

A Paired Conceptual Framework Integrating Information Systems Research and Democracy Theory

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ABSTRACT

Information systems (IS) play an important role in contemporary society, but critical questions remain on their impact on democracy. This study aims to contribute to a better understanding of this phenomenon. In order to do so, the study develops an innovative methodological approach. Drawing from Design Science Research (DSR), we build conceptual pairs between core preoccupations explored by critical thought on democracy and available problem-solving information technologies. The study does not aim at an exhaustive analysis of problems and solutions; this would be unfeasible, considering the limitations of journal article format. Rather, it aims at early-stage methodology incorporation across disciplines that draw from different research paradigms. The findings will offer a preliminary probe on the analytical input of DSR conceptual artefacts in examining functional links between information systems and political outcomes.

KEYWORDS

Information systems; Democracy; Transparency; Government; Social media; · Participation; Public services

1. Introduction

Information systems are increasingly supporting modern decision-making processes and transforming communication flows and patterns of interaction in society. Over the past decade, governments have implemented innovative digital solutions, in order to provide smarter citizen-centric services, to develop more agile and resilient administration structures and, more generally, to improve effectiveness and efficiency in addressing social and political problems. The widespread use of IT instruments by public administration allows decision-makers easier and faster access to data, on the one hand, and expedites access to information by the citizens who are affected by policy decisions, on the other hand. Furthermore, it multiplies venues of citizen participation in decision-making processes. In short, IS significantly reduce transaction costs of civic and political engagement [32, 38, 44, 45, 49, 50, 64, 82]. At the policy-level, the prevailing assumption that information systems contribute to simplifying the public decision-making process and to promote accountability and transparency in governance has led to significant structural reform: International institutions, namely the OECD, the UN and the European Commission have created policy departments dedicated to promoting ICT-led public innovation and these organizations produce a growing number of comparative surveys on e-government development at the national level¹. New concepts such as e-democracy and digital government have emerged [43, 45]. These structural and

¹ See <http://www.oecd.org/gov/digital-government/>; <http://www.oecd.org/gov/digital-government/digital-government-publications.htm>; <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2018>; <https://ec.europa.eu/digital-single-market/en/public-services-egovernment>; https://ec.europa.eu/information_society/newsroom/image/document/2018-47/egovernment_benchmark_2018_background_report_F21FA84B-0254-F4DB-7B2FC4567D4AA925_55487.pdf

conceptual innovations signal the advent of technology-induced paradigmatic change in long-standing models of governance.

As expected in the context of impending paradigm shift, there are growing debates on the effects of the widespread use of digital technologies in society, in general, and in politics, in particular. The current tone of public discussions is dominated by allegations on cyber interference in elections and on the spread of misinformation (“fake news”) suppressing the role of established media and increasing the risk of authoritarian surveillance. In this context, there are critical questions still unanswered by previous work on information systems and democracy: How is democracy affected by information systems? Are the deliberative, representative and distributive pillars of democracy restructured by IT? If so, what are the instruments and tools that interfere with specific functions of democratic governance? Under what conditions do information systems foster citizen trust and encourage participation?

Previous studies on digital government offer important insights on the impact of ICT-enabled public governance tools for government openness, public service efficiency and user-friendliness, and for citizen political participation and societal mobilization [22, 43, 45, 52, 55]. But the literature still lacks a systematic conceptual framework mapping and assessing the role of distinctive IS instruments in democratic problem-solving and specifying functional relationships between specific technology and particular democratic outcomes. Our work aims to contribute to filling this analytical gap.

We propose to identify and pair distinctive problems of democratic governance with specific information technologies that are designed to address them. We claim that the effort to develop a paired conceptual framework tying Information Systems’ solutions

with democratic problems will be useful and necessary to obtain a better understanding of the constituent elements of democracy in the digital age and to examine the factors that affect them. This will allow to improve proactive contingency planning and to design and develop more effective and efficient IT solutions, in order to target resilient domains of democratic underperformance.

Thus, we expect that our findings will encourage theory development in the field of democracy and governance and at the same time will contribute to improving technology solutions and policy choices. On the other hand, we do not intend to be exhaustive in our mapping endeavour. Alas, this would not be possible under the space constraints of a journal article. Thus, the study aims to offer a preliminary probe on the innovative use of design research methodology to deploy conceptual artefacts that aim to operationalize interdisciplinary work integrating political philosophy and information research.

