Which technology to which challenge in democratic governance? An approach using design science research

Maria Anastasiadou and Vitor Santos

Nova Information Management School, Universidade Nova de Lisboa – Campus de Campolide, Lisboa, Portugal,

and Filipe Montargil

ESCS – School of Communication and Media Studies, Instituto Politécnico de Lisboa, Lisboa, Portugal

This is the author accepted manuscript version of the article published by Emerald as: Anastasiadou, M., Santos, V., & Montargil, F. (2021). Which technology to which challenge in democratic governance? An approach using design science research. [Advanced online publication on 11 february 2021]. Transforming Government: People, Process and Policy. https://doi.org/10.1108/TG-03-2020-0045

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Abstract

Information systems (IS) play an important role in contemporary society, but critical questions remain on their potential use and impact on democracy. This study aims to contribute to the discussion on which technology can be adequate to which major challenge of democratic governance, through the identification and pairing of (i) challenges of democratic governance with (ii) specific information technologies (IT) with the potential to be used in applications related to this challenge. This perspective can be positioned in the confluence between information systems, political science, and public administration.

Design Science Research (DSR), a research approach in Information Systems, was used. The suggestion of a conceptual framework with pairs of challenges in democratic governance and IT was initially developed. In a subsequent phase, this framework was discussed and assessed through interviews with a panel of selected experts in e-Government and information systems, reaching a revised conceptual framework.

Results suggest that the conceptual pairing of challenges in democratic governance with information systems' solutions such as Artificial Intelligence (AI), Systems Integration (SI), or blockchain technologies, for instance, if used in a critical, transparent and accountable way, can play a role in capacitating the delivery of better public services and contribute to encouraging citizen trust and political participation.

These results may contribute to open a methodological agenda dedicated to the selection of adequate IS resources to address specific challenges of democratic governance, as well as to help in the development of public policies in the area.

Keywords

Information Systems (IS), Democracy, Governance, Public services, Design Science Research (DSR)

1 Introduction

Information systems are increasingly supporting modern decision-making processes and transforming communication flows in society. Over the last decades, governments have been implementing digital solutions to develop more agile and resilient administration structures, improving effectiveness, efficiency and providing smarter citizen-centric services. The widespread use of information and communication technologies (ICT) and IS by public administration grants both decision-makers and citizens easier, faster access to data and information. Furthermore, it multiplies venues of citizen participation in decision-making processes. IS have the potential to reduce transaction costs of civic and political engagement (Gil-Garcia, Helbig and Ojo, 2014; Lee and Lee, 2014). At the policy level, the assumption that IS can contribute to simplifying the public decision-making process and to promoting accountability and transparency in governance has led to significant reform: international institutions, namely the OECD, the UN, and the European Commission have created policy departments dedicated to promoting ICT-led public innovation and concepts such as e-democracy, and digital government have emerged (Jafarkarimi *et al.*, 2014; Janowski, 2015). These innovations are signs that ICT can contribute to further changes and novel applications in long-standing governance models used by liberal democratic states.

As expected in a context of change, or even of impending paradigm shift, as some argue, there are growing debates on the effects of the widespread use of digital technologies in society, and in politics (Visvizi and Lytras, 2019). In this context, there are critical questions still largely unanswered by previous work on the application of IS in democratic governance: How is governance affected by IS? Can the deliberative and executive powers of the State, and the

functions of the political system be significantly altered, with the contribution of ICT and IS? If so, what are the resources with the largest potential to improve specific functions of democratic governance, if used in an adequate way? Under what conditions do IS foster citizen trust and encourage participation?

Previous studies on digital governance offer important insights on the impact of ICT-enabled tools for government openness, public service efficiency, user-friendliness, and citizen engagement (Jafarkarimi *et al.*, 2014; Janowski, 2015; Lackaff, 2015). This challenge is not only technological: it is, mostly, a cultural and sociological problem. Notions like the middleman paradox, where the politicians from which depends the introduction of new forms of participation are precisely a major obstacle to its adoption (Mahrer and Krimmer, 2005) or the concept of technology materialities, exploring the tensions between the techno-commercial infrastructures underlying technological development and the social use of those same technologies (Mortensen, Neumayer and Poell, 2019) can be useful to understand the complexity, the multiple dimensions involved and the vastness of the challenge.

In this context, the literature still lacks a systematic conceptual framework mapping and assessing the potential adequacy of different IS instruments to deal with democratic governance challenges, establishing functional relationships between specific goals and potentially compatible technologies. Our work aims to contribute to filling this analytical gap.

