crucial for computationally intensive areas of Government activity like Big Data Analytics, Machine Learning, Internet of Things.

## 4.5 Service Co-Creation

Compiled by: *Alexander Ronzhyn (NEGZ)*

### [redacted]Definition

Co-creation refers to active involvement of end-users in various stages of production process (Prahalad & Ramaswamy, 2000; Vargo & Lusch, 2004). In the case of public service production, co-creation is active involvement of the citizens in different stages of public service production. This involvement can be voluntary or involuntary and may happen during public services' design, management, delivery and/or evaluation (Osborne, Radnor, & Strokosch, 2016).

This definition clearly delimits co-creation from more general citizen participation, which may involve also passive participation (W. Voorberg, Bekkers, Timeus, Tonurist, & Tummers, 2017). In the literature the term co-creation is commonly used together (Vargo & Lusch, 2004) or even interchangeably (Gebauer, Johnson, & Enquist, 2010) with co-production.

Co-creation and co-production are the terms used very often to describe the modern reforms in public service provision, especially in the times of austerity (Osborne et al., 2016; W. H. Voorberg, Bekkers, & Tummers, 2015). In the report of the European Commission (Hubert, 2010, p. 30) the co-production is presented as a necessary part of social innovation: "social innovation [..] mobilizes each citizen to become an active part of the innovation process".

### [redacted]Co-creation of government services

Co-creation is seen as a cornerstone of today's public service provision (OECD, 2011; Osborne et al., 2016), which may help to address the problems of democratic deficit (Pestoff, 2006), insufficient citizen involvement and be a way to acquire additional resources for the delivery of public services (W. H. Voorberg et al., 2015).

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Co-creation is a necessary part of the open innovation in government. Open innovation in the government services can be realised by allowing citizens to contribute in the process of co-design and co-creation of the services. Such deeper involvement of the citizen stakeholders, especially on the early stages of the projects, can make use of the widely distributed useful knowledge that may improve the ultimate quality of the services or tools (Chesbrough, 2006). In their literature review of innovation in public services, encompassing studies published between 1990 and 2014, De Vries et al. (2016) note that "involving citizens" and "involving private partners" have been mentioned as a goal of open innovation endeavours in 6 and 2 percent of all studies respectively, while the most frequently cited goals were increasing the efficiency (18%) and effectiveness (15%) of public services.

Technologically, co-creation is often connected to the use of open data produced by the government. The number of services using open government data developed by non-government actors have increased dramatically over the recent years (Jetzek, Avital, & Bjorn-Andersen, 2014). Different approaches can be used to realise and stimulate co-creation: crowdsourcing techniques (S. M. Lee, Hwang, & Choi, 2012; Schmidthuber & Hilgers, 2017), persona development (Coorevits, Schuurman, Oelbrandt, & Logghe, 2016), public-private partnerships (Gassmann, Enkel, & Chesbrough, 2010) and living labs (Gascó, 2016) among others.

As one of possible platforms for facilitation of co-creation, Living Labs are used to involve citizens in co-creation of public services. The European Network of Living Labs (ENoLL) specifically mentions co-creation in their definition of the living labs: "[living labs] are user-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings."[21] Co-creation of value between the participating stakeholders is central to projects realised using living labs (Priday & Pedell, 2017).

*Challenges*

Priday & Pedell (2017) list a number of challenges for effective implementation of co-creation. First, stakeholders involved in the project might not understand the value introduced by the involvement of the service users on the initial stages of the project and tend to limit citizens' involvement only to the later stages of the project (i.e. testing). Secondly, for co-creation to work, there should be certain degree of trust between the parties involved as otherwise disputes about the co-created intellectual property can arise. Thirdly, there is a challenge of involving industry partners in co-creation, who might be cautious about sharing some of their approaches and technology, especially when the time scope of the project is limited. Related are the issues of the conflict of interest between the stakeholders who may be competing in the same market and thus tend to limit their cooperation. Further research in understanding the willingness of stakeholders to contribute is needed (Luarn, Yang, & Chiu, 2014).

More generally, effective use of co-creation in public services can be hindered by the public sector's aversion to change, lack of managerial guidance and possible legislative and budget limitations (Alves, 2013). These issues however are not exclusive to the co-creation and should be addressed in broader open innovation context by emphasizing the added value provided by the citizen collaboration and improvements in responsiveness and personalisation of public sector services (Alves, 2013).

## [redacted] Summary and relation to other concepts

Co-creation is an important aspect of open innovation in public services. Through service co-creation, government can take advantage of the wider knowledge by engaging a range of citizen and private sector stakeholders into the development of the future solutions. This can lead to more responsive, effective, efficient and customised services for citizens, addressing the issues of democratic deficit and citizen engagement. Over the recent years, co-creation has become a standard strategy for designing and improving public services by considering the input of the citizens. The use of AI and machine learning can

[21] http://enoll.org/about-us/

enable the efficient use of larger amounts of data from the citizens, by that improving the decision-making processes within the government and providing better public services.

# 4.6 Customised/Personalised Public Services

Compiled by: *Frank Danielsen (UiA)*

## [redacted] Definition

Customised (or personalised) public services are about customizing or building services based on the individual citizen needs. The UK's Prime Minister's Strategy Unit (2007) defines such services as "tailored to the needs and preferences of citizens" (p. 33). Customised services are understood as those that are adapted to the individual as a unit of interest (Needham, 2011). Personalisation of public services can on the one hand increase the efficiency of public sector (Kim, 2017) and on the other improve the perception of public services by the citizens (Leadbeater, 2004). Research suggests that customised to individual needs services can be enabled through data analysis (Loon, 2014), citizen participation and by involving citizens in the co-creation of services (Leadbeater, 2006).

## [redacted] Realisation

Governments recognise the need to provide more "user-driven" (House of Commons Public Administration Select Committee, 2008) or "personalised public services". Researchers (Liscio, 2014; Loon, 2014) also state the demand and expectation for more closely tailored services that would address individual needs of each citizen. In the age of user-producers, public services that do not take advantage of user-generated content will be inevitably perceived as dated (Leadbeater & Cottam, 2007).

South Korea is an early adopter when it comes to the initiative to provide customized public services (which also includes better citizen centric delivery channels, a one-stop shop for business support services, narrowing digital divide, removing barriers between government departments, promoting public private partnerships, etc). It is argued that two success factors is competency and transparency (Felix, 2017). Other requirements necessary to achieve availability and services personalized on the individual level are cloud computing and big data (Lee & Chung, 2016).

The goal of delivering customized public services can be achieved by uniting supply chain (performed in the office space / back-office) and the demand chain (performed at the front office / window against the residents) (Lee & Chung, 2016). By striving for the options to customize and personalize public services, greater citizens' satisfaction can be obtained, organisational efficiency can be increased (both public and private), leading to the increased competitiveness (Lee & Chung, 2016).

Private organizations are also interested in customized public services, both as users and as suppliers of solutions. For instance, Accenture recommends focus areas connected to customized public services. Those are 1) personalized services, 2) usage of data, both internal and external, 3) collaboration in the delivery of services, (4) reinvention of operating models and (5) developing a value-driven strategy (Liscio, 2014, p. 3).

## [redacted] Literature Review

Needham (2014, chapter 3) produced a review of the personalised services in different areas of public sector providing examples of personalisation in social care, British NHS, housing, employment, education and other areas. Author concludes that implementation of personalised services in government is often guided by the desire to cut costs and improve efficiency, however often such initiatives have a risk of reduced control and predictability for the public bodies (Needham, 2014).

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Leadbeater (2006) suggests three approaches to achieve more customised public services: bespoke services, mass-customisation and mass-personalisation of services. Bespoke service is applying service provider knowledge to solve individual consumer’s problem. Mass-customisation refers to the consumer choosing specific service modules from a standardized list, thus customer choice is driving the public service selection and resource allocation. Finally, mass-personalisation refers to a model, where users are directly involved in the co-creation of value in public sector. This third approach can be achieved through what Leadbeater names “personalisation through participation”, where users have “more direct, informed and creative say” in design of services (Leadbeater, 2016, p. 109).

Similarly, Lee and Chung (2016) present a method for utilizing available information selectively in order to provide more valuable customized service to users. To enhance the delivery of individualized (customized) public services there must be collaboration between internal and external agents related the decision-making process (Park & Lee, 2015), thus involving service recipients in co-creation will lead to services better suited to individual needs.

Identified factors (or enablers) for customized public services are big data, open data, cloud computing, IoT and smart cities (Loon, 2014). The Korean government has a “platform e-government” based on big data and cloud computing technologies “ultimately intending to provide the customized public services from the integrated counter or window for heterogeneous resident services” (Lee & Chung, 2016, p. 1). The use of open [government] data can provide better, more efficient or more customized public services (Van Schalkwyk, Willmers, & McNaughton, 2016). Smart city operating system is achieved “through a realization of data-based customized services and marketing, cost-effectiveness of energy, safety and security, prediction and response, decision-making, and process optimization” (Kim, 2017, p. 737). IoT providing data, often in collaboration with big data solutions, can be used for the input for the development of customised services (Kim, 2017).

Customized public services can contribute to an increase in satisfaction among users of these services and in perception of public service generally (Leadbeater, 2004). Implementation of more personalised services can also lead to an increase in efficiency among all participants and thereby increase competitiveness (Kim, 2017; Lee & Chung, 2016; Mori, 2017; Nam, 2016). An example of increased efficiency can be the ability to attract businesses that appreciate public services adjusted to local demands (Welsh & Endter-Wada, 2016).

### [redacted] Summary and relation to other concepts

Personalized (customized) services has a potential to bring significant benefits like increased satisfaction rate, increased efficiency and competitiveness, but they also require government determination to implement new processes and desire to invest in building new solutions. Personalised services are enabled by big data, cloud computing and IoT technologies in context of smart city. Crowdsourcing and co-creation approaches can be employed to help achieve more customised public services by collecting input (passively or actively, voluntarily or involuntarily) from individual citizens. Customised public services can be an outcome of data-driven decision making in public service provisioning.

## 4.7 Crowdsourcing

Compiled by: *Alexander Ronzhyn (NEGZ)*

### [redacted] Definition

Crowdsourcing was initially defined as a business concept, which described the outsourcing of tasks to a large group of people instead of assigning such tasks to the in-house employees or contractors (Alonso & Lease, 2011). Broader definitions have also been developed according to which crowdsourcing was seen as a set of methods of soliciting solutions to tasks via open calls to large-scale communities (DiPalantino & Vojnovic, 2009; Howe, 2006) or the use of an Internet-scale community to outsource a task (Yang, Adamic, & Ackerman, 2008).

After studying more than 40 definitions published between 2006 and 2011, Estelles-Arolas and Gonzalez-Ladron-de-Guevara (2012) proposed a general definition:

> "Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit." (p.197)

Today the term encompasses many practices and is used for a wide group of activities, however mostly in private sector (Liu, 2017). In relation to e-government these practices include among others content production, task competition, voting, crowdfunding (Panagiotopoulos & Bowen, 2015) and open collaboration over the web and social media (Taeihagh, 2017a). Generally in citizen-government relationships new forms of crowdsourcing are emerging (Linders, 2012) as the concept is leaning towards less institutionalized forms: like monitoring and aggregating content from open information sources (Loukis & Charalabidis, 2015; Panagiotopoulos & Bowen, 2015). Mainly driven by participatory social media technologies crowdsourcing is seen as one of the forms of e-participation and has to be considered as a complement rather than a replacement for other citizen involvement initiatives (Royo & Yetano, 2015a). Apart from providing solutions to the problems directly, crowdsourcing is also used as a research technique, particularly in case studies (Di Mauro et al., 2016; Dubey, Luo, Xu, & Wamba, 2015) as a type of online surveying.

## [redacted] Crowdsourcing in e-Government

When the power of the crowds is harnessed by the government agencies, researchers talk about citizensourcing (Loukis, Charalabidis, & Androutsopoulou, 2015). In citizensourcing government agencies often use their own accounts in social media to solicit citizen feedback on various policies, issues and problems (Charalabidis & Loukis, 2012; Criado, Sandoval-Almazan, & Gil-Garcia, 2013). Citizensourcing has been conceptualized as an important aspect of innovation in e-Government domain (Hilgers & Ihl, 2010; Schmidthuber & Hilgers, 2017). Among successful examples of the use of crowdsourcing by the government are Budget Challenge[22] for balancing California budget, ConsiderIt[23] for deliberating policies, PeerToPatent[24] for collaborative patents examination, CitizenLab[25] platform for city-level crowdsourcing to name a few. Apart from that, crowdsourcing is often used for citizen science projects (Wiggins & Crowston, 2011).

Crowdsourcing can be particularly useful in identifying the key issues that worry the public (Dwivedi et al., 2017) or addressing the uncertainties about policy design and analysis (Taeihagh, 2017b). Policy crowdsourcing was also shown to improve citizen engagement in policy-making (Prpić, Taeihagh, & Melton, 2015) and citizen understanding of the political issues (Kim et al., 2016).

Apart from actively soliciting public's opinion, government can use *passive crowdsourcing*: collect publicly available user-generated data on a specific topic or public policy, later processing it to receive an answer to a specific question (Loukis et al., 2015). Passive crowdsourcing is related to social media opinion mining and data analytics. It is driven by the technologies first pioneered in private sector, such as social media monitoring (SMM) practices, used to extract data from social media, forums, blogs and news feeds (Bekkers, Edwards, & de Kool, 2013; Linders, 2012). For the practical realization of passive citizensourcing in e-Government the method was developed as a part of the NOMAD research project (Loukis & Charalabidis, 2015).

Crowdsourcing can be done using existing social media platforms, when the government engages the citizens using existing social media accounts or using certain dedicated crowdsourcing solutions. A number of such solutions have being proposed

[22] www.budgetchallenge.org
[23] www.consider.it
[24] www.peertopatent.org
[25] www.citizenlab.co

and designed over the years and while they typically offer better tools for common citizen deliberation of the issues (Caetano, Barbosa, De Paula, & De Souza, 2017), they come with inevitable adoption costs: citizens have to register and get used to a completely new platform. Unless the question discussed necessitates some specific technology not available on general social media platforms (e.g. data tagging (Kim et al., 2016), crowdsourcing is almost always can be more effectively implemented through social media (Criado et al., 2013).

Several frameworks for the use of crowdsourcing in government have been developed. Clark et al. (2016). used a modified Brabham's typology (Brabham, 2013) of crowdsourcing to construct the analytic framework of using crowdsourcing to tackle problems in government, while Ma's framework (2016) included a reference data model, text classifier and a credibility assessment approach for crowdsourcing solutions, albeit on the city government level. Cupido (2016) developed a model of essential factors for e-government crowdsourcing, identifying system management and support, rules, feedback, effort and performance expectancy as the most important factors when developing a government crowdsourcing solution (Cupido, 2016). Loukis et al. (2015) proposed a framework for the evaluation of the government's crowdsourcing initiatives.

*Classification*

Apart from differentiating between active and passive crowdsourcing, it is possible to classify citizensourcing initiatives in four problem-based approaches (Brabham, 2013): knowledge discovery and management, distributed human intelligence, broadcast searching, and peer-vetted creative production; or additionally along different dimensions (Nam, 2012): purpose (image-making or ideation), collective intelligence type (professional knowledge or innovative ideas), and strategy (contest, wiki, social networking, or social voting). Prpic et al. (2014) suggested comparing crowdsourcing initiatives along even finer list of dimensions: cost, anonymity, scale of crowd, IT structure, time required to implement, task magnitude and reliability of the crowd.

*Case studies*

Case studies of crowdsourcing dealt with citizens' motivation to engage in crowdsourcing (Brabham, 2012), determinants of the quality of data collected (Kim et al., 2016), different areas of practical application of crowdsourcing (Dubey et al., 2015) and challenges of introducing crowdsourcing elements into a large-scale e-government projects (Ma, 2016).

Dubey et al. (2015) reviewed three case studies where crowdsourcing was used for disaster response. They suggested a CS-IoT model of crowdsourcing and IoT enablers that can improve the amount and quality of the collected data to aid disaster response. Social media analytics, training, development and leadership styles were identified as having significant influence on the collected data using crowdsourcing (Dubey et al., 2015).

Kim et al. (2016) studied BudgetMap's crowdsourced tagging and classification of the budgets of South Korean government programs. Research suggest that user awareness of budget issues increased as a result of using the online system, while the quality of some of the aspects of user produced data was comparable to those produced by the experts (Kim et al., 2016).