The study will be structured as follows. The next section will outline the research approach and propose the methodological claims on the use of DSR iteration for our line of investigation. In Sect. 3 we will offer a condensed review of critical thought on democracy and of the relatively recent literature on ICT and governance. Drawing from core premises of this literature, we will develop conceptual constructs identifying categories of problems in democracy and labelling IT tools, respectively in Sects. 3.1. and 3.2. We will pair those constructs in Sect. 3.3 and display the paired artefacts in Table 2. Section 4 will analyse the conceptual artefacts against the results of structured interviews with a set of experts. The study will conclude with a summary of major findings and contributions.

2. Research Approach

The research proposed here aims to develop an innovative conceptual framework that draws from findings from two disciplines that are not easily integrated methodologically, namely information systems research and democracy studies. We establish the claim that the Design Science Research (DSR) approach is ideal to pursue our interdisciplinary research effort. As defined in the Information Systems literature, the DSR approach combines the construction and analysis of innovative artefacts in view to expand knowledge on specific problem-solving [3, 4, 39, 85].

The DSR method establishes a sequential research trajectory, beginning with the identification of a problem, followed by conceptualization and development of a problem-solving artefact, and moving to assessment and refinement of the latter. The goal is to expand knowledge of a specific problem domain via an iteration process that begins, like other research methods, with a research question, and then proceeds with its characteristic trajectory of construction, evaluation, and re-dressing of design artefacts. The problem-solving artefact developed in the DSR process may not necessarily be a product. Rather, it may consist of an innovative method, technique, and/or conceptual framework [85].

In this study, the artefacts belong to the latter category: we develop conceptual pairs, with each pair identifying a problem of democratic governance and the identifiable

contributions for that given problem of a specific design information system technology or platform tool. The goal is to expand knowledge on the role of IS in democracy. Mapping sets of constructs and developing analytical propositions and functional links in this complex setting involves diverse analytical domains and is a challenging scientific endeavour. The paired conceptual framework that will embody the output of the research will bring significant analytical import for the two fields of research and expand knowledge on design solutions both to long-standing and novel problems of democracy. In adapting the DSR sequence to the tasks and goals of our research, we began our study with a comprehensive analysis of the literature that provides the analytical and conceptual framework for developing the paired constructs, namely classic and contemporary readings on democracy and the recent literature on ICT-enabled governance. From this literature, we deduced conceptual categories of democratic problems and identified information systems instruments targeting problem-solving in those categories. The combined analysis resulted in the development of a paired conceptual framework (see Table 2 below). The initial framework was then assessed and refined through observations gained from structured interviews with nine experts (Table 1).

Table 1. List and occupational categories of interviewees

Profile	Level of education	Current profession	Year of experience in E-government	
			Academic	Practice
Expert advisor of the special secretary of e-government in Greece	PhD	Academic – Professor assistance	7	3
Responsible for IS at a municipality. E-government services	PhD student	Software engineer e-government		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	PhD student	Consulting partner for e-government		43
Former Director General of the DG Informatic	PhD	International consultants and E-government		40
Researcher for e-government integrability	PhD	Researcher e-governance.	8	
Senior Researcher and Project Manager at the Information Systems Laboratory of the same department, working on European and National funded research and pilot application projects	PhD	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

3. A Critical Review of Democracy and ICT

3.1 The Resilient Problems of Democracy: Procedural Challenges and Contradictory Goals

Critical thought on democracy goes as far back as Classical Antiquity. In the long line of political philosophers' reasoning on democracy, one finds a common set of challenges persisting across time, political regimes, technological innovation, and cultural diversity. The enduring problems are largely associated with the great paradox of collective action, itself related to a procedural conundrum: historically, the processes that aggregate individual will and steer the implementation of collective policy have been inherently imperfect, subject to interference and manipulation by narrow interests, and culminate in outcomes that are inconsistent with the ideal democratic principles of freedom, equality, fairness, and accountability in political representation. Recent indicators on electoral participation and political polarization point to significant citizen dissatisfaction with democratic governance and with party politics and suggest that long-lasting problems remain unresolved [36, 61]. The gap between the functional incapacities of democratic institutions and the demands and expectations of citizens has been demonstrated by high levels of abstention and dissatisfaction with the political system [89].

Contemporary critiques of democracy argue that there is a resilient inequality problem in democratic governance. Political institutions have lost trust and legitimacy among their citizens [30]. As argued by 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 [36]. However, as studies on democracy point out, distribution of influence is unbalanced: not all voices are heard and not all individuals have equal access to governance, even in mature political systems. Furthermore, political theorists claim that the combination of the principle “one person, one vote” with the procedural rule of the majority often culminates in an unwanted outcome, namely in a “tyranny of the majority” which leaves minorities unprotected [29] John Adams [2] and John Stuart Mill [48].