We propose to identify and pair, using the framework developed under DSR, distinctive dimensions and challenges of governance in national democratic states with specific IT that might have the potential to be applied to those dimensions and challenges. We argue that developing a paired conceptual framework connecting IS' resources with democratic challenges, using this IS research methodology (DSR), can be useful and relevant to identify potentially compatible technologies, to obtain a better understanding of the constituent

elements of democratic governance in the digital age and to examine the factors affecting them, in future research.

The preliminary findings of the study aim to contribute, as an initial step, to a methodological agenda, focused on the exploration of adequate combinations of tools and their use in challenges of democratic governance, in the confluence between information systems, political science and public administration.

This paper is structured as follows: Section 2 outlines the research method. Section 3 presents a discussion on challenges in democratic governance and IS and the development, using a DSR approach, of a first conceptual framework with pairs of challenges in democratic governance and ICT tools with potential for application. Section 4 represents the discussion and the revised conceptual framework and paired artefacts resulting from the selected experts' assessment of the original proposal. Section 5 presents the conclusion and the contributions of this study.

2 Method

In this study, Design Science Research (DSR) was selected as a methodological approach to connect and pair relevant challenges in democratic governance with ICT tools that might reveal the potential for applications related to those challenges.

We claim that the DSR approach is adequate for our interdisciplinary research effort because, as defined in the literature, DSR is a problem-solving oriented paradigm (Baskerville, Kaul and Storey, 2018) with specific guidelines for developing and achieving knowledge of a specific challenge and understanding it.

The DSR method establishes a sequential research trajectory, based in four phases: (i) identification of an opportunity for improvement (awareness of problem); (ii) conceptualization and development of a suggestion for the challenge-solving artefact

(suggestion and development); (iii) assessment and refinement (evaluation phase) and (iv) conclusion (Figure 1).

[Figure 1 around here]

The goal is to expand knowledge of a specific domain via an iteration process that begins with a research question and then proceeds with a trajectory of construction, evaluation, and redesign of artefacts. The artefact is, essentially, the core concept in the DSR approach (Hevner *et al.*, 2004).

An artefact developed through a DSR process may consist of a product but, also, of an innovative method, technique, or conceptual framework (Cloutier and Renard, 2018). DSR artefacts can include constructs, models, methods, design theories and implementation processes or methods (J. Ellis and Levy, 2010).

The main advantage of this method is that the design and redesign process of artefacts helps to deepen the understanding of a challenge, solving it or contributing to a better solution (Vaishnavi, Kuechler and Petter, 2010). The continuous re-evaluation process, with build-and-evaluate loops, until a solution is finally selected, tends to improve the quality of the final design (Hevner *et al.*, 2004). DSR does not focus so much on the action itself, but mostly on the knowledge to be used in designing the solutions, to be followed by design-based action (Aken, 2004).

The DSR approach emphasizes communicable, testable, and systematic methods. However, some scholars argue that the initial design of artefacts is more a creative process and that the literature lacks specific guidelines and design foundations (Offermann *et al.*, 2009). Though, "it is instructive to reflect on the differences between design science and the science of design and engineering" (Cross, 2002).

In this study, artefacts consist of a construct of conceptual pairs, with each pair identifying (i) a challenge of democratic governance and (ii) a specific IS technology or platform tool with the potential to be used in applications related to this challenge.

In the first phase (awareness of problem), we conducted a literature review, providing the background for the initial framework proposal**.** This review included classical and contemporary readings on challenges faced by national political systems in democratic governance and literature on ICT-enabled governance.

In the suggestion and development phase, we used this literature review to propose conceptual pairs of challenges in democratic governance and IS instruments, resulting in the initial framework.

The framework was then assessed and refined (evaluation phase), through observations gained from structured interviews with nine experts. All experts have a relevant academic background and professional experience in IS applied in governance (Table 1). Their background is mostly around IS and IT. This is not the only area potentially contributing to critical reflection and development on the topic, naturally. But this is certainly a challenging endeavor since, as Barber (Barber, 2001) has observed:

> "Often, those who know the most about democracy and are most concerned with democracy know very little about technology. Those who know most about technology usually know very little about democracy. This makes the discussion of the interface between democracy and technology particularly difficult."

Even if this scenario has evolved, probably bridging some areas, and reducing existing gaps, these are still quite diverse worlds. It was considered, for this reason, that the background on IS and ICT could be privileged, in this initial qualitative approach, for a more consistent and coherent panel of experts. Further research should, however, broaden the scope and include

other key stakeholders, such as experts from other areas, non-experts, ordinary citizens, and politicians, through different approaches.

It is difficult, at this stage, to imagine the adequate approaches to this process, but deliberative polling (Fishkin *et al.*, 2018), participatory design, co-creation or co-design (Bjerknes and Bratteteig, 1995) or hybrid forums (Callon, Lascoumes and Barthe, 2009) could be good examples for complementary alternatives.