*Challenges and limitations*

The use of crowdsourcing is associated with a number of challenges. There are two main tasks that need to be addressed by the organiser of crowdsourcing initiative: selecting an appropriate and relevant crowd and mobilizing it (Royo & Yetano, 2015b). Some other problems with the use of crowdsourcing are listed below:

- Digital divide related problems and *participation inequalities.* Free-for-all crowdsourcing may lead to disproportionate representation of more affluent and digitally literate groups, or on International level of more developed countries (Gellers, 2016).
- *Possible manipulation* of the crowd. Similar to surveying, actual tools/questionnaires may formulated in a way to favour certain opinions and lead to biases in responses (Loukis et al., 2015). This challenge can be addressed by using the best practices for the question formulation, software design and analysis methods, aiming to minimize possible biases.

- Governments may adopt crowdsourcing initiatives rhetorically to improve their legitimacy and the perceived image that citizens have of governments. Similar to other e-participation tools like petitions, crowdsourcing can be used in a way to justify or legitimize some of the government's decisions, while not paying attention to the citizens' input that goes against the government policies (Åström, Karlsson, Linde, & Pirannejad, 2012). To tackle this tendency, special importance must be paid to the transparency and accountability when using crowdsourcing techniques. There should be clear ways for citizens to see whether their contributions have been taken into account (Royo & Yetano, 2015a)

Apart from these more general e-participation issues, there is a problem of transferability of crowdsourcing practices developed in private sector to public services, particularly due to the legal constraints (Liu, 2017). Issues with legal regulation of crowdsourcing practices and questions of privacy of the participants become more apparent in public sector.

*Future directions*

Crowdsourcing is characterized by low cost of implementation and wide reach, having a potential to give voice to the large number of citizens. Used with natural language processing and sentiment analysis methods, it is a very useful tool for understanding the citizen opinion and coming up with effective solutions to problems. Still, the use of the crowdsourcing in some possible areas has been limited. Taeihagh (2017a) suggests that there is a need to involve crowdsourcing techniques on the different stages of policy development by using both non-expert and expert crowds.

Further developments of the ICT solutions and increase in technology diffusion worldwide may lead to the emergence of new better ways to collect citizen-produced data. Crowdsensing or participatory sensing is passive collection of data using sensors of the personal mobile devices: from location and acceleration to temperature and other environmental data (Sun et al., 2016; Zenonos, Stein, & Jennings, 2016). Similar concept of wearable crowdsourcing supposes data collection using embedded sensors of the devices worn by humans (Prpić & Shukla, 2016). Spatial and situated (Hosio, Goncalves, Lehdonvirta, Ferreira, & Kostakos, 2014) crowdsourcing refer to the different spatial organisation of crowdsourcing data collection: data can be collected either at particular place, e.g. at terminals (situated) or over the large territory – as in disaster response (spatial).

### [redacted] Summary and relation to other concepts

Crowdsourcing is a useful technique of engaging large number of people to contribute to the solution of a particular problem. Crowdsourcing (especially passive one) can produce big data. Data analytics tools can be used to process the collected data and come up with a better public service proposition, leading to more customized and responsive public services. Passive crowdsourcing is related to the concept of opinion mining and can include sentiment analysis and natural language processing techniques to make sense of the data collected through social media. Finally crowdsensing is another type of crowdsourcing, which employ IoT and sensors to collect environmental data, which can be used for data-driven decision making and service provision.

## 4.8 Service Modules

Compiled by: *Dimitrios Sarantis, Soumaya Ben Dhaou (UNU)*

### [redacted] Definition

Grönroos (2011) has presented a view of managing a company's service offering in which a service comprises a basic service package and the subsequent augmentation of this package. The augmentation, in turn, comprises four parts: the core solution, the enabling service, the enhancing services, and the user interface (UI). Such argument according to Tuunanen et al. (2011) can help achieve a better conceptualization of information systems and information technology-enabled

services. It can be argued that core, enabling, and enhancing services should be considered as service modules (Johansson and Lahtinen, 2012) that include aspects such as infrastructure, deployment, and user interface.

## [redacted] Service Modules in government

For horizontal governance services, the core of the service delivery, the possibilities of cooperation and centralization of service development are significant. Joint public administration services typically are based on a national core of regulation, which applies to all organisations. This means that, in some cases, it may also be possible to partly decentralize service development. Where the practice of public administration service delivery consists of combining pieces of national and local modules, service development may be approached as a question of integrating local and national modules, thereby limiting the effort needed by each organisation.

The service modules are provided by means of a modular architecture that is based on "building blocks" reuse (Corradini et al, 2018). The services are exposed via web services and through a modality of interaction with non-invasive back-office systems. The possibility to develop services among the different public sector organisations, in a G2G (Government to government) logic, can lead to increased efficiency in administrative procedures and contributing to the presentation of different public sector organisations to citizens and businesses in a more holistic perspective (G2C (Government to citizen) and G2B (Government to business). The service modules approach is based on the distribution of services in national, local and regional portals that constitute the service gates for the potential users.

Individual public agencies can make their functionality and even complete business processes accessible using web services (Janssen et al, 2010). Organizations can make use of web services and web service technology to coordinate their cross-agency processes. These web services can be orchestrated to create a cross-organizational business process (Janssen, Gortmaker, & Wagenaar, 2006). Service-oriented architecture (SOA) is a paradigm which allows users to create modular, accessible, self-describing, implementation-independent, interoperable and reusable components that can be published and remotely invoked (Fremantle, Weerawarana, & Khalaf, 2002). Service modules use is expected to improve interoperability and horizontal integration, as new processes can be build out of the existing services. The basic idea is that by replacing, removing and/or adding components a process can adapted to particular needs. Moreover, modules can be changed without affecting the other components if interfaces do not change.

Using service modules, each single authority separates the core competences services from the supporting ones that are instead shared among different organisations. This allows authorities to improve e-Government assessment results, develop their strategic functions while optimising investments by sharing services and resources of common interest. In this approach, each authority externalises its core services by providing them to outside organisations in the form of separate functional modules.

Service modules can be implemented in various areas of e-Government. For example, e-Participation framework service modules can contain independent but coordinated modules (e-formation, e-discussion and e-decision making). In such case, an e-discussion module could supplement the traditional face-to-face discussion. Consequently, it should possess features that supports real-time/online and offline discussions. Discussion board services can automatically send alert messages to all registered members of that discussion forum announcing the topic to be discussed and the fixed date and time. In turn, e-Decision making modules provide options of co-designing public policy, co-production of service components and delivery modalities. Therefore, they enable both the duty-bearers and the citizens to make informed decision among alternative course of action regardless of the factors affecting the decision being qualitative or quantitative. That is, such a module should guide the participants through the elements of decision making of: formulation of objective, determining the constraints, alternative course of actions, help with forecasting and assessing costs of a particular decision.

One example of the implementation of service modules is iGov project[26]. The project provides a modular smart government framework with a suite of modules that help all levels of government to deliver services and information, automate internal

[26] http://www.imexsystems.com

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operations, and improve staff productivity while reducing costs of governance. It contains all the features and functions required and can be rapidly configured and deployed to meet the needs of large federal and state governments to small local governments. All these modules seamlessly integrate and inter-operate to provide un-paralleled efficiency.

*Future directions*

For service based on national policy, the development of service modules on a national scale is a possible alternative. The responsible ministry, for a specific domain, could develop service modules, such as intelligent forms, web services or expert system modules, and provide them to the rest of public administration organisations to incorporate them in their e-Government systems.

As agencies redesign their websites, they need to focus on making their services and information more granular, or component-based, and give users the ability to use government information in “mashups” with other information sources. Along with the trend in service-oriented architecture (SoA) and the need for reusable service modules in the context of intermediaries extending the reach of government, government agencies need to develop policies to support the handling of such information and service modules (Chang and Kannan, 2008).

### [redacted] Summary and relation to other concepts

The use of service modules may improve interoperability and assist in horizontal integration of government services. It is an important mean of improving both the efficacy of national services and implementing cross-border technologies like Once-only principle. While not dependent on the enabling technologies outlined in this report, service modules may implement some of them as a part of their functionality.

## 4.9 Machine Learning and Artificial Intelligence

Compiled by: *Zoi Lachana, Charalampos Alexopoulos (UAEGEAN) and Alexander Ronzhyn (NEGZ)*

### [redacted] Definition

The most common used definition of Machine Learning is the one provided by Samuel (1959), who defines it as “the field of study that gives computers the ability to learn without being explicitly programmed” (in Garofalo et al., 2017, p. 346).

The definition captures four types of machine learning: (i) un-supervised learning; (ii) supervised learning; (iii) semi-supervised learning; and (iv) reinforcement learning. Fundamentally, none of the data is labelled in type (i), the training/testing samples are labelled in type (ii) and there are many unlabelled data and few labelled data in type (iii) (Chui et al., 2017). Various problems can be tackled using machine learning algorithms, some examples are: classification, regression, clustering, dimensionality reduction, structured prediction, face detection, decision making, speech recognition, signal de-noising, anomaly detection, deep learning and reinforcement learning (Chui et al., 2017).

Artificial Intelligence (AI) is a general term that refers to the demonstration of the cognitive functions typically associated with human intelligence by the machines, usually to solve certain non-trivial problems or make decisions (Russell & Norvig, 2009). Computers use machine and deep learning techniques to collect information and acquire knowledge to make autonomous decisions. Thus, it can be said that Machine Learning is an enabling technology for the AI. AI itself is an important component or supporting element of many other technologies like social bots, natural language processing, computer vision, gaming-based simulations and others (Luger, 2005).

### [redacted] ML and AI in government

Several works from literature explore and/or propose technologies to help citizens and government officers to improve their understanding on the features and issues of public spaces (Barcellos et al., 2017). “Big data machine learning” has

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been widely used in industry, academia and government. Continuous advance in this area is critical to business success, scientific discovery, as well as cybersecurity (Huang & Liu, 2015).

Big data computing is already a market of seven billion dollars in 2011, is projected to increase to 50 billion dollars within six years (Kelly, Floyer, Vellante, & Miniman, 2014) and has become such a powerful paradigm that enables scientists across different disciplines to tackle challenging research problems. One of most important big data applications is machine learning. Machine learning algorithms, such as collaborative filtering and topic modelling are often used to improve user experience and increase the revenue (Zhou, Wilkinson, Schreiber, & Pan, 2008; Blei & Jordan, 2003; Ghoting, Krishnamurthy, Pednault, Reinwald, Sindhwani, Tatikonda, Tian, & Vaithyanathan, 2011; Low, Bickson, Gonzalez, Guestrin, Kyrola, & Hellerstein, 2012).

In modern information societies, who have to deal with large volumes of data, machine learning is used to automate the data analysis. Machine learning technologies can be adopted in different domains of the public sector (Kwok Tai Chui et al., 2017). Various machine learning models are being used to classify data from social media platforms such as Twitter into predefined categories, often among other things for sentiment analysis (Patil et al., 2017). Hirokawa et al. (2017) mentioned that machine learning techniques can be used for real danger detections – reports (Ghosh et al., 2016) collected in social networks. Another promising usage of machine learning in social media can be the detection of certain characteristics of political discourse (Patil et al., 2017) or for evaluation of politicians' truthfulness (Tomašev & Nenad, 2017). There are significant uses for the machine learning in the tourism industry, including analysis of demand and interest in accommodation services, catering, road transport, air transport, car rental industry, travel industry that can lead to the improved decision-making by the government in this sector (Chang & Tsai, 2017). In New Zealand machine learning models are implemented in livestock industries for the predictions of livestock estimation with broad applications in disease risk modelling, biosecurity, policy and planning (Hollings et al, 2017) while Wilbanks & Topol (2016) and Chui et al. (2017) revealed that worldwide great efforts are being made in the field of healthcare, water (Patil et al., 2017) and air pollution (Hu et al., 2017). Other areas of application include: solving problems connected to energy crisis, education, food security, overfishing, environmental pollution, migration crisis, urbanization, and water security (Chui et al., 2017).

The advantages of machine learning systems are the efficiency, accuracy, performance, and usability in comparison to human analysis. This is particularly evident in classification problems. Machine learning is the easiest and fastest way for automated classification to analyse data when compared to manual process which would consume significant amount of time and resources (Patil et al., 2017; Marasco & Kontokosta, 2016).

In the public administrations, Sentiment Analysis (SA) using machine learning is a technique capable to facilitate the improvement of relationship between public body and citizens. SA is able to discover the criticalities of this relationship in order to focus on taking right actions (Corallo et al., 2015) when carried out in social networks, SA allows public administrations to identify and meet user's needs and enables citizens to affect the service delivery and to participate in the creation of a new services, or even to identify innovative uses of existing services (Dolicani, Kajan, & Randjelovic, 2014).

*Challenges*

The grand challenges that machine learning usage in government is confronted with are (i) availability of data (Wilbanks & Topol, 2016; Piscopo et al., 2017), (ii) quality and quantity of data (Eshleman & Yang, 2015; Netten et al., 2016) (iii) unstructured data (Eshleman & Yang, 2015; Netten et al., 2016), and (iv) information overload (Netten et al., 2016; Chui et al., 2017).

In many cases there can be found (i) difficulties of gaining regulatory approval of accessing data (for instance in healthcare), (ii) lack of data (geographical data) or even (iii) accessed data may not be representative and in cases of predictions barriers can be found. Unstructured data (iv) are a major challenge in the usage of machine learning if we think of different regional languages.

In relation to the AI, there are certain ethical concerns; some scientists and businessmen voiced their concern about the realisation of "full AI", which may be an existential threat to humanity if not managed correctly (Gibbs, 2014; Rawlinson,

2015). Among the AI experts there is disagreement regarding the potential dangers of AI, some researchers claiming that the risks are overestimated (Müller & Bostrom, 2016).

AI and ML have a potential to be used for automated decision making in government. The benefits include: capability to make more flexible and faster decisions based on real-time or dynamic data, possibility to handle much greater number of decisions, ability to detect patterns and decisions otherwise hidden (Le Sueur, 2015). Another possible benefit is fairer and more impartial decisions, based on data alone.

However, application of AI/ML for making decisions automatically brings further challenges that need to be considered: both technical challenges as mentioned above and ethical challenges: like the changing roles of the public service officers (from the decision makers to the mediators of decisions made by the machine), desirability of surrendering executive power to the computer and issues with algorithmic bias (caused by the biased data used as input, incomplete data and/or confounding variables in the data) (Le Sueur, 2015; Wihlborg, Larsson, & Hedström, 2016).The governments worldwide have already started to consider possible solutions to these issues, developing recommendations and guidelines for proper implementation of automated-decision making processes. Ensuring transparency is seen as a main way to ensure accountability of the government and safeguard from possible biases.

*Future prospects*

The integration of different dataset categories (Eshleman & Yang, 2015) can create new ways to solve complex problems combining deep learning techniques with neural network (Patil et al., 2017) or to offer more detailed information (such as in case of datasets containing crime statistics, school and business records). The effectiveness of machine learning models can be improved by using more than one algorithm or by testing the results with other techniques in the literature or available tools (Nepali & Wang, 2016). Furthermore, as Terlyga & Balk (2017) mentioned, governments can use machine learning clustering techniques to assign goals to their units based on different indicators (for example clustering universities by their spending overall P&L statements, will help governments to set expectations for the universities). AI has significant applications in healthcare, automotive industry, military, finance and economics (Luger, 2005), especially in relation to automatic decision making, perception and planning (Russell & Norvig, 2009). With the increase of AI application in government the importance of automated decisions will inevitably rise, so it is necessary to consider the ethical issues and elaborate the proper regulatory system that will minimise the possible problems.

### [redacted] Summary and relation to other concepts

With the increased availability of big data in different domains, rises the demand for efficient and timely analysis of the data. Human-driven data analytics are often not cost effective and fast enough to satisfy the growing citizen expectations and demands. In many cases AI and machine learning techniques can provide an alternative solution. Machine learning is particularly useful for the classification problems, such as sentiment analysis though text mining and natural language processing.  Machine-learning can also be used to analyse data generated by the citizens in crowdsourcing. AI can be implemented in many different domains to aid in data-driven decision making, especially where decisions need to be made quickly and autonomously.

## 4.10 Natural Language Processing

Compiled by: *Christina Kappatou, Nikolaos Kousantas (PwC)*

### [redacted] Definition

Natural Language Processing (NLP) is an area of research and application that explores how computers can be used to understand and manipulate natural language text or speech to do useful things (Noble, 1988).

In 1963 Reed C. Lawlor surmised that computers would one day become able to analyse and predict the outcomes of judicial decisions (Lawlor, 1963). According to Lawlor, reliable prediction of the activity of judges would depend on a scientific understanding of the ways that the law and the facts impact on the relevant decision-makers, i.e. the judges. More than fifty years later, the advances in Natural Language Processing (NLP) and Machine Learning (ML) provide us with the tools to automatically analyse legal materials and to build successful predictive models of judicial outcomes (Aletras et al., 2018).