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 [88]. However, along the electoral cycle, the elected representatives have the freedom to act according to their judgment and their decisions may not be aligned with the will of those who elected them. In other words, there is a misalignment between the interests of the mass of electors and the few representatives who determine public policy outcomes. Ultimately, this contributes to dissatisfaction and people not participating, since most representatives are selected or self-selected from elites with economic power and market influence [21, 45, 53, 69, 88, 89].

Some studies also claim that the transient character of political representation may produce unwanted outcomes in democratic representation too. Accordingly, electoral cycles yield frequent government turnover and the latter induces policy instability,

which plays a part in citizen dissatisfaction [19, 37, 71]. Furthermore, the electoral cycle creates incentives for politicians to sponsor interests that will support reselection. Corruption may emerge as a result, especially in less developed political systems, undermining effective legal systems and the protection of human and civil rights [36, 60, 71, 83]. Corruption breaks the relationship between the collective decision-making process and people's powers to influence the decision-making process, damages the culture of democracy and as a result generates inefficient public services. All this discomfort leads to a lack of participation and security with ineffective and inefficient governments, citizens are judging and criticizing the inefficiency of all democratic process including the bureaucratic processes [25, 30].

External factors are also pointed out as determinant of inequality in access to policy and political representation [88]. As argued by some scholars, global economic competition, itself an outcome of dramatic advances in communication throughout the past century, creates obstacles to fairness and equality in contemporary democracies, eroding trust and creates suspicion. Democracy is harmed and corruption of this sort cuts representative connections. Accordingly, multinational economic interests and global competition hold great sway over governments. More concretely, they can manipulate electoral processes and to impose a policy that undermines social rights and accentuates social, political and economic inequalities [18, 25, 88]. Other more recent outcomes of globalization, namely mass immigration and terrorism seem to have intensified citizen dissatisfaction with the social costs of unfettered market pressures. Political polarization and radical political parties and movements are the ensuing outcomes [19, 37, 71].

Studies have also pointed out the role of subjective factors in challenging democracy. In his classic writings, Dahl argued that a significant percentage of citizens are not able to participate in governance in a competent or meaningful way because they do not have the necessary experience, education or knowledge [19, 71]. Lipset's classic essay on democracy also suggested that education is a key factor for a democracy to emerge [9]². More generally, scholars have argued that citizen lack of information allows politicians to manipulate electors; furthermore, the lack of adequate information undermines policy [14, 16, 18, 19, 36, 88].

From these analytical premises, we establish the following conceptual constructs on the core problems of contemporary democracy:

- Globalization and unfettered market forces
- Influence of powerful economic interests
- Problems of fairness and lack of transparency
- Lack of education of citizens and representatives
- Inefficient processes
- The tyranny of the majority, which does not protect minorities and human rights
- Unequal distribution of influence, not all voices are being heard, there is no equality in access to policy-making
- Lack of participation in the political system
- Imperfect representation of social groups.

² Other authors, however, argue that education alone is not a sufficient condition to maintain democracy [13].

3.2 The Functional Ties Between Information Systems and Democracy

Studies on the relationship between information technology and politics suggest that the use of information systems and platforms in public governance and democratic practice contributes to adjust long-standing problems and imperfections of political systems, namely issues of accountability and participation, which culminate in low levels of trust. Allows governments to serve citizens in a more effective, timely, and cost-efficient way [28]. The general assumption is that, as a medium for human communication and expression, information systems have escalated knowledge sharing, have addressed resilient communication gaps between public administrations and citizens, and have facilitated public service delivery as well as citizen participation in policy [43, 45, 52].

Mark E. Warren argued in more than one paper that modern technologies and IS are the solution to more than one pathology of democracy, such as corruption, trust, security, and inefficient public services, and that the new technologies promise the power to expose those pathologies [25]. Information systems can be used to create different forms of participation in the decision-making process, including those who have little voice within electoral politics, structuring deliberation and working across and beyond jurisdictions. Information systems can enable collaborative research and form the basis for improving democratic inclusion, civic engagement, and effective public problem-solving. Information systems can enhance equality and/or inclusion in political processes, tries to improve public services and enhance public accountability [30].