[Table 1 around here]

The nine experts were asked to evaluate each of the artefacts with a Likert scale to indicate a degree of agreement or disagreement with the suggested artefacts, using semi-structured questions.

In the conclusion phase, we used a combination of summarization, grouping and categorization techniques, such as summarizing, categorization and structuring of meaning to summarize and present the results.

3 Background & Research

3.1 Challenges in democratic governance: procedural challenges and contradictory goals

Critical thought on governance and democracy goes at least as far back as Classical Antiquity. In this long line, one finds some challenges persisting across time and different political cultures.

The general concept of governance refers here to "all processes of governing, whether undertaken by a government, market, or network, whether over a family, tribe, formal or informal organization, or territory, and whether through laws, norms, power or language" (Bevir, 2012) involving, in our case, an "authoritative allocation of values for a society"

(Easton, 1965) through a government. This concept is further delimited to the application to liberal democratic states, considering democracy essentially based in four key elements: (i) a system for choosing and replacing the government through free and fair elections; (ii) active participation of the people, as citizens, in politics and civic life; (iii) protection of the human rights of all citizens and (iv) a rule of law in which the laws and procedures apply equally to all citizens (Diamond, 2004).

The representation process in a democracy is essentially based on collective action (Olson, 1965), bearing difficulties and procedural conundrums: historically, the processes that aggregate individuals will and steer the implementation of collective policy have been inherently challenging and can culminate in outcomes that are inconsistent with the values initially established. Research on political culture and participation points to significant citizen disaffection with democratic governance and with party politics and suggests the existence of unresolved challenges (Almond and Verba, 1963, 2003; Dahl, 1998; Norris, 1999, 2011; Pharr, Susan J., 2001; Schmitter and Trechsel, 2004; Nyirkos, 2018).

Some contemporary critiques of democracy focus on the argument of a resilient inequality challenge in democratic governance. As argued by some scholars, the "one person, one vote" principle of democratic political representation implies that individuals should have equal say and influence over decisions that affect their interests (Dahl, 1998). However, as studies on democracy point out, distribution of influence is unbalanced, and there is a lack of responsiveness, even in consolidated democracies (Achen and Bartels, 2016).

Furthermore, political theorists claim that the combination of this principle of "one person, one vote" with the procedural rule of the majority often culminates in an unwanted outcome, namely in a "tyranny of the majority" that can leave minorities unprotected (Stuart Mill, 1913; Tocqueville, 2002; Nyirkos, 2018). Scholars also point to the inherent contradictions of the

principal-agent model in a representative democracy. Citizens elect representatives in the expectation that the latter will espouse their interests (Warren, 2017). However, the elected representatives have the freedom to act according to their judgment. There is here a potential for misalignment between the interests of electors and their representatives. This factor can also contribute to dissatisfaction, aggravated by the fact that most representatives are selected from elites (Warren, 2009).

Other issues were also considered in our research as potentially leading to citizen dissatisfaction and disaffection, including (i) the influence of powerful economic interests (Warren, 2004, 2017), (ii) globalization and multinational economic interests in global competition that can undermine social rights and accentuate inequality (Carter and Stokes, 2002; Warren, 2004; Forsythe and Wilkinson, 2015), (iii) corruption in public administration (McMullan, 1961; Della Porta and Annucci, 1997; Susan, 1999; Warren, 2004) or (iv) bureaucracy and expensive cost for public services and processes (Caplan, 2005).

These issues can affect citizen engagement and public participation. Regardless of the cause-effect relationship to be established, the decline of participation is another inescapable challenge in democracies, at least since the 1970s (Perry, 2015; Dahl, 2017; Arrhenius, 2019).

Studies have also pointed out the role of education in democracy. Several authors argue that education is a key factor for democracy to emerge and that citizens and even representatives can be affected in the ability to participate in governance in a competent or meaningful way if they do not have the necessary experience, education or knowledge (Bendix and Lipset, 1957; Dahl, 1991; Sartori, 1997; Bobbio, 2014).

From these analytical premises, we establish our proposal for conceptual constructs on six dimensions of major challenges for contemporary democratic governance, including challenges of (i) fairness; (ii) representation; (iii) transparency; (iv) processes and

administration; (v) participation and (vi) education. These dimensions have been operationalized through the subdimensions presented in Table 2.

[Table 2 around here]

In the process of digital transformation, technology has the potential to be used in the design of systems that allow citizens to participate in the development of legislation, measures and policies. Citizenship is acquiring a digital dimension, either through conventional forms of participation directly transposed to the digital world or through new forms of engagement and citizen participation (Tolbert *et al.*, 2006; Bertot, Jaeger and Grimes, 2010).