## [redacted]NLP in government

Natural language processing includes many different techniques for interpreting human language, ranging from statistical and machine learning methods, Bayesian and semantic networks to rules-based and algorithmic approaches (Cambria & White, 2014). There is a need for a broad array of approaches because the text- and voice-based data varies widely, as do the practical applications of these methods.

E-Government includes a wide-range of areas, which can be tackled by the NLP such as e-voting, e-procurement, data collection, management and analysis, inter-agency collaboration, intra- and inter-agency communication, e-learning, and human resource management. A key focus of e-Government development in many countries is on the interactions between the government and citizens. Therefore, many government agencies view e-Government as their primary method for interacting with users (Bertot & Jaeger, 2006, 2008; Ebbers, Pieterson, & Noordman, 2008; Steib & Navarro, 2006).

In the recent years, online social networking has revolutionized interpersonal communication. The newer research on language analysis in social media has been increasingly focusing on the social network impact on our daily lives, both on a personal and professional level. Natural language processing methods have been used with a high degree of success to solve a variety of practical problems including email filtering, speech recognition systems, search engine predictions and even artificial intelligence systems (Jackson & Moulinier, 2007). In the social sciences, natural language processing methods combined with machine learning techniques have been used to estimate media bias (Young and Soroka, 2012), identify the politically relevant features of texts (Barberá, 2014; Bond and Messing, 2015; Lowe et al., 2011; Monroe, Colaresi, and Quinn, 2008) and to measure agendas in political texts (Grimmer, 2009).

NLP contributes the public management field in two ways: 1) it evaluates a comprehensive model of determinants of user satisfaction from public services, and 2) offers an effective method to analyse big data for public services. The contributions stem from the implementation of NLP to solve a public management analytical problem (Kowalski, Esteve, Mikhaylov, 2017).

*Challenges of using NLP in Government*

One of the great benefits of working with unstructured data (in this case, speech or text input) is that it is created directly by the people with the knowledge that is interesting to decision makers. Unstructured data directly reflects the interests, feelings, opinions and knowledge of citizens, (Jade and Jade, 2018). Thus, government could use NLP to gain a better understanding of what citizens are discussing any given issue or in general. It allows for a clearer understanding of items that may need to be addressed, from healthcare to consumer safety. Data collection for NLP can be done with the help of data mining, passive crowdsourcing or e-participation tools, both on social media and outside. NLP could help government do a better job of not just listening to the people but answering them as well (Ojo and Millard, 2017).

*Future Prospects*

There are future prospects both in the application of NLP innovations in e-government and in the optimization of the techniques in NLP field. Textual analytic methods applied to the e-government data is an important future direction of NLP's use in e-government (Harrison, 2018), another future direction is the use of NLP technologies by social chatbots, capable of understanding human speech. Chatbots when used in e-government can improve accessibility of public services and engage more citizens.

### [redacted] Summary and relation to other concepts

During the recent years natural language processing has developed rapidly both in private and public sector. E-Government includes a wide range of areas where NLP can be useful, such us e-voting, e-procurement, e-petitioning, e-learning, etc. NLP can be used to process textual, audio and video data (including big data) collected on social media and crowdsourcing e-government platforms and also power the chatbots, which can be implemented to make public services more usable and accessible. The implementation of NLP can be based on machine learning and cloud computing technologies.

## 4.11 Blockchain

Compiled by: *Zoi Lachana, Charalampos Alexopoulos (UAEGEAN)*

### [redacted] Definition

Hou (2017, p.1) defines BlockChain (BC) as "a distributed ledger that maintains a continually growing list of publicly accessible records cryptographically secured from tampering and revision".

Zhang (2017) compares BC to a creation of a persistent, immutable, and ever-growing public ledger that can be updated to represent the latest state of it. BC was originally used to record historical transactions of encrypted digital currencies, such as bitcoin (Zhu & Zhou, 2016). BC implementations are largely technology driven and often various combinations of technologies are needed to make the BC architecture fit for e-Government applications (Engelenburg, Janssen, & Klievink, 2017). At present, the application of BC technology has been extended to five representative domains: finance, Internet of Things, public and social services, security and privacy, and reputation systems (Zheng, Xie, Dai, & Wang, 2016).

### [redacted] Implementation

The general-purpose BC technology is viewed as one of the most important technology trends with a potential to influence business and society in the years to come (Webb, 2015). The basic idea behind the BC technology is that it allows actors in a system (called nodes) to transact digital assets using a peer-to-peer (P2P) network that stores these transactions in a distributed way across the network (Back et al., 2014). Blockchain stores the same information at different nodes and the information will only be added when the nodes have reached consensus. New transactions can be added, but previous information cannot be removed enabling all nodes to track the history. Storing transaction information in different nodes is called a distributed ledger (Olnes et al., 2017). The owners of the assets, and the transactions involving change of ownership, are registered on the ledger by the use of public key cryptography and digital signatures (Warburg, 2016). Every transaction is validated by the nodes in the network by employing some kind of a 'consensus mechanism' (a consensus protocol). This works as follows. Whenever a transaction is entered into the P2P network, the nodes first validate the transaction. If the nodes agree on its legitimacy, they confirm the transaction and this decision is laid down in a block. This new block is added to the previous chain of blocks and as such locked. In this way, the latest block maintains a shared, agreed-upon view of the current state of the BC (Buterin, 2014).

Current blockchain systems can be roughly categorized into three types: public blockchain, private blockchain and consortium blockchain (Buterin, 2015). These three types of BC can be compared from different perspectives: consensus determination, read permission, immutability, efficiency, centralized and consensus process (Zheng et al., 2017). On public blockchains each node takes part in storing the information, which is therefore decentralised. On private blockchains a limited number of nodes determines the consensus and the storage BC information is centralised (which also allows these nodes to tamper with the stored information, e.g. reverse transactions). Consortium blockchains are the middle ground, where like in private blockchains a limited number of nodes determine the consensus, however these nodes are not controlled by a single organisation (Zheng et al., 2017).

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Although Bitcoin is the most famous application of the blockchain technology, blockchain can be used in domains far beyond cryptocurrencies (Zheng et al., 2017), including public sector. If fully distributed, unpermissioned BCs have their own inherent limits, permissioned BCs may represent instead a valid solution for governmental online services. Since it allows payment to be finished without any bank or other intermediary, BC can be used in various financial services such as digital assets, remittance and online payment (Foroglou & Tsilidou, 2015). Additionally, blockchain technology is becoming one of the most promising technologies for the next generation of Internet interaction systems, such as smart contracts (Kosba et al., 2016), public services (Akins et al., 2013), Internet of Things (Zhang & Wen, 2015), reputation systems (Sharples & Domingue, 2015) and security services (Noyes, 2016).

## [redacted] Blockchain in government

There have been a number of literature reviews of the use of BC technology in government. Ølnes (2016) shows that most articles dealing with BC focus primarily on the technology behind bitcoin and until 2015 there had been few publications dealing with BC in government in the literature databases (including bitcoin, cryptocurrency technology, eGovernment, electronic Government, e-Government, etc.). Author suggests that in order to be a potentially valuable technology for use in public sector, BC needs to be more than a payment solution (Ølnes, 2016).

As it was noted, BC is often used as a solution for the improvement of public services. Recent case studies include BC technology for digital payments (Luther, 2016), providing academic certificates stored on the blockchain at the University of Nicosia (Ølnes, 2016), a sovereign government-backed identity credential (e-ID card, e- Residency) in Estonia (Sullivan & Burger, 2017) and healthcare, pensions, government performance, food safety and government divisions, all of which have close relationships with individuals' livelihood in China (Hou, 2017).

*Benefits*

BC technology can be used to improve the quality of government services (Hou, 2017) by ensuring greater transparency and accessibility of government information (Atzori, 2016), development of information-sharing across different organizations, and assistance in building an individual credit system. BC-based platforms can be used to give citizens or even businesses (Engelenbur et al., 2017) access to reliable government information, which can in turn strengthen the government's credibility. Moreover, within the BC system, every transaction is recorded, which makes it easy to trace the parties authorizing transactions and understand the scope of the transaction. It also means that data can be more easily and safely transferred between different organizations and promoting the integration of information amongst different organizations. Ølnes (2016) reveals that storing certificates on the blockchain is a cost-effective way of storing and securing vital information. Thus, social benefits such as a more collaborative society could be a result of BC technology usage in government (Swan, 2015).

*Challenges*

At the same time, the application of the BC to the domain of e-Government is associated with a number of challenges: scalability, privacy leakage and selfish mining (Zheng et al. 2017).

- *Scalability* refers to the need to store all of the recorded transaction. The bitcoin blockchain has already exceeded 100GB in size (Zheng et al. 2017). Furthermore, due to the original restriction of bitcoin BC block size and the time interval used to generate a new block, there is limited bandwidth in the number of transaction processed per second.
- *Privacy leakage*: while BC is believed to be very safe as users make transactions with generated addresses rather than real identity. However public blockchain is publicly visible and ultimately cannot guarantee the full transactional privacy. Some researchers suggested ways of linking IP addresses of users to the transactions (Biryukov, Khovratovich, & Pustogarov, 2014).
- *Selfish Mining* refers to the attacks of the colluding selfish miners, which can prevent propagation of some information in the blockchain for their own advantage. It is assumed that groups that control more than 51% of

total computer power are able to reverse the completed transactions stored in blockchain. However, Eyal and Sirer (2014) showed that there is possibility to realise the attacks even controlling less than 51% of power.

Another e-Government specific issue is the management problem, which may lead to the issues with the quality of data entered into Blockchain. Sullivan and Burger (2017) also note that although BC-stored records in case of e-Residents, e-IDs and authentication can be proved to be valid, it is not necessarily legally binding in all country's jurisdictions and even less so in any other state. Moreover, there is the risk that identity information authenticated on the BC but which is otherwise invalid may find its way into traditional channels to enable creation of new, false identities, which could then be used to hide one's real identity.

*Future prospects*

BC is a "neutral," non-political technology. However, being a transformative technology, its political implications are significant: the applications that the technology affords can reconfigure economic, legal, institutional, monetary and ultimately broader socio-political relationships (Reijers et al., 2016). BC could be a promising technology for all types of permanent, or relatively permanent, public documents. As Ølnes (2016) claimed, BC has a great potential for use in public sector. Having a great potential is not the same as having a great success, however. There are quite a few examples of technologies with great potential nevertheless failing to be embraced and included in the technologies used for everyday service provision.

Still, given the promising benefits the BC technology holds, it is important that the researchers in the e-Government field start to investigate it. There are a lot of questions about the potential application of BC that need to be answered through more research. These questions are not that different from the questions of public sector's use of the Internet and the web in the beginning of the 1990s. Perhaps going back 25 years and looking at how these questions were answered can give us an idea of how public sector should approach the BC technology.

### [redacted] Summary and relation to other concepts

There has been much interest in Blockchain as a technology beyond a digital currency, as a recordkeeping solution. Towards the adoption of this innovative technology especially in the public sector the understanding of this mechanism and the identification of its benefits and obstacles are necessary requirements. As long as BC technology uses public keys in association with cryptographic signatures, it provides secure transactions and reliable records, thus contributing to the openness and transparency of public services. It is particularly useful for the realisation of secure eID service. Although there are clear benefits of BC in public sector, an in-depth analysis of the technology is required in order to address conflicts or possible limitations and risks accompanied with its usage in public services.

## 4.12 Augmented Reality

Compiled by: *Alexander Ronzhyn (NEGZ)*

### [redacted] Definition

According to the most widely accepted definition proposed by Azuma et al. augmented reality (AR) system has three core features: (i) it combines real and virtual objects in a real environment; (ii) it registers (aligns) real and virtual objects with each other; and (iii) it runs interactively, in three dimensions, and in real time (R. Azuma et al., 2001; R. T. A. Azuma, 1997). In other words, augmented reality adds virtual elements to the user's view of the reality aiming to enrich it and provide additional information or features. That way, AR seamlessly bridges the gap between the real and the virtual (K. Lee, 2012).

As AR supposes the interplay between real and virtual worlds, the technological demands and challenges in AR are higher than in pure virtual reality (VR); thus it needs longer time to mature as a technology compared to VR (Krevelen & Poelman, 2010a). Any realisation of AR requires some sort of output device (usually display or projector), sensors (for input and

registration), processing unit and possibly other technologies, depending on the type of AR offered (Chatzopoulos, Bermejo, Huang, & Hui, 2017; Krevelen & Poelman, 2010a). While first AR prototype appeared in 1960s it took fifty years for truly mass-market technology to be developed (Krevelen & Poelman, 2010b; Tamura, 2002). AR applications are now readily available on a wide range of consumer devices, such as smartphones and portable game consoles.

### [redacted] Realisation

Researchers recognised potential of AR for tourism industry (Cho & Park, 2012; De La Nube Aguirre Brito, 2015; Yovcheva, Buhalis, & Gatzidis, 2012), medicine, urban planning (Höllerer & Feiner, 2004), education and training (Kaufmann, 2003; K. Lee, 2012). Some researchers envision that location-aware AR technologies will become the next step in the evolution of the World Wide Web, improving and increasing a number of services offered to the users (Spohrer, 1999).

There are three ways to present augmented reality visually: with a video see-through, optical overlay or projection (Krevelen & Poelman, 2010a). With the growing processor power and availability of high-resolution displays in smartphones, video see-through AR has become by far the most wide-spread type of visual augmented reality. The AR implementations using a smartphone are also called Mobile augmented reality systems (MARS) (Höllerer & Feiner, 2004). Some of these system rely on cloud computing for resource-intensive parts of their realisation (Chatzopoulos et al., 2017).

While the creation of a head-worn AR system is expected to be a major achievement for getting a truly mass-market AR device, until now the success of such systems has been limited. High-price and limited usefulness of Google Glass AR-glasses led to Google discontinuing the product after a public beta release and changing its focus from mass consumer to business market (Levy, 2017). Hand-held system based on a smartphone is currently the most popular AR realisation. With the iOS 11 update, Apple introduced ARKit[27] and started to promote AR-enabled applications by creating a separate section in the Apple Appstore and featuring best AR application and games on the homepage of the application store. The number of AR applications grows continually, however for now most of the applications can be classified as entertainment (Koetsier, 2017).

### [redacted] Augmented Reality in government

Augmented reality is a useful assisting technology that can aid in realisation of various e-Government projects. Broadly speaking, AR can be used in e-Government in two different ways: as a mean of reducing complexity of large amounts of information through better visual representation of the data, and as a way of making the services more interactive and user-friendly by providing a user with a natural way to interact with the application.

*Improved visualisation of information*

Huang et al. (2014) and Bermejo et al. (2017) explore possible uses of AR technologies in *big data visualisation* and suggest that in public services, AR will be particularly useful in healthcare, urban planning, transportation, policing, surveillance and more effective collaboration between public workers. In each of these areas, AR can help to make sense of large amounts of available data and make the public services more efficient.

*Healthcare* provision can be improved by visualising patient data in AR and improving diagnosing and treatment. Quicker access to patient data through augmented views can give doctors an access to the relevant information about the patient (such as patient's history, tomography and X-ray scans and other images) and when necessary even overlay these data over the patient's view (Bermejo et al., 2017; Rosenthal et al., 2002).

AR can be useful for *urban planning* by making it more visual and accessible (Kamel Boulos, Lu, Guerrero, Jennett, & Steed, 2017). In AR-enabled applications users can actually see the suggested changes to the urban environment on their

[27] https://developer.apple.com/arkit/

smartphone screen. As these applications are realised on smartphones, they can also increase communication between users by providing networking/collaborative capabilities (Liao & Humphreys, 2015).

*Transportation* can be enhanced by providing drivers with additional information on traffic and environmental conditions. While car equipment manufacturers already have working prototypes of AR-based systems that improve navigation by projecting additional information on the windshield (9D Research Group, 2016; Cunningham, 2017), coupling that with provision of the real-time data on traffic conditions can be important step towards realisation of the smart city concept.

AR can also be used in *law enforcement and surveillance* by allowing quick verification of identity and (with the help of IoT-enabled devices) accessing information on vehicles and goods in the situations, where reaction time is important (Bermejo et al., 2017).

AR can improve *collaboration between public workers* by showing them additional information on the current task – such as information on the skills/positions of the colleagues from different departments, views of the underground networks during infrastructural work or overhead views during rescue missions (Bermejo et al., 2017).

*AR and enhanced citizen participation*

Apart from visualisation, AR has great potential for increasing the interactivity of citizen-oriented services. Along with the increase of AR-enabled consumer devices, increased the number of participatory solutions that take advantage of this technology.

AR can be used to increase engagement of the young generation as a part of the gamification of e-participation initiatives. An urban planning youth-oriented project realised in Bandung City, Indonesia showed along with gamification and story-telling elements, AR may increase the youth's participation in environmental planning (Argo, Prabonno, & Singgi, 2016) and smart city initiatives (Thiel, 2016). Applications like Spot Crime[28] take advantage of AR to improve the provision of public services by collecting the responses of the public.