More concretely, the widespread use of information systems and recent platform technology allow citizen access at any time to up-to-date information and knowledge on

political and public issues, sustain public debate beyond geographical and time discontinuities, and expedite interaction with public authorities, including collaboration on resolving local issues. In other words, the use of information technology in governance has dramatically lowered the transaction costs of political communication and has vastly expanded the scale and scope of citizen engagement and opportunities for input in policy implementation. Therefore, scholars agree that information systems contribute to enhancing the core components of collaborative political participation, empowering individuals, and ultimately, advancing the common good [8, 10, 12, 51, 56, 58, 74, 81]. The literature suggests a set of functional ties between specific technologies and democratic outcomes. For a start, information systems operate at the very core of democratic procedures, namely by allowing citizen electronic participation in elections, polls, and referenda. [87] Information systems also provide electronic access to government services and information, such as electronic filing of taxes and direct deposit of government checks [6, 7, 10, 72, 86].

Moreover, the low cost and widespread use of information technology and the internet have transformed the scale of deliberative democracy: millions of voices and point of views can be shared across the world instantly and such fast and global exchange of ideas supports civil society and freedom of speech, inducing pressure on governments to become more transparent and fairer [33, 46, 47, 54, 56, 76, 78]. According to Hilbert's study on the maturing character of e-democracy, the Web 2.0 and social media technology have spurred outright revolutionary transformation in democracy practice,

suggesting it is possible to overcome the traditional problem of the size of participation in democratic processes [41].³

Other scholars highlight the role of social media in enabling intense and sustained collaboration between citizens and governments, thus enhancing public policy and social innovation [59, 90]. And existing studies also suggest that information systems have been used to increase young people political knowledge, and awareness of processes of public choice. 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. The goal is to involve teenagers in expressing needs and opinions via online political debate and to try out e-democratic models for online-voting [5, 17, 40]⁴.

Drawing from these insights, we will next label a set of IT tools and explore their respective functional role of problem-solving in contemporary democracy.

3.3 Developing Paired Conceptual Artefacts

Web 2.0 is the evolution of content platforms to focus on user-generated content, such as forums, discussion boards, social networks, wikis, collaborative platforms, knowledge sharing tools, blogs, micro-blogging, and participative budgeting platforms [57, 63, 65, 79]. It can be used to solve the problems of (see Table 2):

³ One should note that Hilbert also highlights the problematic aspect of the unstructured character of data in social media, which, in his view, can be overcome by new technologies, such as big data analytics.

⁴ One should note that scholars have expressed preoccupations with the manipulation of youth participation in politics resulting from insufficient experience and knowledge [5, 17].

Table 2. Conceptual framework

		Problems of Democracy															
		Not being fair			The problem of transparency			The imperfection of the representative political system		Insufficient government services		Lack of participation		Lack of education			
		No equal distribution of influence	Not all voices are being heard	Those who are not equal rights to access resources	Globalisation and Democracy Capitalism	Influence of Big Money	Corruption	Public services	The representation of the interests of the social groups	The transparency of the system which does not protect the minorities and human rights	Insufficient bureaucratic processes	Expensive cost for public services and processes	Lack of participation of the young people	Lack of participation of people in general	The citizens	The representation	
Technologies	Web 2.0	Forums, discussion boards	x	x	x				x	x			x	x	x	x	
		Social Networks	x	x	x				x	x			x	x	x	x	
		Wikis, collaborative platforms, knowledge sharing tools	x	x	x				x	x				x	x	x	x
		Blogs, Micro blogging	x	x	x				x	x				x	x	x	x
		Participative budgeting platforms	x	x	x				x	x				x	x	x	x
	Internet of things / smart cities	Automatic meters				x	x	x	x			x	x				
		E-voting	x	x	x				x	x				x	x		
		E-voting	x	x	x				x	x				x	x		
		Big data analysis, Cognitive services	x	x	x	x	x	x	x			x	x				
		Textual data, Automated sentiment	x	x	x	x	x	x	x			x	x				
	Artificial intelligence / smart cities	Anomalies detection, Fraud detection	x	x	x	x	x	x	x			x	x				
		Web services, data standards				x	x	x	x			x	x				
		Public key infrastructure, smart identity cards				x	x	x	x			x	x				
		RIS feeds	x	x	x				x	x				x	x	x	x
		Portals/ webinars/knowledge sharing tools	x	x	x				x	x			x	x	x	x	x
Artificial intelligence / smart cities	Twitter feeds	x	x	x				x	x			x	x	x	x	x	
	Mobile Computing	x	x	x				x	x			x	x	x	x	x	
	Blockchain Technologies	x	x	x				x	x			x	x	x	x	x	
	Open Source networks	x	x	x				x	x			x	x	x	x	x	
	Geographic information systems				x	x	x				x	x					

- a) Not being fair: Tools provided by the web 2.0 promote the participation of individuals willing to contribute with their ideas in the democratic processes [30, 35].
- b) The problem of transparency: Tools provided by the web 2.0 allow greater transparency over how a consensus is reached, as contributions can be archived and remain accessible to examination. Especially useful for facilitating access to public records and information. Improve public services quality [30, 35].
- c) The imperfection of the representative political system: Tools provided by the web 2.0 facilitate and expand the participation of interested parties. It is possible to measure the inclusiveness of political representation accounting for how many people participate in discussions [30, 35].
- d) Lack of participation: Forums, discussion boards, social networks, wikis, collaborative platforms, knowledge sharing tools, blogs, micro-blogging, and participative budgeting platforms expand access to policy-making and increase

collaboration between citizens and the public. Policy-makers can use web 2.0 to gather information about what people need and about public opinion. These tools enhance open source government and inclusive decision-making [30, 35].