3.2. The functional ties between information systems and democratic government

Studies on the relationship between information technology and politics suggest that the use of IS in democratic practice and governance can contribute to addressing challenges in political systems, expanding the scale and scope of civic engagement and serving citizens in a more effective, timely, and cost-efficient way (Evans and Yen, 2006). Warren argued more than once that modern technologies and IS have the potential to be used in several applications in democratic governance (Warren, 2004).

Several scholars agree that IS can play a role in enhancing the core components of collaborative political participation, empowering individuals (Bakardjieva, 2009; Saglie and Vabo, 2009; Bertot, Jaeger and Grimes, 2010) and fostering collaboration between citizens and governments (Panagiotopoulos, Bigdeli and Sams, 2014). IS can be used in applications at the very core of democratic procedures, namely by allowing citizen electronic participation in political debate, elections and referenda (Vragov and Kumar, 2013) or potentially inducing pressure on governments to become more transparent and fair (Jensen, Danziger and Venkatesh, 2007), for instance. According to Hilbert´s study, the Web 2.0 and social media technology have spurred a transformation in democracy practice, suggesting it is possible to overcome the traditional

challenge of size in democratic participation, rethinking and pushing the existing limits (Hilbert and Hilbert, 2009).

Other studies suggest that IS can be used to increase engagement from young citizens. For example, the Highland Youth Voice in Scotland allows individuals between the age of 14 and 18 to participate in the decision-making process via websites and online fora (Coleman, 2008; Highland Youth, 2018).

From the above findings, we can conclude that there are functional ties between IS and the implementation of resources in the area of democratic government. IS can have an impact on democratic processes and contribute to addressing challenges in democratic governance.

This does not mean that technology and IS are considered here as necessary and sufficient to deal with challenges in democratic governance, as a technical fix (Pacey, 1983; Street, 1992) able to solve all political problems. Technology is a social product, developed and used in a specific social context and, as Pacey (~~Pacey,~~ 1983) suggests, any attempt to develop technological applications without considering the social component, involving social and cultural measures, would be to pursue an illusion (idem: 10). It can easily be demonstrated that technology can also be used for authoritarian purposes – and not only to deal with challenges in democratic governance (Morozov, 2012). However, this does not mean that technology cannot have a role in the development of new applications in this area. We argue, for this reason, that ICT, including emerging and more mature technologies, can have the potential to be explored in new and useful applications.

It is, therefore, relevant to implement requirements of openness, transparency and accountability (Bertot, Jaeger and Grimes, 2010; Hacker and Dijk, 2013; Mol, 2015; Hosseini *et al.*, 2018; Szołno-Koguc, 2019), in order to ensure a democratic process and an outcome that effectively reinforces democracy.

In the next section, we will label a set of IT tools and explore their respective functional role of challenge-solving in democratic governance. This step will lead us to the conceptual framework, mapping and assessing the potential role of distinctive IS instruments in democratic challenge-solving.

3.3 Developing paired conceptual artefacts

According to the analytical premises and the previous analysis, we paired challenges in democratic governance with the following IS tools: Web 2.0, Internet of Things (IoT)/Ubiquitous computing (UC), Electronic Voting (EV), Artificial Intelligence (AI), Systems Integration (SI)/Interoperability, Distribution of Information (DI) and Geographic Information Systems (GIS).

Web 2.0 tools promote the participation of individuals willing to contribute their ideas to the democratic processes (Naranjo-Zolotov *et al.*, 2019). They may allow for greater transparency on how a consensus is reached, as contributions can be archived and remain accessible for examination, improving public services' quality (Bonsón *et al.*, 2012). Web 2.0 tools can also be considered to facilitate and expand the participation of stakeholders and make it possible to measure the inclusiveness of political representation by counting how many people participate in discussions, expand access to policymaking and increase collaboration between citizens and public institutions (Sivarajah, Irani and Weerakkody, 2015; Naranjo-Zolotov *et al.*, 2019). Policymakers can use Web 2.0 to gather information about what people need and about public opinion. These tools have the potential to enhance open source government and inclusive decision-making (Fung and Warren, 2011; Estermann, 2018; Visvizi and Lytras, 2019). For example, Etherpad, an open-source online editor, provides collaborative editing in real-time (The Etherpad Foundation, 2009).

IoT and UC can support bidirectional communications to allow for accurate billing of utilities such as electricity (O'Maley, 2016). IoT adoption will generate big data, that can also be used to audit bureaucratic processes and communications, increasing transparency (Fung and Warren, 2011). IoT may also enable dynamic capabilities, useful to develop policies and services of public interest and value (Chatfield and Reddick, 2018; Gruzda, Lanniganb and Quigleyc, 2018), such as smart license plates (Cooley, 2017).