*Limitations and challenges*

There are still significant barriers for the wide use of AR in public services. Technology limitations include the lack of a standard consumer platform for AR, display and battery technology limitations for smaller wearable devices (Bermejo et al., 2017). Apart from that, there are also significant privacy concerns (Bermejo et al., 2017) and issues with social acceptance of AR (Krevelen & Poelman, 2010a), which mirror the issues with some other Government 3.0 technologies like IoT and e-identity.

*Future directions*

There has been no large-scale implementation of AR-enabled government service to date, however the industry's investment in the technology has been significant (Deloitte, 2013). Report published by Deloitte (2013) envisions several areas where AR will become more prevalent in the future: training and education, data capture, location and navigation, identification, collaboration and contextualisation. All these areas are relevant to the government and have potential to improve various aspects of citizen-government interaction.

## [redacted] Summary and relation to other concepts

As Government 3.0 is characterised by the necessity to use the large amounts of big, open and linked data, in some of the domains AR can be extremely useful as an assisting technology, helping to visualise, make sense of and interact with big data. Apart from that AR can be an effective component in gamification of public services, especially those that depend on visualisation. For services like urban planning AR can be used to increase citizen participation and foster co-creation of

[28] https://spotcrime.com/

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public services. AR proliferation in public services is associated with privacy concerns, similarly to IoT and e-identity technologies.

# 4.13 Virtual Reality

Compiled by: *Alexander Ronzhyn (NEGZ)*

## [redacted] Definition

Virtual reality is a simulation, in which computer graphics are used to create a dynamic realistic-looking world, which a user can interact with by using certain input methods (Burdea & Coiffet, 2003). It is usually presented to a user through a head-mounted device with screen(s), which allow the user to immerse into the completely artificial environment, instead of augmenting the reality with some virtual elements as in case of AR.

Since 1993, researchers have recognized the potential of virtual reality for training and education. It is seen as a valuable technology in the spheres, where real world practical training would be expensive or difficult, like surgical procedures (Satava, 1993) or aircraft piloting (Bricken & Byrne, 1992). Ideally virtual reality can simulate real situations and prepare the trainees to dealing with real world problems and complications.

## [redacted] Virtual Reality in government

There has been certain confusion about how the VR can be used in e-Government. One way to use VR for public administration would be to construct the virtual spaces mimicking the real-world administrative buildings – so the virtual avatars of citizens would interact with virtual avatars of public officers. Tozsa (2013) proposed practical recommendation for the realisation of this kind of virtual environments and described the procedures that can be realised within the VR.

At the same time term VR have been used by some researchers to mean 3D-modelled environments. In such cases a broader understanding of "virtual" is used, meaning something created and modelled on a computer, merely opposite of "real". In such "virtual" projects, there is no need to interact with a system's user and platform users adopt a passive role of an observer (Cappelle, El Najjar, Charpillet, & Pomorski, 2012), where "virtual" 3D visualisations are used for demonstration of certain concepts or objects (Nakaya et al., 2010; Van Schaik, 2010) or visualisation of future urban planning proposals (Lopes & Lindström, 2012). For example the WebVRGIS engine used to construct 3D Shenzhen CityWeb platform (Lv, Li, et al., 2016; Lv, Yin, Song, & Chen, 2016) despite its name, does not offer its users the ability to immerse themselves into the virtual environment. Instead it uses 3D-modelled environment to visualise and analyse big data collected in the city.

Existing immersive gaming environments can also be used for the e-Government purposes. Second Life[29] for instance have been used for collaborative learning (Sutcliffe & Alrayes, 2012), health research (Beard, Wilson, Morra, & Keelan, 2009) and e-Participation (Macintosh & Mikroyannidis, 2009). While Second Life's VR support is limited, similar VR-based multiplayer games are already available.

In the context of VR, it is also worth mentioning the virtual worlds created in the Minecraft game (which also supports VR[30]). While Minecraft has not been used for provision of public services, the game's capabilities for collaborative construction allowed realising a number of public virtual construction projects of unprecedented scale. The number of people investing their time in virtual building and committed to such projects, can potentially provide valuable tips for organisation of citizens for future projects in public services (Levine, 2017). Some areas one can think of are collaborative urban planning, infrastructure crowdsourcing and similar. Also, the relative technological simplicity of Minecraft (famously

[29] http://secondlife.com/
[30] https://minecraft.net/en-us/vr/

developed by one person), underlines the importance of innovation when designing projects aimed to engage people (Nebel et al., 2017).

*Future directions*

In public service provision, virtual reality has not been used extensively; it is trailing behind even the augmented reality as an e-Government technology. The VR systems in e-Government available today are mostly experiments or proof-of-concepts (Li et al., 2015; Lv, Li, et al., 2016), however with the rise of mobile VR the expectations are high (Porwol & Ojo, 2017).

### [redacted] Summary and relation to other concepts

While augmented reality overlays additional information on top of the displayed real world, virtual reality is used to create an immersive simulation that users can interact with. VR technology can be used for much more dramatic visualisations, which can be used for example for training or education. It can also be used to create virtual meeting spaces and virtual public administration buildings where citizens interact with officials through digital avatars. VR can be used as a supportive technology in co-creation initiatives and help to improve citizen e-participation through gamification.

## 4.14 Internet of Things

Compiled by: *Alexander Ronzhyn (NEGZ)*

### [redacted] Definition

Gubbi et al. (2013) define the Internet of things as

> "Interconnection of sensing and actuating devices providing the ability to share information across platforms through a unified framework, developing a common operating picture for enabling innovative applications. This is achieved by seamless large scale sensing, data analytics and information representation using cutting edge ubiquitous sensing and cloud computing." (p. 4)

This definition captures the three "visions" of IoT realisation as described by Atzori et al. (2010): internet-oriented (middleware), things-oriented (sensors) and semantic-oriented (knowledge). It also underlines the intrinsic connections of IoT to the other concepts relevant for defining Government 3.0: cloud computing, sensors, (big) data analytics and smart cities.

### [redacted] Realisation

On the component level, IoT is realised with the use of smart objects ("things"), which have a physical embodiment, unique identifier, possess at least basic computing and communication functionalities and are able to either sense certain physical phenomena or trigger actions that have an effect in physical world (Miorandi, Sicari, De Pellegrini, & Chlamtac, 2012). These things may range from simple RFID tags to elaborate array of sensors and microprocessors found in self-driving vehicles. IoT is one of the most hyped technologies today and while big companies like IBM, Amazon, GE and Cisco are pushing for IoT adoption, the rate of adoption of IoT in public sector is still relatively low (Harmon, Castro-Leon, & Bhide, 2015).

Over the years IoT technologies were applied in a large number of different domains, in the public service provision, IoT are particularly useful for improving urban infrastructure, transportation and health care (Atzori et al., 2010). IoT aid in realisation of the smart city concept by enabling infrastructural monitoring, which can make the use of resources and provision of services on the municipal level more efficient and support added-value services for the administration of the city and for the citizens (Zanella, Bui, Castellani, Vangelista, & Zorzi, 2014). For example, IoT can be used for monitoring of traffic information in cities by collecting data about the displacement of individual vehicles (cars, buses or bicycles). The data collected can then be analysed and used for the optimisation of the city infrastructure or planning of public services.

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In health care sector the IoT can be used for secure storage of patient information (which can be quickly accessed during emergency treatment) or for the purposes of monitoring of either individual patients or hospital as a system (Yazici, 2014).

## [redacted] IoT in government

There have been a number of literature reviews of the IoT field (Atzori et al., 2010; Gubbi et al., 2013; Whitmore, Agarwal, & Da Xu, 2015) providing comprehensive overview of the use of this technology. Whitmore et al. (2015) show that the majority of the articles dealing with IoT focus on technology. Works dealing with hardware, software and architectural questions of the IoT account for 53 of 127 analysed articles in the review. Authors suggest that such bias towards technology can be explained with the relative youth of the field and as the IoT matures, there will be more articles dealing with the implementation and practical realisation. While none of the IoT literature reviews focuses exclusively on the use of IoT in e-Government, smart cities and healthcare are the two public service areas discussed most often.

Brous and Janssen conducted a systematic review of benefits IoT can bring the e-Government (Brous & Janssen, 2015b) and impediments for the use of IoT in e-Government sector (Brous & Janssen, 2015a). They mention that in 2015 (Brous & Janssen, 2015b) there have been zero results when searching for “benefits”, “Internet of things” and “e-Government” in the academic databases of Scopus, IEEE and JSTOR. Looking at the government-related IoT research in the 2015-2018 time period, we note the increasing interest in the use of IoT for public service provision. A total of 19 relevant research items were identified for this timeframe. The majority of the analysed articles deal with smart cities application of IoT or related urban computing concept (10 of 19 articles).

Geographically, two articles discuss IoT in China (Song, Cai, Chahine, & Li, 2017; Zhang, Zhang, & Wang, 2017) and one in Indonesia (Nugroho & Haryani, 2016). All articles were presented or published in the developed countries, mostly in Europe and North America. Only one paper was presented in Africa (Dlodlo, Gcaba, & Smith, 2016), however it had no specific relevance to African context.

As it was noted, IoT is often used as a supporting technology which aids in the realisation of smart city and smart healthcare paradigms. Recent case studies include IoT-enabled smart transportation projects in the US (Le Dantec, Watkins, Clark, & Mynatt, 2015), IoT for road and water management in the Netherlands (Brous & Janssen, 2015b, 2015a), the use of IoT for smart cities in China (Song et al., 2017; Zhang et al., 2017) and review of IBM supported IoT projects (Scuotto, Ferraris, & Bresciani, 2016). Non-academic reports include survey research by Accenture (Terry Hemken & Gray, 2016) and report by Delloite (Maissin, Ronan, & Colin, 2015). Both articles dealt with the realisation of IoT in developed countries of Europe, North America and Asia.

*Benefits*

Brous and Janssen (2015b) identified the benefits brought by IoT to e-Government on different levels. On strategic level data collected with IoT can aid long-term planning, improve forecasting and trend analysis. Large amounts of IoT data can be also made open to the public improving government transparency and leading to better accountability and reduced government waste (Castro, 2008). On the tactical level, IoT can improve medium-term planning and maintenance of public services, thus leading to overall cost reduction (Brous & Janssen, 2015b). On the operational level data collected in real-time enables greater flexibility of service provision: thus leading to improved efficiency and effectiveness (Andrews, 2015).

*Challenges*

At the same time, the application of the IoT to the e-Government is associated with some inevitable challenges: security, privacy, data ownership and sharing of the collected information (Scarfo, 2014).

Security and privacy are the main challenges on the strategic level: in some cases (especially in health care) IoT may collect sensitive data about the individuals. Unauthorized access to such data by the third parties due to the insufficient security of the system or inappropriate sharing may lead to dire consequences (Nath & Som, 2017; Scarfo, 2014). As the data collected with IoT is meant to be processed, analysed and possibly combined with different datasets, there is a requirement

of strong data governance and appropriately designed legal framework (Scarfo, 2014; Sicari, Rizzardi, Grieco, & Coen-Porisini, 2015; Weber, 2015).

On the tactical level, there is also an issue with public sector's readiness for the IoT. Research conducted by Accenture (Terry Hemken & Gray, 2016) identified a number of challenges associated with the adoption of IoT in public sector. These are legacy systems, lack of leadership support and lack of internal skills or ability to hire. Implementation of IoT is a resource intensive and expensive undertaking (Yazici, 2014). While many public administrations choose to implement IoT (usually as a part of a smart city initiative), such efforts often end up very costly and inefficient due to the insufficient agility of the organisation and lack of personnel able to support the system (Clarke, Dunbrack, & Webber, 2017).

Finally on operational level, effective implementation of IoT requires the willingness of participants to be part of the system and share their data (Fan, Wang, Zhang, & Lin, 2013; Nam & Pardo, 2014). To ensure citizen support of the IoT in public services, government needs to effectively communicate the benefits and risks of the IoT, addressing in particular the privacy concerns through appropriate legal regulation (Andrews, 2015; Nugroho & Haryani, 2016).

*Future Directions*

When envisioning the possible future trends in IoT, experts tend to agree that IoT is still a young technology and will continue to grow in the coming years (Atzori et al., 2010). The use of IoT technologies in governance is connected to the realisation of smart city principles and is likely to be further developed as more smart city/ smart governance projects are executed worldwide (Clarke et al., 2017). Most of such projects will implement some sort of IoT or sensor technology to gather environmental data, which will need to be processed and analysed. Effective management of vast amounts of data require standardisation and development of solutions to aggregate data from the non-standard sensors that have already being implemented (Kramer, 2016).

## [redacted] Summary and relation to other concepts

IoT is a valuable supporting technology that can enhance and improve public service delivery through the realisation of the smart city concept. IoT can provide a detailed view of the different aspects of life in the city by collecting plethora of information using different sensors. The information then can be analysed using the big data analytics approaches with the support of cloud computing and be used for the provision of customised and personalised public services. Finally, the open data produced by IoT and shared with citizens can improve government transparency and accountability.

# 4.15 Gaming-Based Simulation

Compiled by: *Zoi Lachana, Charalampos Alexopoulos (UAEGEAN)*

## [redacted] Definition

Becu et al. (2016) expanded on the widely accepted definition of Gaming-based Simulation (GS) by Duke (1974):

> "[GS is a] gestalt communication mode (today we would call it a [participatory simulation] workshop), which combines a game-specific language (e.g. game rules), appropriate communication technologies (communication channel by which participants transmit and receive messages) and the multilogue interaction pattern (the multiple, simultaneous dialogue among members of a group that takes place during a gaming/simulation workshop)." (p.10)

GS includes an operating model of central features of real or proposed systems or processes. Scenarios are developed, roles are defined in interacting systems, and players are given goals, resources, and rules. Then, they work out the simulations, trying out alternative roles and strategies within the system constraints defined (Tanwattana & Toyoda, 2018).

Elements of GS are: (i) People playing roles not necessarily corresponding to those they assume in the real-life situation, (ii) a scenario defining a problem area or a given 'state of the system', (iii) an accounting system designed to record such decisions and events together with their consequences, as are taken or occur during play, and (iv) some algorithm(s)

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(implicit or explicit) which indicate(s) operating procedures for playing and controlling the exercise. The scenario in a GS exercise defines the situation presented to the players at the start of the exercise. It provides information before, during and after GS such as written report, diagram, maps, physical models, statistical information and financial statements.

In practice, GSs require individuals to assume roles, interact with multiple actors and experience the results of their choices, and can therefore provide an excellent environment for entertainment, training, motivation, assessment, education and learning, research and decision support (Mayer and Veeneman, 2002; Oblinger, 2004).

As the name suggests, GS brings together simulation, which simplifies the real world, making it "as simple as possible, but not simpler" (Holling, 2001, p. 391), for a better understanding of complex systems with games, which include rules, players, cooperation and competition (Rusca et al., 2012). An effective simulation game can respond to players by offering immediate, contextualized and sometimes surprising feedback results.

## [redacted] Realisation

Overall, GS help to (1) determine how the system of interest works and how it can be influenced by players' choices, (2) understand the positions of other players, and interactions between their differing interests and (3) explore new institutional and organizational arrangements (Rusca et al., 2012).

Gaming and gaming simulations have previously been examined for improving on issues involving the government (Andreas Frank & Meije, 2017) since their usage have been applied in a broad spectrum of application areas, such as military, government, educational, corporate, healthcare, and renewable energy sources. Some GS have been used effectively as intervention method with local stakeholders at a community level, for instance with local farmers or fishermen in rural areas of developing countries (Hertzog et al., 2014; Le Bars et al., 2014; Magombeyi et al., 2008; Barreteau et al., 2007).

Furthermore, gaming simulations have been chosen as a method for communicating issues in planning transport infrastructure due to being good tools for assessing the social and informal spaces of urban transport systems (Raghotama and Meijer, 2015).

## [redacted] Gaming-based Simulation in government

Initially, GS was used in the military (Oblinger, 2004) and began to spread to non-military applications in the mid-1950s. In the 1970s and 1980s with increasing recognition of GS as an effective tool for the management of limited resources, the approach was adopted by social science disciplines, including education, biology, land management, policy analysis and economics (Mayer, 2009; Mayer & Veeneman, 2002). As an example, the educational process is frequently criticized for failing to provide students with employability skills (Bennis and O'Toole, 2005). This failure can be divided into two main parts: the management theories being taught are not relevant (Chia and Holt, 2008) and the process used to teach students are outdated. To overcome these weaknesses, business simulation as an approach of GS aimed at bridging the gap between theory and practice including the perspectives of employer, student and government.

GS has been widely used by the governments worldwide, particularly for purposes of policy development. Among recent implementations of GS in government is a tool developed by Agriculture and Agri-food Canada (AAFC). The Invitational Drought Tournament (IDT), combines a workshop with features of a game: competition, cooperation, strategies, rules, players and referees. Essentially a "workshop with a winner", the IDT involves multi-disciplinary teams that compete over the course of a day to develop the best drought mitigation plan for reducing social, economic and environmental drought risks in both the short- and longer-term e and thereby achieve the best score (Wang & Davies, 2015). Also, in agriculture, a variety of agricultural GS models were implemented to simulate the crop development processes based on physical states such as climate and soil conditions and management actions such as irrigation. Examples include CROPWAT (Smith, 1992), AquaCrop (Raes et al., 2009; Steduto et al., 2009), DSSAT (Jones et al., 2003) and CropSyst (Stockle et al., 2003), and for Canada, the Irrigation Water Demand model (Fretwell, 2009), the Irrigation District Model (Irrigation Water Management Study Committee, 2002), and the Alberta Irrigation Management Model (Alberta Agriculture and Rural Development,

2014a). Iglesias and Blanco (2008) and Elmahdi et al. (2007) developed models to simulate effects of water tariffs and total water cost on agricultural water use in Spain and Australia, respectively. Other models investigate inter-relationships between water supply and demand. Langsdale et al. (2007) and Xu et al. (2002) developed simulation models to explore future water supply and demand under different water conservation policies and climate change scenarios in the Okanagan Basin, Canada and the Yellow River Basin, China, respectively. Community Cooperation Game (CCG) 'Jishubo' is a gaming simulation of a possible flood emergency Thailand. It is used as a disaster training for residents and prepare community systems to cope with disaster such as evacuation, and crisis management (Tanwattana & Toyoda, 2018). The results of the simulation is then discussed to suggest infrastructure and process changes in the area (Tanwattana & Toyoda, 2018). A gaming-based simulation system of the entire inland shipping network of the Netherlands was developed (Veenstra A. W. et al 2015). The objective of this simulator was to support the design and evaluation of new inland shipping concepts in specific operating areas, by market parties.

Another example of a gaming simulation conducted in cooperation with government agencies in India is the Communication Protocol Game (Andreas Frank & Sebastiaan Meije, 2017). The goal of the game is to promote communication between agencies in the case of a disaster in the country. The different agencies commonly develop their own reactions to disasters. To ensure the optimal response when several different agencies are involved, good communication between them is key and preventing miscommunication should be a main objective. The simulations identified several critical points where communication could go wrong and highlighted the importance of not just having a protocol, but also how to adhere to it (Palavalli, et al, 2012).

*Benefits*

A properly conceived and employed gaming-based simulation system is a powerful tool both for conveying gestalt and for explaining alternative situation that could not otherwise be managed (Tanwattana & Toyoda, 2018). It is particularly useful for guiding speculation about future circumstances for governments (Tanwattana & Toyoda, 2018). Conclusively, participatory planning processes are considered useful tools for including perspectives commonly difficult to assess. Gaming simulations can fill an important role in this context, as they, although being data demanding, are generally cheaper than field training or other simulations with similar goals (Asiri et al., 2017). Furthermore, they can facilitate discussions between laymen, experts and decision makers, even potentially sidestepping the significant e-Government challenge of differing literacy rates, providing a good base for a socially inclusive participatory planning process (Asiri et al., 2017).

*Challenges*

Still, even though GS provides a complex view of "all kind of-" environments, they have been criticized for several reasons. Firstly, it is hard to replicate real life experiences and decision-making activities and GS will inevitably be an incomplete model of the simulated system, risking excluding some important and substantial aspects of the system (Strachan 2016). Another limitation in the educational field related to gaming-based simulation is the possible focus of the actors on gaming rather than learning component of GS (Doyle and Brown 2000). Moreover, there is an issue of the different cultural contexts. Meershoek et al. (2014) write about the importance of taking great care to adapt the game to the cultural context of the players for which the game is intended. Otherwise there is a risk that the behaviour of the players will prevent reaching the intended objectives of GS.

## [redacted] Summary and relation to other concepts

Gaming-based simulation constitutes a powerful tool for explaining alternative concepts and situations of real or even imaginary systems. Although its usage is relatively new especially in the field of public services, GS is particularly useful for dealing with urban information. GS provides a better way for understanding and exploring situations, experimenting alternative futures and even in some cases predicting solutions and behaviours. Thus, GS can be a useful component of decision-making, smart city governance and policy modelling. Technically AR and VR systems can be used to create more realistic and engaging simulations, while big data can be sued as in input to provide realistic system simulation.

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# 4.16 Policy Modelling

Compiled by: *Charambos Psintridis, Savvas Chatzikostas, Giannis Tsiaousis* (*SiLo*)

## [redacted] Definition

Ruiz Estrada (2011, p.524) defines policy modelling as "an academic or empirical research work, that is supported by the use of different theories as well as quantitative or qualitative models and techniques, to analytically evaluate the past (causes) and future (effects) of any policy on society, anywhere and anytime". The author goes on to review 1501 papers published in the Journal of Policy Making to provide a classification of the policy modelling research conducted so far with respect to the field in which it contributes. In particular, Estrada identifies 12 different categories of policy making research including (i) domestic and international trade policy modelling; (ii) energy, communications, infrastructure and transportation policy modelling; (iii) environmental and natural resources management policy modelling; (iv) fiscal and government spending policy modelling; (v) institutional, regulation and negotiation policy modelling; (vi) labour, employment and population policy modelling; (vii) monetary, banking and investment policy modelling; (viii) production and consumption policy modelling; (ix) technological and R&D policy modelling; (x) welfare and social policy modelling; (xi) economic growth and development policy modelling; (xii) miscellaneous policy modelling (Estrada, 2011).

## [redacted] Policy Modelling in government

Academic research on policy modelling and the development of the necessary technology provides insights in how technology could assist policy makers. For instance, in Bothos et al. (2014), the authors attempt to assist the policy decision process and proactively sensing possible problems concerning global matters, by suggesting a novel computational platform called SYMPHONY to offer a solution for designing and testing policies and regulatory measures. In this way, policy modellers and policy makers can access tools will support them to make decisions which will prevent and mitigate economic and financial crises as well as foster an economically and ecologically sustainable growth path. Similarly, Gusev et al. (2015) develop and present methodology, stressing the need for technology optimization to support policy modelling. They draw on case studies of modelling an optimisation intended to support the urban policy at cities to support their mathematical model and modelling the optimisation.

Most of the literature dealing with policy modelling takes a technical research path and focuses on the technologies that can support policy modelling for Government. In addition, as underlined by Brooks et al. (2018), the policy modelling strand is fragmented as it encapsulates different disciplines which are distinct from each other and meet in their own conferences and specialist fields. Realising these limitations and through the FP7-funded eGovPoliNet[31] project, authors have attempted to set up an international community for ICT solutions for governance and policy modelling, aiming to build on experiences accumulated by leading actors and bring together innovative knowledge of the field. Beyond bringing together different research communities working on policy modelling topic, their work aimed to provide a barometer for effectiveness for public governance and policy modelling in Europe and worldwide.

eGovPoliNet project provided important theoretical and empirical contribution in policy modelling research. Mellouli, Shanin and Hamza (2015) produced a comparative analysis of different technology frameworks for policy modelling, classifying them into three categories: (i) frameworks focusing on policy process stages, (ii) frameworks focusing on institutions and (iii) those that focus on human factor and collation. Bär, Wimmer, Glova, Papazafeiropoulou, & Brooks, (2015) analysed several project dealing with climate change policy from the policy modelling angle, highlighting the fragmentary application of policy modelling when developing the policies.

[31] http://www.policy-community.eu/

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Other result of the eGovPoliNet project was the creation of seven future scenarios about the ICT use for governance and policy modelling. Scenario 2[32] particularly discusses the use of open and big data for simulation and policy modelling, suggesting that integrating open data into modelling can improve policy decision-making on alternative choices. Scenario 5[33] envisions the increased use of mobile and wearable technology as well as smart devices, also relevant in the context of Government 3.0. These emergent technologies will likely contribute to the connectedness of the citizens and improve the responsiveness of the Government.

### [redacted] Summary and relation to other concepts

Policy modelling as an approach can support and improve policy decision-making processes in government. Policy modelling can be conducted based on the open linked big data sources and employing various other techniques like Gaming-Based Simulation, supported by visualisation. Policy modelling also has implications for Smart City governance and innovation in government generally.

# 4.17 Smart City Government

Compiled by: *Gabriela Viale Pereira (DUK)*

### [redacted] Definition

Dameri and Benevolo, (2016) define smart cities (SC) as

> "a recent but emerging phenomenon, aiming at using high technology and especially information and communications technology (ICT) to implement better living conditions in large metropolises, to involve citizens in city government, and to support sustainable economic development and city attractiveness. The final goal is to improve the quality of city life for all stakeholders." (p. 1)

In a more technical perspective, Costa and Santos (2016) state that

> "Smart Cities are known for their human dynamics, which makes recurrent use of permanently connected devices, frequently known as Internet of Things (IoT). Consequently, since these new cities generate a vast volume of data with significant variety and velocity, they have the potential to be one of the richest and challenging systems to generate Big Data and to benefit from its adequate storage, processing, analysis and public availability." (p. 1247)

Smart city is also defined as innovative (not necessarily but mainly ICT-based) solutions that enhance urban living in terms of people, governance, economy, mobility, environment and living (Anthopolous & Reddick, 2016).

### [redacted] Realisation

Some author analysed the concept through its relation to emergent technologies, such as big data, IoT and Cloud Computing. When analysing digitalization and virtualization in smart city government, the increased possibilities of the public sector to generate, collect and utilize data, as well as information management (digital technology, data mining and ICT) and the related processes of digital information transfer influence the organization of cities and the development of local services (Syväjärvi et al., 2015).

According to Muthulakshmi, Lalitha and Uma (2017), the progression of technologies such as big data and IoT has played an imperative role in operationalizing smart city initiatives (Muthulakshmi, Lalitha & Uma, 2017). The integration of the smart city and big data concepts allow it the development of smart city applications that will help to reach sustainability,

[32] http://www.policy-community.eu/results/scenarios/scenario-2-policy-decision-making-using-intelligent-simulations-and-exploiting-open-and-big-data-sources

[33] http://www.policy-community.eu/results/scenarios/scenario-5-using-smart-and-mobile-ict-for-developing-governance-and-policy

better resilience, effective governance, enhanced quality of life, and intelligent management of smart city resources (Al Nuaumi et al., 2015).

Al Nuaimi et al. (2015) review the applications of big data to support smart cities, in which big data analytics can provide deeper insights and better decision-making practices, as the “process of collecting, organizing and analysing large sets of data to discover patterns and other useful information” (Muthulakshmi, Lalitha and Uma, 2017, p. 105). Cloud computing can also provide the needed large computational and storage facilities to support smart city big data management and applications (Al Nuaimi et al., 2015).

The relation between smart city development and IoT projects is very clear (Alamsyah, Susanto & Chou, 2016). According to Jin et al. (2014), utilizing ICTs, such as IoT, to provide adequate services and infrastructure in the urban centers presents “an opportunity for the development of smart cities, where city management and citizens are given access to a wealth of real time information about the urban environment upon which to base decisions, actions and future planning” (p. 1). The same is analysed by Mali and Kanwade (2016) in which based in IoT, “smart city government, management and local people are provided with access to various real-time information about the environment and local objects on which automatic decisions, actions are planned” (p. 1). Thus, according to Kubler et al. (2016), IoT is playing a new role in making the world smarter and more interconnected, although is still one of the main challenges that faces today’s smart city movement.

## [redacted]Literature review

Some authors provided literature reviews on smart city, especially with focus on government and governance frameworks.

Dameri and Benevolo (2016) focus in the governance labels in SC-Related Literature that include: Government; Leadership; Actors and Stakeholders; Urban governance and participatory governance; and Participation, Collaboration and Partnership. The authors conclude that government and governance of a smart city involve the “transition from city to SC, which should be driven by both institutional and noninstitutional actors” (p. 4).

Anthopoulous and Reddick (2016b, p. 354) performed a literature review on smart government and its relation to smart cities, concluding that “smart government is proved not to be synonymous to smart city but a broader term that describes the next step for government transformation, while the smart city is considered to be an area within the overarching term smart government”. Smart-city government is also seen as an important driver for developing a smart urban environment (Scholl and AlAwadhi, 2016a)

Regarding governance aspects, smart city government rests on the implementation of a model of smart governance (Scholl & AlAwadhi, 2016b). According to Dameri and Benevolo (2016), “an SC vision requires a well-conceived governance framework, capable of both integrating all of the political, social, and economic aspects of a city and managing the investments required to produce the best returns in terms of public value and benefits” (Dameri & Benevolo, 2016, p.693). According to Scholl and AlAwadhi (2016b), AlAwadhi and Scholl (2016) suggest that smart governance is a foundational aspect to create smart cities. The main success factors in smart-city initiatives are “reshaping administrative structures and process across multiple local government agencies and departments” as well as “stakeholder involvement in governance” (AlAwadhi and Scholl, 2016). Scholl and AlAwadhi (2016b) affirm that creating a collaborative governance model is an important success factor considering the multi-jurisdictional smart-city initiatives. The influence of the governance and the new public management discourses on smart cities discourse was identified by Przeybilovicz et al. (2018), especially regarding to the “new urbanism” themes such as quality of life, the compact city and the consumption of fewer resources.

Al Nuaimi et al. (2015, p. 12) conclude that a smart city will “improve governance, enhance the economic standing of the city, improve the quality of life of its citizens, and help create environmentally friendly and sustainable infrastructures”. And that the perspectives of a smart city include the “intensive use of ICT and next generation information technology, the integration of the physical and social components of the city via the use of ICT, implementing advanced monitoring and control tools and applications to enhance efficiency and quality, and improving the infrastructures to support better quality of life and higher sustainability” (Al Nuaimi et al., 2015, p. 12).

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Last, but not least, other reviews address a variety of perspectives that are participation-based and citizen oriented, including a critical view from the rise of the corporate smart city (Hollands, 2015), a multi-stakeholder co-creation analysis in smart city management (Mayangsari & Novani, 2015) and the adoption of smart community services with focus on IT acceptance (Li et al., 2018).

*Barriers for implementation*

Among the barriers for a successful SC implementation, Claudel, Birolo and Ratti (2015) identified the need to manage the balance between smart city efficiency and innovation, in which the latter might need an environment with less regulation, and maybe also less optimization. It is also crucial for the effectiveness of smart cities implementation that political and administrative activities are grounded in a well-conceived governance system (Dameri & Benevolo, 2016).

Although smart city concerns the governance of urban areas and the political programs and visions of a city, Dameri and Benevolo (2016) states that few political actors are currently formally involved in SC governance, and the city strategic plans are not addressing SC initiatives.

*Future Prospects*

Dameri and Benevolo (2016) recognize smart cities as a diverse research topic but still an immature practice. When analysing the possible future trends in smart cities, one of the main aspects is the need for a clear definition of governance models and frameworks to support the decision-making and use of technologies in local governments (Dameri & Benevolo, 2016; Scholl and AlAwadhi, 2016a), especially on the role of each actor in governing Smart Cities (Dameri & Benevolo, 2016).

Al Nuaimi (2015) identified several open issues in the field of smart city applications including: the role of *social media* as data source in SC and communication between government, citizens and business; Security and privacy issues; political considerations and effects on the city; the side effects of using technology; the need for highly *educated* and *well qualified* people in the field; and finally, the need to set common measurements and control policies for smart applications.

Regarding smart city IoT platforms, Jin et al. (2014) indicate that in order to achieve the main goal of having an interoperable backbone for plug-and-play smart objects, there are many technological hurdles including architecture, energy efficiency, security and privacy, QoS, Cloud computing, data analytics and GIS based interpretation to be addressed.

Finally, Dameri and Benevolo (2016, p. 695) suggest that the study of smart city governance is pivotal to "understanding how to face and support the complex government needs of an SC as well as the change processes required to manage a changing vision of a city".

### [redacted] Summary and relation to other concepts

Smart city is an area of practice for smart government (including collaboration and service co-creation), and therefore for Government 3.0. The Smart City concept is intrinsically connected to: 1) big data and data analytics, by providing deeper insights and better decision-making practices 2) IoT, by enhancing the decision-making of city management; 3) Cloud computing, to provide the computational and storage facilities to support smart city big data management and applications.