EV has been considered as a development with the potential to simplify and reduce, in several contexts, the cost and time of the electoral process, allowing the government to survey the opinion of the population in a faster and more efficient way (Hilbert and Hilbert, 2009). Estonia´s voting process, for instance, is based on the I-voting system (E-Government Academy, 2016). This may also contribute to increased participation, offering citizens the opportunity to vote in a chosen location, more convenient, therefore reducing the cost (tangible and intangible) of casting a vote (Zissis and Lekkas, 2011). EV systems can be used to improve the integrity of elections and prevent some types of errors in the process (Abu-Shanab, Knight and Refai, 2010). It is possible to use EV systems that simultaneously maintain the vote as secret and auditable, resulting in added transparency in the decision-making process (Abu-Shanab, Knight and Refai, 2010).

AI consists of the use of algorithms to obtain insights into various subjects, and analysis of massive amounts of data to infer useful information about trends and preferences. If implemented correctly, AI can grant additional guarantees against corruption, since the decisions are based on the application of pre-established rules to data. This data-driven decision-making process can contribute to more effective and efficient decisions (Visvizi and Lytras, 2019), applying a set of defined rules consistently. Any decision can be traced back to the set of rules; all decisions should be able to be replicated using the same data and the same set of rules. If the rules are published, any citizen can understand why a certain decision was

made and audit both the process and the outcome, providing a transparent decision-making process (Fung and Warren, 2011; Reis, Santo and Melão, 2019).

SI and Interoperability, such as web services and data standards, provide common sets of technologies that allow different IS to transfer information between themselves using a standardized data format. The ability of the various systems to be connected requires the use of common data formats. These formats allow each individual to analyze data and reach conclusions. The ability to autonomously analyze data and replicate processes is a fundamental requirement for transparent systems (Fung and Warren, 2011). It is often difficult for public administration services to communicate with each other and for citizens to retrieve paper records from public administration services. These can become highly inefficient and time-consuming processes. Many bureaucratic procedures can probably be automated using online platforms, thus allowing easy and quick access to governmental services. The use of national identity cards that include a digital certificate allows authenticating the citizen using a state-managed public key infrastructure and can lead to the dematerialization of many bureaucratic processes, as in the case of Estonia (E-Government Academy, 2016; European Commission, 2016; Scholta *et al.*, 2018).

DI tools allow people to be informed and share information about important policy issues through the internet. They can improve the way we access the data and reinforce fairness in access. Technologies such as RSS feeds can help users being up to date and to make decision processes more transparent. Portals, websites, and knowledge sharing tools allow users and organizations to cooperate in a meaningful way (Gagliardi *et al.*, 2017). It is the case, for example, of Ushahidi, an open-source application that allows users to upload real-time data, respond to issues, follow election monitoring and enable crisis response (Ushahidi, 2008; Fung and Warren, 2011). By leveraging tools for the DI, it is possible to keep governmental employees aware of valuable information that they require to be more efficient. Obtaining

feedback is essential to improve efficiency in governmental services (Gagliardi *et al.*, 2017). Blockchain can probably be considered in public services payment, without the need for central validation (Visvizi and Lytras, 2019). For example, the Dutch Government is exploring blockchain in several pilot projects, such as digital identity, income tax, logistics, and debt counselling (Dutch Government, 2018). This scheme redistributes power away from central decision-makers, can make service delivery more efficient and increase transparency (Boucher, Nascimento and Kritikos, 2017; Scholta *et al.*, 2018). DI expands the number of individuals who obtain knowledge on processes that directly affect their interests. This measure stimulates participation and knowledge sharing (Fung and Warren, 2011; Naranjo-Zolotov *et al.*, 2019).

GIS applications take advantage of the development of online maps to improve services provided by the state, such as land registry and other services where geographical data is relevant (Information Analytical Centre, 2001; European Global Navigation Satellite Systems Agency, 2018). These applications can help people in visualizing and interpreting information in order to make decisions or spot inconsistencies faster. One example is the visualization of election data to identify patterns in the geographical distribution of electoral behavior (and identify areas with lower turnout, for instance). Another example can be the involvement of citizens through web-based applications for the administrative and electoral redistricting process (Redistricting QGIS Plugin) (Goodchild, 2007; Geography.com, 2016). The use of GIS applications in government services allows, therefore, for information to be represented and displayed in a more understandable format and can improve the quality of several public services.

According to the analytical premises and the dimensions mentioned above, we can pair key challenges of democratic governance with the above set of IS tools. Tools related to the concept of Web 2.0 (such as forums, discussion boards, social networks, wikis, collaborative platforms, blogs, micro-blogging or participative budgeting) are considered, according to our initial

proposal, as having the potential to be used in applications mostly in the challenges of democratic governance related to fairness, representation, participation and education, for instance.

The initial global proposal, completing the DSR phase of suggestion and development (conceptualization and development of a suggestion for the challenge-solving artefact), with potential applications of the considered IS tools to challenges in democratic governance, is presented in Table 3.

[Table 3 around here]

4 Results & Discussion

4.1 Expert assessment of the conceptual artefacts

Selected experts agreed, according to the analysis of the interviews carried in phase 3, with the dimensions and subdimensions proposed for both the IS technologies and for the key challenges in democratic governance used as the base for the paired conceptual artefacts.

All experts strongly agree that IS can contribute to addressing the selected key challenges in democratic governance, and that IS will be a necessary venue in its future practice and challenge-solving. However, interviewees pointed out that, when assessing the role of IS in democracy, the risk of manipulation must be considered. Also, they argued that open data is an essential missing element in the framework and that it is a necessary condition to ensure the fairness and transparency of the political system. This subdimension was included, for this reason, in the dimension of DI, in the revised conceptual framework (Table 4).

All experts underlined the evolution towards lower levels of political participation, with citizens growingly disconnected from the political decision-making processes, as a major concern.

Questioned if relevant dimensions and subdimensions were missing in the key challenges of democratic governance in the initial proposal, two of the nine experts mentioned the existence of a relation of trust between citizens and the political system and public administration – that can probably be related with lower levels of political participation. As a result, this additional dimension was added to the revised conceptual framework.

Experts agreed that Web 2.0 and the subdimensions proposed could play a relevant role in solving the selected key challenges of democratic governance. Web 2.0 technologies can contribute to deal with the challenge of inefficient government services, making them less bureaucratic and more accountable, by allowing citizens to report issues and public services to incorporate feedback as a result, for instance. They said that social media technologies had improved the possibilities of communicating within a community, but at the same time have been frequently misused.

Crowdfunding platforms for e-government purposes have been designed to make processes faster and easier by matching relevant challenges with governmental funding. Moreover, they have stimulated active participation.

On EV, interviewees claimed that adoption has been slow because the average voter is not fluent in the use of technology, and the concept has not been adequately marketed. EV introduces great opportunities for governments to increase participation by making people believe their vote is important.

Experts pointed out that IoT/UC and their subdimensions can be used to automate several public services processes and information dissemination processes as well. In automating decisions by measuring everything everywhere, data becomes available for decision-making. As a result, interviewees consider there is room to increase transparency and the final quality of services.

According to interviewees, AI capabilities will be important in solving challenges of authentication, detecting fraud rapidly, measuring people sentiment on what the government is doing, wants to do or has done. This capability can be used to further involve citizens in governmental projects. Experts claimed that SI and inter-operability technologies constitute one of the most fundamental technologies - together with AI and DI - in implementing e-government solutions. The referred technologies can increase the efficiency of government services in a relevant and consistent manner. Ultimately, they claimed, this will also contribute to increasing transparency and citizen return of government services.

According to experts, the DI technologies will be at the core of trust and security. All agreed that open data and blockchain concepts would change the way citizens think, feel, and behave in online processes and services. As stated, transparency can be reinforced in political culture, contributing to improving trust in e-government services. This can also increase the accountability of public services.

To conclude, experts argued that geographic IS could mitigate democratic challenges such as not being fair. For instance, building systems that use ubiquity computing, mobile technologies, geographical IS, and their interconnectivity, provide a workflow that follows the decision-making process and enables citizens to participate. Such systems allow citizens to find information about a specific point of interest as they pass by, and to receive data about related public decisions. Furthermore, the applications can be used for fraud detection, security, and fairness: for instance, the records of the ownership of properties is fundamental for the ministry of agriculture.

In table 4, we can see the revised conceptual framework and paired artefacts resulting from the experts' assessment of our original proposal.

[Table 4 around here

5 Conclusion

The spread of digital technologies and the use of social media as channels for individual expression, political debate, and social mobilization has contributed to transforming the democratic practice and is lowering the transaction costs of political participation. To understand this phenomenon, we began our research by identifying a set of challenges in contemporary democratic governance. Next, we examined specific applications of IS that can contribute to addressing those challenges and developed conceptual pairs of challenges and IT. We then tested the resulting conceptual framework against an assessment by a panel of experts.