## 4.18 Community Awareness Platforms

Compiled by: *Charambos Psintridis, Savvas Chatzikostas, Giannis Tsiaousis* (*SiLo)*

### [redacted] Definition

Community awareness platforms, often found in literature as Collective Awareness Platforms for Sustainability and Social Innovation (CAPs), are defined by the European Commission as follows:

> "[CAPs] are ICT systems leveraging the emerging "network effect" by combining open online social media, distributed knowledge creation and data from real environments ("Internet of Things") in order to create awareness of problems and possible solutions requesting collective efforts, enabling new forms of social innovation. The Collective Awareness Platforms are expected to support environmentally aware, grassroots processes and practices to share knowledge, to achieve changes in lifestyle, production and consumption patterns, and to set up more participatory democratic processes." (Bellini et al., 2016, p. 11).

Pacini and Bagnoli (2016) also define the collective awareness platforms as "important crowdsourcing instruments that may promote cooperation, emergence of collective intelligence, participation and promotion of virtuous behaviours in the fields of social life, energy, sustainable environment, health, transportation, etc" (p. 19).

### [redacted] CAPs in government

CAPs contribute to creating awareness of emerging challenges and therefore foster changes by boosting collective action. To this end, community awareness platforms can enable government to connect with citizens so as to directly raise awareness on several domains relevant to e-Government such as informing citizens for serious public health issues, natural disasters, environmental issues, etc.

There is very limited work on community awareness platforms, while most of the relevant research directs to collective awareness platforms. The scholars mainly analyse the impact of collective awareness platforms on several domains related to the public as well as the motivation behind the engagement of individuals in community awareness platforms. For example, Zowawi et al. (2015) employ such platforms to inform the public about the serious public health issue of appropriate antibiotic use in the general public and in the medical communities of the Arabian Peninsula. In Okazaki et al. (2015), authors explore community disaster preparedness by considering appropriate sources of information about disaster severity and the ways that community members process information via community awareness platforms in order to protect themselves against natural disasters. Angelido & Psaltoglou (2017), investigate community awareness platforms and their impact on social innovation especially towards urban sustainability discourse. The authors found out that CAP in their study empowers urban citizens and their communities towards serving common interests. Concerning research on what shapes the motivations for the participation in CAPs based on a model of the individual user, Pacini and Bagnoli (2016) analysing 70 different CAPs, develop a framework on understanding human behaviour related to collective awareness motivation and co-production of information in such services. Authors conclude that information co-produced on CAPs is the main pay-off to their users, thus the more users participate, the more useful for them such platforms are.

### [redacted] Summary and relation to other concepts

Community Awareness Platforms contribute to creating awareness of emerging challenges and therefore foster changes by boosting collective action. To this end, community awareness platforms can enable government to connect with citizens to directly raise awareness on several domains relevant to e-Government. These platforms can be an example of citizen co-production/ co-creation and crowdsourcing in e-Government.

## 4.19 Once Only Principle

Compiled by: *Dimitrios Sarantis, Soumaya Ben Dhaou (UNU)*

### [redacted] Definition

Once only principle (OOP) is defined by the European Commission in EU eGovernment Action Plan 2016-2020 (European Commission, 2016) as one of the principles that should be observed by the initiatives within the Action Plan: "Once only principle: public administrations should ensure that citizens and businesses supply the same information only once to a

public administration. Public administration offices take action if permitted to internally re-use this data, in due respect of data protection rules, so that no additional burden falls on citizens and businesses" (p. 4).

## [redacted] Realisation

The "once only" principle in the context of public sector means that citizens and businesses should supply information only once to a public administration within the EU. Public administration takes action to share the data across organisational borders, so that no additional burden falls on citizens and businesses. OOP supports the concept of user centricity. It focuses on the reduction of administrative burden of users by re-organising public sector internal processes rather than making users to adapt to the public sector's internal processes (Lethbridge, 2015; Veiga et al, 2016). OOP includes different implementation aspects. Some of the enablers for making the once-only principle possible include data protection, interoperability and data exchange, base registries, data quality, technical aspects, open government and administrative collaboration.

The implementation of OOP is expected to bring numerous benefits: cost savings and time savings (Tallinn Digital Summit, 2017), lowering administrative burden, reducing bureaucracy (Decman, 2016), reducing costs for businesses and fulfilling legal obligations faster while improving the accuracy of the same data (Veiga et al, 2016). Applying the once-only principle on the EU level is estimated to generate total net savings of around €5 billion per year (Tallinn Digital Summit, 2017).

Administrations will benefit through improved service quality and administrative efficiency. Gains will be more obvious and immediate in enterprises since they have more interactions, than individual citizens, with public authorities. OOP will also facilitate cross-border interactions and it will reduce concerns related to data protection. Where OOP has not been implemented yet, stakeholders have to provide their data again and again to different administrative offices, resulting in several copies of one data set, which in turns leads to outdated data, as soon as just one of these copies is not synchronously updated (Frecè and Selzam, 2017).

There are certain barriers concerning privacy and data sharing requirements, implementation costs, public sector silos and legal constraints (Frecè and Selzam, 2017). Organisational silos of public administration frequently referenced as barriers to government transformation and implementation of once only principle. Systems not created by managerial processes but designed politically and legislatively are hard if not impossible to change solely through internal managerial or technical action (Waller and Weerakkody, 2016).

*The Once-Only Principle Project*

The Once-Only Principle Project[34] (TOOP) was launched by the European Commission in January 2017 as an initiative of 51 organisations from 21 EU member states and associated countries. Its main objective is to explore and demonstrate the application of once-only principle to the sharing of data across borders with an aim of reducing administrative burden for businesses and public administrations. The project envisions three different pilots: (1) cross-border e-Services for business mobility, (2) updating connected company data and (3) online ship and crew certificates to connect 60 information systems from at least 20 countries. TOOP project was launched in January 2017 and is a part of EU eGovernment Action Plan 2016-2020 (TOOP, 2017).

*Stakeholder Community Once-Only Principle for Citizens Project (SCOOP4C)*

TOOP's sister project, SCOOP4C[35] aims to investigate, discuss, and disseminate how co-creation and co-production in public service provisioning for citizens can be achieved by implementing the once-only principle. SCOOP4C focuses creating and maintaining a stakeholder community and engage them in discussion and co-creation of implementation of once-only for

[34] http://www.toop.eu
[35] https://scoop4c.eu/

citizens. Apart from that SCOOP4C identifies and shares good practices of the realisation of OOP across Europe and aims at developing a roadmap of future areas of action to implement OOP for citizens (SCOOP4C, 2017).

*e-Certis*

e-Certis[36] is an information system that provides information on different requirements and evidence necessary to take part in procurement procedures across the EU and the European Economic Area. It provides real time information about possible means of proof required when taking part in tenders in different countries, i.e. various certificates, self-declarations, attestations, etc. e-Certis is a unique one-stop-shop available to public authorities and bidders alike. It contains samples of documents and when available, it also helps user to get them directly from an online database. The information included in e-Certis will be linked with the European Single Procurement Document (ESPD) and e-procurement platforms will also automatically connect to e-Certis to obtain updated information on criteria or means of proof (European Commission, 2016). The ESPD is the building block for the implementation of the OOP in the EU. In fact, the ESPD can be connected to the national pre-qualification services or to the databases storing the means of proof and certificates. Such automation will take some time to be implemented. However, it has potential to greatly simplify the processes for all parties involved in the public procurement procedures.

*Future directions*

Once-only principle can be applied at the national level and is a part of a wider e-Government policy. Possible future directions can be extracted from the recent initiatives. When OOP will be fully implemented, numerous interactions between citizens and public administrations could therefore become obsolete. Existing databases could be increasingly connected and information that is already known to one public administration should be exchanged with others according to OOP. For example, data such as birth certificates, citizenship certificates, or company register extracts need no longer be submitted by the citizens concerned but could be directly requested with their consent by a public administration body from an electronic statutory register. According to OOP, important data already collected by the national authorities will only need to be submitted once and should then be made available to be reused (Pernice, 2016) internally or in cross-border procedures at the request of the user.

The European Commission plans to implement initiatives targeting the interconnection of business registers, cross-border OOP, extending and integrating European and national portals towards a "Single Digital Gateway" and accelerating the transition of member states towards full e-procurement and interoperable e-signatures (Lammerant and De Hert, 2016).

### [redacted] Summary and relation to other concepts

Fundamental building blocks of OOP are: interoperability, base registries, data quality and data protection. Open government can be a driver for OOP that will lead to data sharing, information re-using and ultimately it will contribute in breaking silos. OOP is aimed to facilitate public services by easing the administrative burden and improving cross-border cooperation. In future OOP will become one of the important principles for managing data across borders.

## 4.20 e-Identity / e-Signature

Compiled by: *Jon Matthew Switters, Francesco Mureddu (LC)*

### [redacted] Definition, justification

The EU Regulation No 910/2014 of the European Parliament and of the Council of July 23, 2014 on electronic identification and trust services for electronic transactions in the internal market, defines electronic identification or eID as: "the process

[36] http://ec.europa.eu/growth/single-market/public-procurement/e-procurement/espd/

of using person identification data in electronic form uniquely representing either a natural or legal person, or a natural person representing a legal person"[37]. In other words, eID is a way for citizens, businesses or administrations to prove electronically that "they are who they say they are and thus gain access to services" (European Commission, 2007). An electronic identity can take various forms. Different forms of eID include: smartcard with chip; username & password; username & password with mobile verification; software-based solution (e.g. public key infrastructure (PKI)), certificates and Mobile ID or application. Some countries already provide eIDs to their citizens for the access to public services, mostly in the form of smartcards (with a chip) but also through username and passwords.

The same Regulation defines electronic signature or eSignature as "data in electronic form which is attached to or logically associated with other data in electronic form and which is used by the signatory to sign"[38]. An eSignature can represent a person's intent to agree to the content of a document or a set of data to which the signature relates, and a qualified electronic signature should have the same legal effect as handwritten signatures. Under the eIDAS[39] Regulation, only natural persons can "sign" a document and therefore certificates for electronic signatures cannot be issued to legal entities.

## [redacted] Realisation

The eIDAS Regulation provides the regulatory framework to enable secure and seamless electronic interactions between businesses, citizens and public authorities including both eID and eSignature elements. The Regulation aims to increase the effectiveness of public and private online services and e-commerce and improve trust in EU-wide electronic transactions.[40] Regarding electronic identity or eID, the eIDAS Regulation puts forward a framework that establishes the conditions for Member States to build the necessary trust in each other's electronic identification schemes and to mutually recognise electronic identification means falling under each of their schemes. European level legal framework is necessary to facilitate this trust and insure the functioning of e-identity internationally (Abdipourfard, Minaei-Bidgoli & Morteza, 2017).

With a functioning system of electronic identification and authentication within e-Government, citizens will be able to process their requests without the need to physically visit the public office. Analysis of the experience from some member states has shown that those e-Identification tools that are more likely to succeed are those that are simple, user-friendly and allow logging into e-services of both public and private sector (Průša, 2015). Both eID and eSignature services are crucial for transactional eGovernment services in Europe. The use of mobile technology facilitates the implementation of these systems with various European countries having already deployed eID and eSignature solutions on a large scale, using application in both the public and private sector (Zefferer & Teufl, 2015).

eID and eSignature solutions have been implemented around the world with varying degrees of success and penetration. Amongst these tools, mobile eID has significant potential for growth particularly in Africa, which has become a pioneer in mobile payments and other intelligent services via mobile phones. In addition to eID, a successful identification and authentication tool through cards issued in cooperation with banks (payment card issuers) as occurs in Europe and already in some parts of Africa (Průša, 2015). Hong Kong can also be seen as a best practice example of the use of e-Identity cards providing useful lessons to help guide future research into the nature and role of eID cards (Goodstadt, Connolly, & Bannister, 2015).

In Europe, Estonia is at the forefront of the use of eID and eSignature solutions and is the first country to open up its e-services to the world by issuing e-residencies, the Estonian equivalent to eID, to non-nationals. This digital identity or e-residency gives its holder several rights that are not known by, or at least not provided in the majority of the EU member states (Särav & Kerikmäe, 2016).

[37] https://www.eid.as/Regulation
[38] ibid.
[39] Electronic IDentification, Authentication and trust Services
[40] ibid.

In Austria, the eID system forms one of the pillars of the Austrian e-Government strategy. This system ensures unique identification and secure authentication for citizens protecting access to applications where sensitive and personal data are involved (Zwattendorfer & Slamanig, 2015). The German eID solution also provides every citizen with the ability to identify themselves against various government and private organisations with the help of their personal electronic ID card and corresponding card reader. New approaches through mobile devices and being studied further and represent the future of eID solutions without the need for a physical identity card or card reader (Otterbein, Ohlendorf & Margraf, 2016).

Finally, the service provided in Finland fulfils the strong identification in the Finnish “identification” Act. This service offers the Finnish citizens and businesses an opportunity to use trusted signature services on various services channels for applications hosted on the premises or in a cloud (Kerttula, 2015).

*Benefits*

The adoption of systems such as eID and eSignature in the realm of public administrations allows a proper organisation autonomy, supporting access to the services offered by the institution. These services will also help increase the progressive adoption of cloud computing by public administrations (De Angelis, Falcioni, Ippoliti, Marcantoni, Rilli, 2016). eID solutions can also provide citizens with the possibility to set up a business or to change a residence. This, together with an increasing mobility of citizens, provides the possibility of using eIDs issued in other states and thus enabling easy, simple and efficient handling of certain matters including tax payments for citizens of other countries (Průša, 2015).

An example can be seen in the Austrian case where the system supports the three main use cases for eID: identification and authentication of Austrian citizens, electronic representation, and foreign citizen authentication at Austrian public sector applications (Zwattendorfer & Slamanig, 2015). As has been previously mentioned, Estonia is a prime example of the benefits digital services can offer such as the possibility to digitally sign documents (legally enforceable in any EU Member State), do online banking, encrypt documents, as well as establish and manage a company and declare its taxes online via the state-proven digital identity card issued and backed by the Estonian government (Särav & Kerikmäe, 2016).

*Challenges*

Whilst the benefits of implementing eID and eSignature solutions are clear, there are number of issues and risks that have to be taken into account and addressed. One of these risks lies in the fact that quite often, programmes such as the Estonian e-residency programme are based on a defective concept and conflicting Estonian national regulatory framework that does not fully support the integration of the idea (Särav & Kerikmäe, 2016).

The expansion of eGovernment and online authentication in recent years has increased the risk of not properly implemented authentication systems. This can lead to risks such as identity theft and privacy issues over the manner in which governments handle information in their identity management systems (Schroers & Tsormpatzoudi, 2016). In the private sector, the risks remain similar. For example, an eID realisation commonly involves a service Provider which provides a service, such as online shopping, to the user, and an Identity Provider which verifies the user’s identity and facilitates the user identity itself to the Service Provider. Each transaction that is made generates information about the user that can subsequently be accumulated and abused. Therefore, security and privacy regulations are needed to prevent the misuse of data and the misuse of private data (Shrishak, Erkin, & Schaar, 2016).

## [redacted] Summary and relation to other concepts

Recent development in ICT such as the Internet of Things, Cloud Computing and Big Data further promote the design and implementation of e-Government systems for citizens and businesses. These e-Government systems help to improve everyday lives, expand business frontiers and facilitate the movement of citizens between the EU member states. eID and eSignature solutions are fundamental pillars of these eGovernment systems, allowing for a more effective identification and authentication of citizens, facilitating access to government services and contributing to an easier, more simple and efficient handling of certain matters including tax payments. However, the possible risks involved should not be overlooked.

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# 4.21 Gamification

Compiled by: *Shefali Virkar (DUK)*

## [redacted] Definition

The first widely accepted definition for this concept was put forward by Deterding, Dixon, Khaled, & Nacke (2011), who define gamification as

> "…the use of game design elements in non-game contexts." (p.10)

This definition, according to Deterding et al., encompasses the following key concepts (pp.11-13): i) *games,* or structured situations characterized by explicit rule systems and the movement of actors towards goals or objectives; ii) *elements,* or 'atoms' of games constitute a gamified application; iii) *design,* or the purposeful incorporation of technical mechanisms; and iv) *non-game contexts*, or the application of game elements for purposes other than entertainment. When looked at from these four axes, gamification differs significantly from 'serious games' or the mere use of full-fledged games in non-game contexts (p.14).

Taking forward the definition advanced by Deterding et al., Robson et al. (2015) define *gamification* to be:

> "...the application of lessons from the gaming domain to change behaviors in non-game situations." (p.412)

This definition may be considered important as it introduces 'behaviour change' as the stated objective of gamification. Seaborn and Fels (2015) go further, and state that the term *gamification* may be used:

> "…to describe those features of an interactive system based on video gaming that aim to motivate and engage end-users through the use of game elements and mechanics" (p.14)

Here, the main aims of gamification are further clarified to be the motivation and engagement of individual system end-users through the application of game design elements.