Our research suggests, considering this assessment, that the conceptual pairing of challenges in democratic governance with information systems' solutions such as AI, SI, or blockchain technologies if used in a critical, transparent and accountable way, might have the potential to play a role in the public delivery of smart, citizen-centric services, and contribute to encouraging citizen trust and political participation. In stimulating transparency and making fraud easier to detect, open data can have the potential to transform the way citizens think, feel, and behave while engaging in online processes, hopefully increasing citizen confidence in participatory venues. Web 2.0 technologies, GIS, and collaboration tools can be considered as adequate to stimulate information sharing and to learn between public organizations that have traditionally operated in silos, as well as between public administrations and citizens.

In analyzing the functional relations between specific IT and identifiable challenges of democracy, the study aims to contribute to a better understanding of how democratic governance institutions and IS can work together in addressing key challenges ahead. The preliminary findings of the study aim to open a methodological agenda that will help to select effective combinations of tools to address challenges of democratic governance, as well as to

design public policies that stimulate and coordinate the intervention of technology in society and politics.

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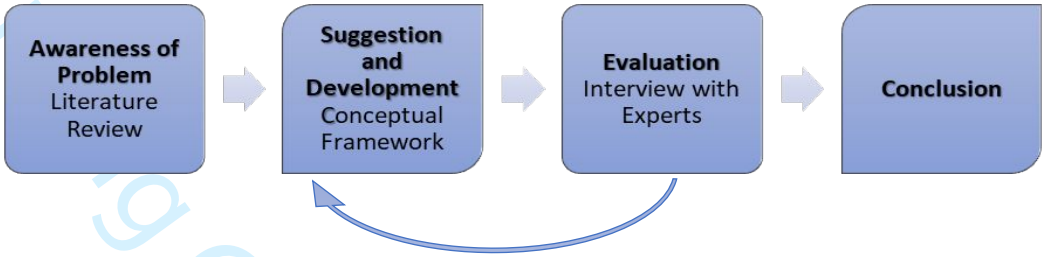
Figure 1: Research phases in DSR



Profile	Level of education	Current Profession	Year of experience in E-government	
			Academic	Practice
Expert advisor of the special secretary of e-government Greece.	Ph.D	Assistant Professor	7	3
Responsible for E-government services, Municipality.	Ph.D student	Software engineer		20
E-government Consulate.	Master	Sells director specialized in e-government segment		18
President of the Portuguese Association for the Development of the Information Society and eGov development.	Ph.D student	Consulting partner for e-government		43
Former Director-General of the DG Informatics.	Ph.D	International consultants		40
Researcher for e-government integrability.	Ph.D	e-governance researcher	8	
Senior Researcher and Project Manager at the Information Systems Laboratory.	Ph.D	Project manager for e-government integrability	7	
Works for the Greek Parliament.	Master	IS and E-government		14
Works for the Greek Parliament.	Master	Computer Analyst		30

Table 1: List of selected experts

1. Fairness
(Dahl, 1998; Bartels, 2016)
1.1. Equal distribution of access
1.2. Equal distribution of influence
1.3. Responsiveness
2. Representation
(Stuart Mill, 1913; Tocqueville, 2002; Warren, 2009, 2017; Janowski, 2015; Tamás, Nyirkos, 2018)
2.1. Equal/balanced representation of social groups
2.2. Equal/balanced representation of minorities
3. Transparency
(McMullan, 1961; Della Porta and Annucci, 1997; Rose-Ackerman Susan, 1999; Carter and Stokes, 2002; Cudd and Scholz, 2014; Perry, 2015; Warren, 2004, 2017)
3.1. Transparency in public services
3.2. Balance the influence of powerful economic interests with potentially conflicting interests of citizens
3.3. Reduce corruption
3.4. Globalization and democracy capitalism
4. Processes and Administration
(Caplan, 2005)
4.1. Efficiency of bureaucratic processes
4.2. Reasonable cost for public services and processes
5. Participation
(Cudd and Scholz, 2014; Perry, 2015; Dahl, 2017; Arrhenius, 2019)
5.1. Participation of young people
5.2. Participation of people in general
6. Education
(Bendix and Lipset, 1957; Dahl, 1991; Sartoni, 1997; Bobbio, 2014)
6.1. Education of citizens
6.2. Education of representatives

Table 1: Proposed key challenges in democratic governance

			1. Fairness		
			Equal distribution of access	Equal distribution of influence	Responsiveness
Technologies	Web 2.0	Forums, discussion boards	x	x	x
		Social Networks	x	x	x
		Wikis, collaborative platforms, knowledge sharing tools	x	x	x
		Blogs, Micro-blogging	x	x	x
		Participative budgeting platforms	x	x	x
	Internet of things / Ubiquitous Computing	Automatic meters			
	Electronic voting	E-voting	x	x	x
		I-voting	x	x	x
	Artificial Intelligence	Big data analysis, Cognitive services	x	x	x
		Textual data, Automated sentiment analysis	x	x	x
		Anomalies detection, Fraud detection	x	x	x
	Systems Integration / Inter-Operability	Web services, data standards			
		Public key infrastructure, smart identity cards			
	Distribution of Information	RSS feeds	x	x	x
		Portals/ websites/knowledge sharing tools	x	x	x
		Emails lists	x	x	x
		Mobile Computing	x	x	x
		Blockchain Technologies	x	x	x
		Peer to Peer networks	x	x	x
	GIS applications	Geographic information systems			