Huotari and Hamari (2017), through an analysis of service and marketing literature arrive at the following definition:

> "Gamification refers to a process of enhancing a service with affordances for gameful experiences in order to support users' overall value creation." (p.25)

Exploring this definition, Hassan (2017) argues that the outcomes of gamification are dependent on the types of external stimuli or 'motivational affordances' introduced by system designers into serious contexts that affect the psychological states of system users and encourage them to act in desired ways.

## [redacted] Gamification in government

Gamification represents a conceptual tool or deliberate intervention applied to leverage the motivational potential of games and game-play in order to promote participation, engagement, persistence and achievement (Hassan, 2017; Richter et al., 2015). Gamification is applied to stimulate specific desired behaviours or usage patterns amongst a target population within ICT-mediated contexts through the introduction of external game elements including points, badges and leaderboards, levels, paths, challenges, missions, feedback, and user powers (Kazhamiakin et al., 2015). Consequently, the incorporation of game design elements into a system of action constitutes an intention on the part of the designer to modify human behaviour by directly influencing extrinsic motivation of the individual through the use of (externally provided) stimuli and rewards – in the eventual expectation that reinforced behaviours will eventually be internalized and self-sustained (Hassan, 2017).

Though a relatively recent concept, gamification is already a growing practice in business, education, government, the non-profit sector, and healthcare (Kim & Werbach, 2016). Simultaneous to the developments in technology and pervasive/ubiquitous computing that have prompted the widespread adoption of e-government systems by a variety of

public sector organizations eager to engage their citizens in the process of smart governance, there has also been an increased interest in how gamification can be harnessed to modify citizen behaviour to tackle smart city concerns (Schouten et al., 2017; Kazhamiakin et al., 2016). It is argued that first-hand experience with public data creates a data-literate citizenry that actively engages with governance processes and contributes to the co-design and innovation of public services (Wolff et al., 2017).

Recent case studies that either extend the conceptual scope of gamification or examine its impact on citizen participation/ civic engagement and the innovation in public, include: gamification in participatory democracy (Sgueo, 2017), gamification for public service co-creation (Kauppinen et al., 2016), gamification for citizen reporting and monitoring (Susanto et al., 2017; Rakhmawati & Fibrianto, 2017; Chea, 2017), gamification in urban mobility (Wolff et al., 2017; Sandoval-Almazan et al., 2017; Pajarito et al., 2016; Johannessen & Berntzen, 2016; Kazhamiakin et al., 2015) gamification in urban planning (Thiel & Ertiö, 2018; Devisch et al., 2016), gamification in law enforcement and security (Coulter, 2017; Alexandrova et al., 2016; Lindley & Coulton, 2015; dos Santos et al.,2015), the gamification of government open data portals (Blazhko et al., 2017), and gamification for the preservation of cultural heritage (Bryant, 2015).

## [redacted] Related Key Concepts

*Citizen Participation and Civic Engagement*

Sgueo (2017) argues that the gamification of governance has come to represent an attempt by public administrators to *'…attract more citizens into public life and make decision-making more participatory*' (p.6). Gamification engages people, and increases their involvement in serious processes, by letting them have fun; wherein techniques reward users for attainment of objectives, encourage constructive competition, and make 'tasks' feel like 'games' (Masser & Mory, 2017). The development of a positive and interactive user experience through the incorporation of a system of motivational stimuli and rewards can create a powerful imperative for citizens to actively participate in public decision-making process and take interest in other government-led campaigns (Thiel & Ertiö, 2018; Al-Yafi & El-Masri, 2016). In particular, Handler and Ferrer Conill (2016) argue that game mechanics foster civic participation by offering users a sense of '*…autonomy, competence and relatedness*' (p.163). Johannessen and Bertzen (2016) further state that user-generated data obtain through the gamification of online engagement platforms can form valuable input for the decision-making process.

Governments are well-placed to harness the full potential of gamification, given the extent of their resources; particularly, they are in a position to encourage the formation of new habits in-line with policy goals, and make routine or 'boring' processes more attractive to fulfil (Rehm et al., 2018). Hassan (2017) notes, however, that, in the case of online civic platforms, the incorporation of game design elements to gamify processes on their own might not be enough to either effect sustained behavioural change or to induce change in those behaviours that are well-entrenched. In order to realise the long-term value of the technique within the public sector context, designers of gamified public spaces should focus on understanding and seeking to address the intrinsic reasons that prompt people to participate in public processes (Thiel & Ertiö, 2018).

*Public Service Delivery*

A variety of public services and applications can be enhanced through gamification (Hassan, 2017). For a government service to remain relevant, citizens need to actively engage with processes of service delivery and regularly avail themselves of what is on offer when required. Dargan and Evequoz (2015) identify gamification as a key tool in the engagement of citizens and the retention of a public service's user base. From a behavioural science perspective, Hassan (2017) argues that the purposeful use of motivational stimuli or 'affordances' in the design of a service, done with the express intention of affecting the intrinsic and extrinsic motivation of the service users, would in turn impact the nature and direction of service use by changing user behaviour and/or increasing engagement with the service provider.

*Co-design/Co-creation of Public Services*

The practice of public service co-design or co-creation aims to involve citizen users in the active creation or (re)design of public goods and services within in a given territorial context (Osborne et al., 2016). The success of this practice lies chiefly

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in motivating individual actors and groups to actively involve themselves in the process together with government. Gamification has already been discussed as a valuable approach to increase citizen participation and engagement.

Opromolla et al. (2015) argue that the application of gamification to governance would not only encourage citizens to participate in decision-making processes, but also increases their willingness to co-create or co-design public services alongside government within the context of a smart city. In other words, ICT-mediated gamification becomes an apt tool to involve smart city dwellers in the real, effective, and continuous co-design of data-driven products and services (Wolff et al., 2017; Opromolla, 2015).

*The 'Playable' or 'Playful' City*

There is a growing body of literature that has come to discuss the ways in which digital technologies and smart city innovations have been used together to develop so-called 'playable' or 'playful' cities (Vanolo, 2018; Schouten et al., 2017; de Lange, 2015). Vanolo (2018) discusses three game-related phenomena outlined in existing literature (p.322-323): 1) the use of urban spaces as playgrounds in so-called 'pervasive games'; 2) the gamification of previously 'serious' or 'non-ludic' applications over time; and 3) the implementation of 'gameful' or 'playful' elements in cities to enhance experiences within selected urban spaces. A further application of gamification within the smart city context is advanced by Kazhamiakin et al. (2015), who propose the deployment of game elements within urban spaces to incentivise actors to leverage the diverse technological assets of a smart city in ways that are beneficial to the wider community, thus making them active participants in the process of smart city governance.

## [redacted] Implications

Hassan (2017) argues that not all public services are suited for gamification. This conclusion is supported by Rehm et al. (2018), who explore the literature surrounding the true efficacy of gamification. They discuss two sets of studies in this regard (p.30): Hamari et al. (2014) and Fitz-Walter et al. (2014; 2013). Both sets of researchers observed that while most of the reviewed studies involving gamification reported at least partly positive outcomes, the positive effects of gamification varied across contexts and users. Rehm et al. argue, therefore, that future application designs involving gamification need to be informed by a deeper understanding of which kinds of game elements work in a particular context.

In a separate empirical study centred around the mobile participation app *Community Circles*, Thiel and Lehner (2015) examine the potential of gamified participation approaches to motivate individuals in the long term. The researchers conclude that while the introduction of game design elements could spark an initial interest in public participation, an effective dialogue between citizens and officials is more important to sustain engagement.

## [redacted] Summary and relation to other concepts

Gamification is considered an important mechanism or intervention for facilitating and sustaining changes in citizens' behaviour within the conceptual fields of electronic government or digital government; modifying their actions towards the achievement of desired policy outcomes. Gamification as a tool has become highly relevant within a smart city context where it is used to encourage active citizen engagement with the data-driven city, to promote civic participation (via crowdsourcing or in co-creation) in governance process, and to foster the co-creation of public services.

# 5. WORKSHOP RESULTS

## 5.1 Workshop organisation

*Compiled by: Alexander Ronzhyn, Maria Wimmer (NEGZ)*

As a part of the research within WP1, two workshops were conducted with an aim to improve and better structure the collected data by leveraging the knowledge of the experts in the field of e-Government: both academics and practitioners.

The two workshops were:

- Workshop on Framing Government 3.0: Concepts and Research Objectives at the 11th International Conference on Theory and Practice of Electronic Governance (IceGov 2018), held in Galway, Ireland.
- Workshop on Gov 3.0 Areas at the Samos Summit on ICT-enabled Governance, held in Samos, Greece.

The workshops had similar structure and organisation with minor differences in timing. The discussion was guided and moderated by the workshop organisers with the aim of gathering as much of varying input regarding as many different points as possible. The workshop discussions were recorded and later transcribed to identify the core topics and main points. In the second workshop additional input was gathered from the participants through the collection of anonymised written notes about the specific questions of the discussion. Transcribed voice recordings, written notes and minutes of the workshops were used as an input for this report, allowing to better focus the literature reviews in section 4 and at the same time to validate the list of search terms chosen for the analysis.

## 5.2 Results

### [redacted]The IceGov 2018 Conference Workshop

The workshop took place as a part of the IceGov Conference on April 3, 2018 in Galway, Ireland. The workshop was organised by Charalampos Alexopoulos, Yannis Charalabidis (UAEGEAN), Maria Wimmer (NEGZ) and Gabriela Viale Pereira (DUK). The workshop was focused on the definition and discussion of the terms within the Government 3.0 domain.

The main focus of the workshop was to analyse the main challenges for Government 3.0 answering the following questions:

- State of the art: What is Government 3.0 and what are the differences with Government 2.0?
- What are the new domains of Government 3.0? Are they originated from the web 3.0?
- What are the current training needs and which of them are covered by existing curricula?
- Research Roadmap Development: what are the research priorities of the domain?

Only first two questions are relevant for the purposes of this report. The third question relates to the other task of the first work package (WP1 Task 1.2), while the fourth was used as an initial glance into the second work package of the project.

The three-hour workshop had the following structure, consisting of four parts:

1. Introduction to the project (15 minutes)
2. Description of the workshop and WP objectives (15 minutes)
3. Moderated discussion of the workshop questions (120 minutes)
4. Summary of the discussion (10 minutes)

In the second phase of the workshop, the conducted research was briefly introduced (for example, the section's 3 results on the distinction between the three stages of e-Government) and the initial list of the proposed search terms listed as a

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starting point for the discussion. In the third phase the participating experts were invited to provide input regarding the three main points relevant to the work package and corresponding to the first two questions of the workshop:

1. The differences between the e-Government stages and the need to distinguish between different e-Government generations. Particularly focusing on the relation between Government 2.0 and 3.0 and the definition of Government 3.0 (input relevant for the section 3).
2. The domains of Government 3.0 and their relation to Web 3.0. (section 4).
3. The important soft issues that need to be discussed when addressing the use of new technologies in Government 3.0 (section 4).

A total of 16 experts participated in the workshop and contributed to the discussion. Experts represented 14 different countries, representing both business and academia. Apart from the written input by the participants, the audio recording of the discussion was transcribed.

During the discussion, the participants emphasized the importance of responsible research and the ethical approach to the introduction and implementation of the new technologies in the public sphere. Particularly, experts concluded that despite the improvements in AI, it is not advisable to let "the machines" control the decision-making processes. Instead AI should play a supporting role to humans, who make the decisions. Major discussion points included the role of educators and ensuring proper understanding of the new technologies by those who teach others from school to professional and university level.

Regarding the definition of Government 3.0, two important points were highlighted by the experts. First, the definition should include the vision of the future, the final goal of the implementation of the technologies in public sphere. Secondly, the key ingredient of Government 3.0 definition should be decision making. Both of the points were specifically reflected in the final definition proposed in Section 6 of the report.

## [redacted] The Samos Summit Workshop

The second workshop took place on July 2, 2018 in Samos, Greece as a part of the Samos Summit on ICT-enabled Governance. The workshop was organised and conducted by Alexander Ronzhyn (NEGZ) and Charalampos Alexopoulos (UAEGEAN). The second workshop was aimed at the validation of results and improving the classification of the concepts.

The two-hour workshop had the following structure, consisting of three parts:

1. Introduction to the project, description of the workshop and WP objectives (20 minutes)
2. Moderated discussion of the workshop questions (90 minutes)
3. Summary of the discussion (10 minutes)

In the first phase of the workshop, the conducted research was briefly introduced, and the list of the search terms listed as a starting point for the discussion. In the second phase the participating experts were invited to provide input regarding the three main points relevant to the work package:

1. General discussion of the draft version of the current report, its structure and methodology.
2. The appropriateness of the suggested search terms: which terms should be added, which should be removed, extended or combined (section 4).
3. The approach to the discussion of the proposed terms. E.g. specific areas and issues discussed within each of the search terms relevant to Government 3.0 (section 4).

The first draft of this report was presented and discussed with the audience. The audience of this workshop consisted of the participants of the Samos 2018 Summit and the International Summer School on Government 3.0. The experts represented 18 different organisations from academia, business, NGOs and public sector. The workshop was organised as

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an open discussion moderated by the organisers. The important points of the discussions were recorded by the moderators and further notes from the audience were collected and transcribed.

During the workshop a number of weaknesses of the report were identified, that were subsequently addressed. For example, the Artificial Intelligence as a disruptive technology was made more prominent and discussed together with the Machine Learning.

Furthermore, workshop allowed to identify a number of horizontal issues relevant to the concepts discussed in the workshop. Particularly data quality, privacy and security issues as well as ethical concerns regarding the implementation of the new technologies were deemed as important areas of research within each of the concepts. Subsequently these issues were addressed for each concept in the revised version of the report.

Finally, workshop allowed to validate the classification of terms into three broad categories: enabling technologies (Big, Linked and Open Data, Data Analytics, Cloud Computing, Service Modules), disruptive technologies (Machine learning, NLP/ Sentiment analysis, Blockchain, Virtual reality, Augmented reality, Internet of Things) and concepts (Service Co-Creation, Crowdsourcing and Customised public service provision). After the discussion, the experts agreed on the appropriateness of such categorisation.

## [redacted]Summary

Two workshops allowed to collect input from more than 30 different experts (researchers, practitioners, representatives of the NGOs, public sector and e-Government students) and better prioritize and classify the collected information. The workshops were instrumental in improving the structure of the report's subsections in section 4 (particularly focusing more on the human elements, innovation and ethics in the discussion of individual technologies and trends), validating the chosen list of search terms (and their classification in enabling technologies, disruptive technologies and related concepts) and better structuring of some of the subsections (ML/AI, AR/VR). The input of the workshops allowed cleaner, better structured and more comprehensive narrative, which is reflected in this report's structure and the definition of Government 3.0 discussed in Section 6.

# 6. DEFINING GOVERNMENT 3.0

*Compiled by: Alexander Ronzhyn (NEGZ)*

The focus of the keyword review and subsequent more detailed literature review in the project are the new, emergent, disruptive technologies (DA, BC, NLP, AI, ML, AR and VR), which enjoyed significant increase in popularity over the last five years both in the general discourse and in scientific literature. Previously confined to the papers in information systems research, such technologies are readily used by businesses in different industries and are taken up in public sector. It is worth pointing out that although we use a term "disruptive technologies" as an umbrella term for a number of emergent technologies, the actual technologies are very heterogenous. Furthermore, the adoption rate and maturity stage of these technologies are quite different. While Big Open Linked Data has been recognised as an important public technology in early 2000s (Arzberger et al., 2004; Fountain, 2001), Blockchain and VR's practical applications within e-Government are still very limited.

Disruptive technologies that have appeared over the last several years could not be effectively used without a number of established ICTs. Such precursor technologies not just enable the use of the new disruptive technologies, but they are also the reason why such technologies have appeared in the first place. The Big Data not only can be enabled and effectively used with the help of cloud storage and computing systems; cloud storage was also the reason why large amounts of data became available. Large social networks produce huge volumes of data; however, it is only possible because of the networks' reliance on the cloud storage and distributed computing technologies allowing the networks to grow almost indefinitely. AR has long been confined to the concept models and expensive specialized systems, largely unavailable to the general public. Only in the recent years, increase in computing power, graphic capabilities and imaging systems of smartphones, along with them becoming near ubiquitous, opened possibilities for the cheap and consumer-oriented AR technologies. Natural Language Processing and AI have also entered the everyday lexicon after the increase in processing power made them feasible. Widespread implementation of IoT technologies became only possible because of advances in miniaturisation, wireless protocols and falling technology costs.