Challenges in democratic g

2. Representation		3. Transparency		
Equal/balanced representation of social groups	Equal/balanced representation of minorities	Transparency in public services	Influence of powerful economic interests vs interests of citizens	Reduce corruption
x	x	x		
x	x	x		
x	x	x		
x	x	x		
x	x	x		
		x	x	x
x	x	x		
x	x	x		
		x	x	x
		x	x	x
		x	x	x
		x	x	x
		x	x	x
x	x	x		
x	x	x		
x	x	x		
x	x	x		
x	x	x		x
x	x	x		
			x	x

governance

	4. Processes and administration		5. Participation		6. Education	
Globalization and Democracy Capitalism	Efficiency of bureaucratic processes	Reasonable cost for public services and processes	Participation of young people	Participation of people in general	Education of citizens	Education of representatives
			x	x	x	x
			x	x	x	x
			x	x	x	x
			x	x	x	x
			x	x	x	x
x	x	x		x		
			x	x		
			x	x		
x	x	x				
x	x	x				
x	x	x				
x	x	x				
x	x	x				
	x	x	x	x	x	x
	x	x	x	x	x	x
	x	x	x	x	x	x
	x	x	x	x	x	x
	x	x	x	x	x	
	x	x	x	x	x	x
x	x	x				

			1. Fairness		
			Equal distribution of access	Equal distribution of influence	Responsiveness
Technologies	Web 2.0	Forums, discussion boards	x	x	x
		Social Networks	x	x	x
		Wikis, collaborative platforms, knowledge sharing tools	x	x	x
		Blogs, Micro-blogging	x	x	x
		Participative budgeting platforms	x	x	x
	Internet of things / Ubiquitous Computing	**Sensors**			
	Electronic voting	E-voting	x	x	x
		I-voting	x	x	x
	Artificial Intelligence	Big data analysis, Cognitive services	x	x	x
		Textual data, Automated sentiment analysis	x	x	x
		Anomalies detection, Fraud detection	x	x	x
	Systems Integration / Inter-Operability	Web services, data standards			
		Public key infrastructure, smart identity cards			
	Distribution of Information	RSS feeds	x	x	x
		Portals/ websites/knowledge sharing tools	x	x	x
		Emails lists	x	x	x
		Mobile Computing	x	x	x
		Blockchain Technologies	x		x
		Peer to Peer networks	x	x	x
		Open Data	**x**	**x**	**x**
	GIS applications	Geographic information systems	**x**	**x**	**x**

Challenges in democratic governa					
2. Representation		3. Transparency			
Equal/balanced representation of social groups	Equal/balanced representation of minorities	Transparency in public services	Influence of powerful economic interests vs interests of citizens	Reduce corruption	Globalization and Democracy Capitalism
x	x	x			
x	x	x			
x	x	x			
x	x	x			
x	x	x			
		x	x	x	x
x	x	x			
x	x	x			
		x	x	x	x
		x	x	x	x
		x	x	x	x
		x	x	x	x
		x	x	x	x
x	x	x			
x	x	x			
x	x	x			
x	x	x			
x	x	x	**x**	x	**x**
x	x	x			
x	**x**	**x**	**x**	**x**	**x**
		x	x	x	x

nce (revised framework)

4. Processes and administration		5. Participation		6. Education	
Efficiency of bureaucratic processes	Reasonable cost for public services and processes	Participation of young people	Participation of people in general	Education of citizens	Education of representatives
x	**x**	x	x	x	x
x	**x**	x	x	x	x
x	**x**	x	x	x	x
x	**x**	x	x	x	x
x	**x**	x	x	x	x
x	x				
	x	x	x		
	x	x	x		
x	x				
x	x				
x	x				
x	x				
x	x				
x	x	x	x	x	x
x	x	x	x	x	x
x	x	x	x	x	x
x	x	x	x	x	x
x	x	x	x	x	x
x	x	x	x	x	x
x	**x**	**x**	**x**	**x**	**x**
x	x			**x**	**x**

Trust	
Lack of trust in the Public sector	**Lack of trust in the Political system**
x	**x**
x	**x**
x	**x**
x	**x**
x	**x**
x	**x**
x	**x**
x	**x**
x	**x**