Just as Government 2.0 social and collaborative services and portals were an inevitable consequence of the Web 2.0, created by the growing numbers of people having internet access and their demand for more social, interactive technologies (Johannessen, 2010), Government 3.0 emerges from the widespread application of the Big Data technologies and distributed computing increasing expectations of citizens about the use of such technologies by the government

Modern web dramatically reduces the distance between politicians and citizens. Very often a politician's twitter can be used to engage with the citizens in real-time. Citizens start to expect the same finesse from the public sector. Thus, to satisfy public demand for greater responsiveness, governments need to stay ahead, not only respond quickly to the public's grievances but even predict future issues. This responsiveness can be achieved firstly by designing services customised to the citizen needs and secondly by predicting (and addressing) the problematic issues before they become real problems in public's view. Public services that are more personalised and better customised to users' needs can be designed by involving citizens on the different stages of service production (co-creation) or by letting the citizens participate in solution of specific tasks either actively or passively (active and passive crowdsourcing). Better predictability of public interests can be achieved with the use of modern data analytics technology: through the use of opinion mining, sentiment analysis, natural language processing technologies to collect and analyse the public opinion on a wide range of different issues and consequently prioritize and address the problematic areas. Policy modelling and gaming-based simulation can further help predict the future of specific public policies and interventions based on the available data. These data-driven predictive technologies on a large scale are only possible through the application of distributed computing and cloud technologies that allow analysing effectively and subsequently acting upon the vast volumes of data.

Thus, Government 3.0 vision of data-driven and evidence-based decision making can only be realised through the effective interplay of a large number of different technologies. The connections identified between the different technologies and

concepts were summarized in the concluding part of each concept's subsection of section 4. These interconnections have been synthesized into one diagram presented visually in Figure 3Figure 3. Interconnections between the analysed concepts. For simplicity two types of connections are shown: green arrows depict the enabling relation, when one technology enables the realisation of other in the public service context, blue connectors depict the "related to" connection, meaning the concepts or technologies may be used together or complement each other in the context of public service provision. Red circles show the previously identified disruptive technologies.

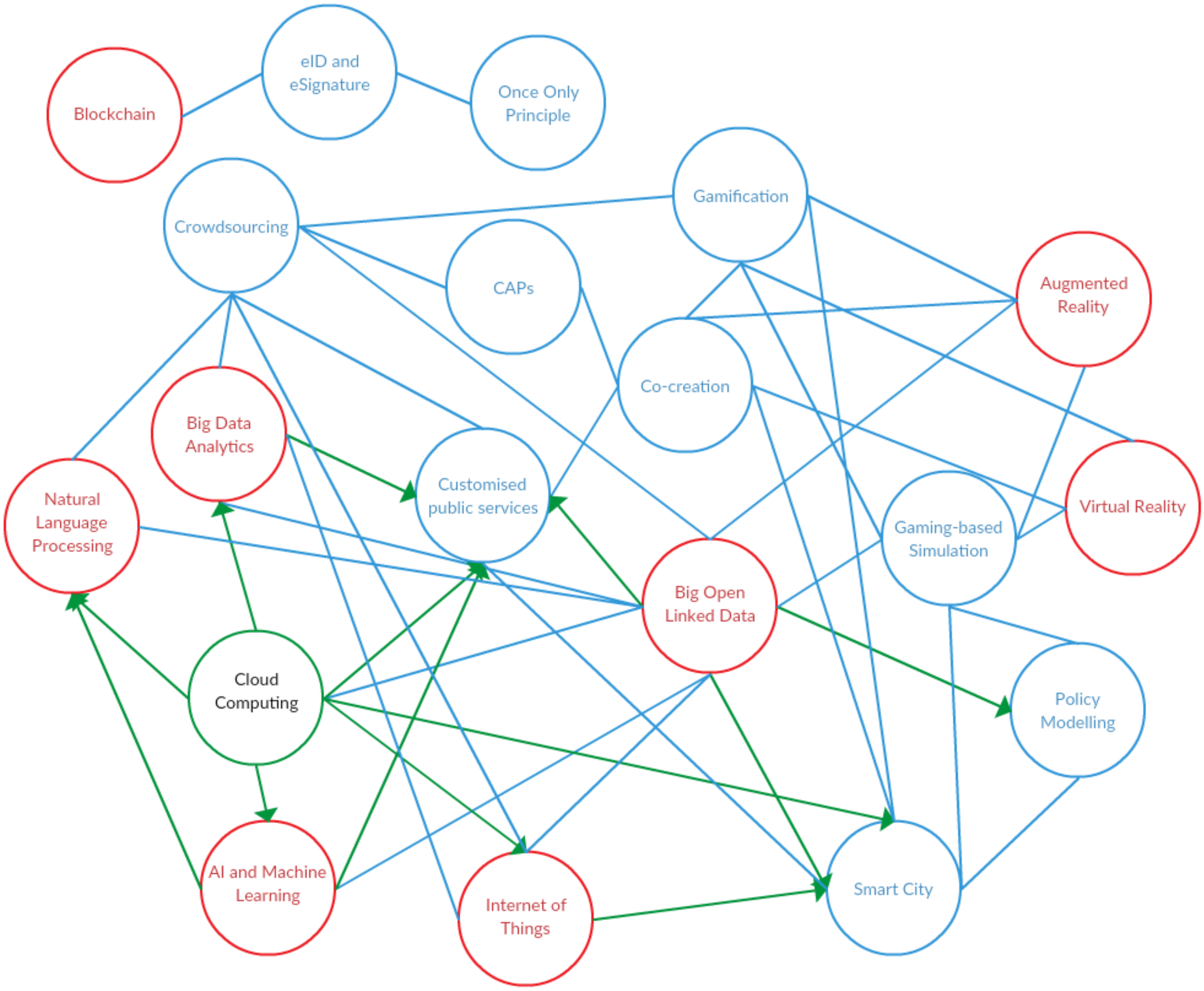


**Figure 3. Interconnections between the analysed concepts**

Cloud computing emerged as the most important technology enabler with the highest number of outgoing enabling connectors. Out of the identified disruptive technologies, big data is the most interconnected of all and can be considered a cornerstone for the realisation of the majority of technologies and approaches described here. As we can see apart from the small cluster which contains Blockchain, e-ID/e-Signature and OOP, all the other concepts are technologies are well interconnected. Among the best-connected concepts are Customised public services and Smart city as the realisations that require (or at least can make use of) most of the technologies described here.

Figure 4 shows the relation of the technologies and trends to the concept of data-driven decision and policy making, identified in section 2 as the end result of the application of the disruptive technologies in government. Here, it can be seen how the big data collected with the help of crowdsourcing, sensors and through co-creation is analysed using different

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techniques (Data analytics, NLP) or used as an input for ML, GS or Policy modelling with an aim to allow making decisions based on data and evidence, by that improving the quality of government decisions, making the solutions more customised (and thus relevant) to specific needs of citizens and businesses and realising the principles of smart governance.

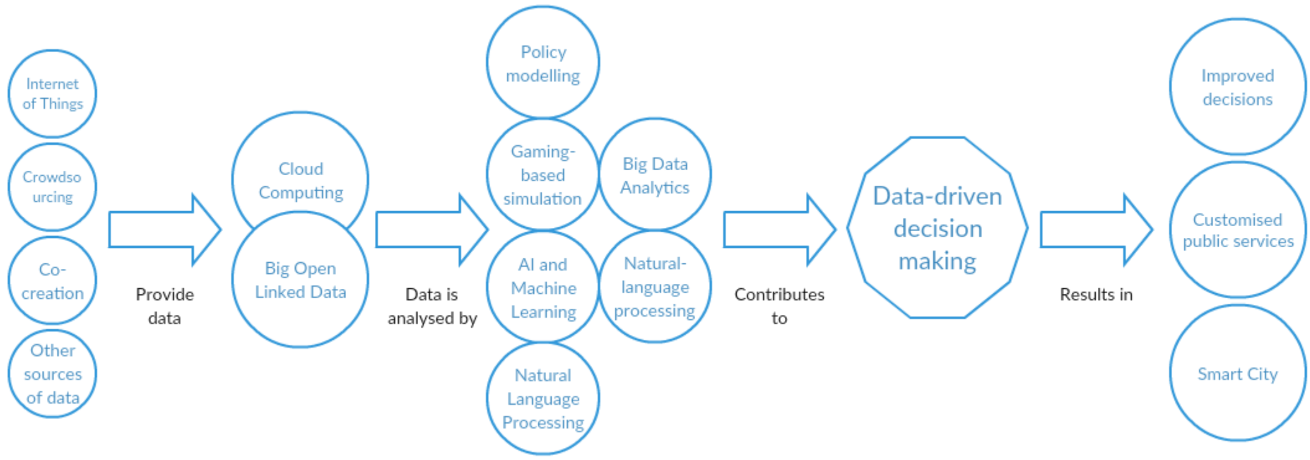


**Figure 4. The relation of the concepts to data-driven decision making**

Some concepts have been purposely omitted from the diagram to make it more readable. Supporting concepts like AR and VR technologies and gamification are not depicted here, as they may enhance some of the services on the left side of the diagram (like e-participatory services, providing input via co-creation and crowdsourcing), but do not generate any data by themselves. Blockchain, OOP and eID/eSignature are also not depicted in the figure as they are not clearly connected to the process of using big data for data-driven decision making. As we have chosen to view the data-driven decision making as the main outcome of the Government 3.0, based on the visualisation of the interconnectedness of different concepts, it seems that Blockchain, eID, eSignature and OOP should not be the part of the definition.

Using the preliminary literature review in section 2 as a starting point, based on the literature analysis of the concepts and technologies presented in section 4 and the discussion of the connections between the concepts discussed in this section, we suggest the following definition of Government 3.0:

> *Government 3.0 refers to the use of disruptive technologies (AI, ML, IoT, NLP, VR, AR and big data technologies) in combination with established information and communication technologies (distributed technologies for data storage and service delivery) and the wisdom of crowd (crowdsourcing and co-creation) towards data-driven and evidence-based decision and policy making and provision of relevant smart customised public services for decision support of citizens and enterprises.*

Going back to the diagram presented at the beginning of the section 3, we can expand its components to show the specific technologies and trends discussed in this report to visualize new, expanded definition (Figure 5Figure 5).

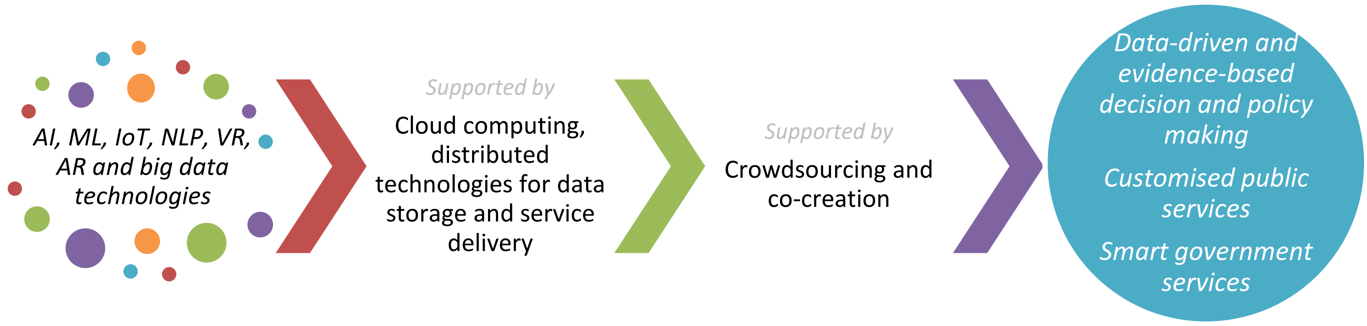


**Figure 5. Government 3.0: detailed view**

The proposed definition views Government 3.0 as the result of application of new disruptive technologies in public services, recognizing that such technologies are connected to and enabled by established technologies, primarily those of big data analytics and cloud computing. Finally, the definition includes the ultimate goal for application of these technologies: data-driven and evidence-based decision and policy making and provision of smart personalised services for decision support of citizens and enterprises.

# 7. CONCLUSIONS

*Compiled by: Alexander Ronzhyn, Maria Wimmer (NEGZ)*

The evolution of digital public services can be viewed as a continuity of e-Government generations, driven by societal demands and needs, while pushed forward by continuous technological improvement. Albeit the public's need for transparent, accountable and effective services remains largely the same over the years, technology changes dramatically, improving in leaps driven by the innovation. A decade and a half ago, the improvement in network technologies, coupled with sinking device and subscription costs, led to the Internet becoming ubiquitous in the developed world, and propelled the social media revolution, creating the phenomenon of Web 2.0. Web 2.0 was not a simple quantitative improvement, where more people created more content, it was a profoundly qualitative shift. In Web 2.0, consumers became the producers and the way people interact with the online world changed forever, sending powerful ripples across all industries. Government services also changed, as citizens were not satisfied with simple information provision and new public services had to account for that. Government services started using social media elements and gamification to engage citizens and collect opinions. Thus, Government 2.0 was born.

In this report we argue that the recent changes in technology have caused another qualitative shift in digital government that allows us to speak of Government 3.0. The reason for this shift is the dramatic increase in the volumes of produced data of all sorts, caused by a number of factors from the improvements in ICT (high-speed mobile Internet, smartphones and other mobile devices) to the proliferation of IoT and sensors. The desire to take advantage of the big data commercially led to the emergence of data analytics, machine learning algorithms, natural-language processing and resurgence of the artificial intelligence research. The demands for the computational power and storage needed to manage these technologies led to the widespread use of cloud and distributed computing technologies. These emergent disruptive technologies coupled with existing and improved ICT provided incredible opportunities both for business and the governments.

The potential of these factors and corresponding disruptive technologies to transform public sector, necessitates careful research and study of the field and possibly re-thinking of some of the concepts we took for granted for so long. At the same time there is a growing public demand for more responsive, personalised and transparent services. Addressing these demands remains a challenge and various approaches are implemented to better understand the public interests. Opinion mining, sentiment analysis, passive and active crowdsourcing, involvement of citizens in co-creation of services: all these techniques are used to understand the citizens and to improve the quality of government services. Disruptive technologies can also contribute to co-creation by enriching the interactions for citizens (IoT, AR, VR, through Gamification), making it more secure (Blockchain, eID) and more informed (Data Analytics).

In this report the systematic literature review was employed to conceptualise Government 3.0, delineate it from the previous e-Government generations, and not only describe the relevant technologies and concepts in the government context, but to establish the links between the concepts, describe the objective of the Government 3.0 and the methods for achieving it. The in-depth literature analysis of 21 different concepts, encompassing a total of 1039 scientific articles, allowed defining Government 3.0 and developing a model of decision-making in Government 3.0, answering the three research questions defined in section 1.1.

*RQ1 (What is Government 3.0 and how it is different from the previous e-government generations?):* Government 3.0 qualitatively differs from the previous e-Government generations in its main goal (societal problem-solving), method (data-driven decision making, smart governance) and the area of application (including international level). The proposed definition of Government 3.0 (described in section 6) provides a clear link between the use of big open linked data, cloud computing and the new disruptive technologies that when combined with citizen-input from crowdsourcing and co-creation of services, can significantly improve the quality of governmental decisions, providing evidence-based and data-driven decision making. This definition shifts the focus from collaboration with citizens (as in Government 2.0) to the societal problem-solving, using large volumes of data collected from various sources.

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*RQ2 (What are the concepts relevant in Government 3.0 and how do they interrelate?):* The relevant concepts include disruptive technologies (Machine learning, NLP/ Sentiment analysis, Blockchain, Virtual reality, Augmented reality, Internet of things, policy modelling), enabling technologies (big, linked and open data, data analytics, cloud computing, service modules), paradigms (service co-creation, crowdsourcing and customised public service provision) and notable realisation of the government technologies (smart city, community awareness platforms, Once-only principle and e-identity). The concepts are significantly interconnected, with cloud computing technologies and BOLD being crucial for Government 3.0 service provision.

*RQ3 (How the different technologies and paradigms contribute to the realisation of Government 3.0 goals?):* The model of data-driven decision making is developed in section 6. It shows how the big data produced by IoT, social media and crowdsourcing/co-creation approaches can be analysed with the help of data analytics and a range of different methods. The results of the analysis can be subsequently used for data-driven decision and policy making, improving public service provision (first, by providing more customised and personalised services for citizens and businesses; secondly, by allowing smart government services that can dynamically respond to the needs of citizens).

Another result of the literature analysis was the understanding that there is a distinct lack of literature about the use of disruptive technologies in government and discussion of these technologies in the context of policy making, e-democracy and e-participation. The literature review revealed that most of the disruptive technologies relevant to Government 3.0 have been studied primarily in the context of the private sector and possible business applications.

For that reason, authors believe that the current project can be a very useful and important mean for improving the understanding of disruptive technologies in e-Government. This report is the first step that defines the concept of Government 3.0 and outlines the area of interest, analysing the core concepts and technologies involved. The output of the first task of work package 1 described in this report will be used in the Gov 3.0 project further: as an input to the roadmapping of Government 3.0, which constitutes the second work package of the project, as well as in the development of the training modules and curricula.

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