- e) Lack of education: Not all participants have the same level of education and understanding of issues. Easy access to prolific information sources allows citizens to increase knowledge about important policy issues [30, 35].

Internet of things/Ubiquitous Computing, such as automatic meters that support bidirectional communications to allow for accurate billing of utilities such as gas, electricity, and water [20]. This can be used to solve the following problems (see Table [2](#)):

- a) The problem of transparency: The heavy use of these tools will generate a big volume of records that can be used to audit existing bureaucratic processes and communications, resulting in more transparent processes [30].
- b) Inefficient government services: IoT-enabled dynamic capabilities that can empower digital transformation and unlock the potentials of digital government into smart government and developed policies and services of public interest and public value [15, 35].

Electronic voting has been considered an inevitable development that simplifies and reduces the cost of, and speeds up processes around, elections. It also can improve the integrity of elections and can reduce the errors of the election process [1]. Scholars argue it increases the engagement and turnout of citizens and contributes to restoring relationships between citizens and political institutions [11]. E-voting systems are engineered for the specific purpose of

voting and are not used online, while I-voting systems allow a voter to vote from any computer connected to the internet, even from their homes, through an online voting platform [68]. It can be used to solve the following problems (see Table 2):

- a) Not being fair: Using electronic and internet voting, it is possible to provide a platform where all interested parties can express their views [1].
- b) The problem of transparency: Using a voting platform, it is possible to have an auditable record of who voted and in whom, resulting in added transparency in the decision-making process [1, 25].
- c) The imperfection of the representative political system: As all parties can cast their votes one can assume that all interested parties are adequately represented. Moreover, it allows the government to survey the general opinion of the population in a fast and efficient way at any time [41].
- d) Lack of participation: An electronic voting system increases participation because citizens can vote from everywhere, even from their homes via a user-friendly environment implemented in cloud computing services [91].

Artificial Intelligence is the use of algorithms to obtain deeper insights into various subjects. Through the analysis of massive amounts of data, it is possible to infer useful information about trends and preferences [62, 70]. It can be used to solve the following problems (see Table 2):

- a) Not being fair: If implemented correctly, artificial intelligence is not biased and not subject to corruption. Decisions are based only on the data provided. The data-driven decision-making process should allow for more effective and efficient, and fairer decisions [67].
- b) The problem of transparency: Artificial intelligence will apply the set of defined rules consistently. Any decision can be traced back to the set of rules; all decisions should be able to be replicated assuming the same data and the same set of rules are used. If the rules are published, any citizen can understand why a certain decision was made. This provides a fully transparent decision-making process [30, 67].
- c) Inefficient government services: Artificial intelligence is orders of magnitude faster than humans in analysing and applying a set of rules to reach a decision. This could provide nearly instantaneous decisions [67, 75].

Systems Integration/Inter-Operability, such as web services and data standards provide common sets of technologies that allow different information systems to transfer information between themselves using a standardized data format. Systems Integration/Inter-Operability can be used to solve the following problems [30] (see Table

[2](#)):

- a) The problem of transparency: The ability of the various system to work together requires the use of common data formats. Common data formats allow citizens and data scientists to independently analyse data and reach their conclusions. The ability to independently replicate results or analyses data is a fundamental requirement to implement transparent systems [30].

- b) Inefficient government services: Public administration services have traditionally not talked to each other and required citizens to retrieve paper records from other services. This is highly inefficient and time-consuming. Systems integration makes it possible to connect information systems of different governmental services so that they exchange information and provide citizens with a more efficient service. Most bureaucratic procedures can 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. Once all citizens have digital certificates it becomes possible to benefit from advances in cryptography that allow for legally binding digital signatures and the dematerialization of most bureaucratic processes, as is the case in Estonia [24, 26, 30, 75].

Distribution of Information is the flow of data through the internet. It can be used to solve the following problems [30] (see Table 2):

- a) Not being fair: Various tools for the distribution of information allow people to be informed about important policy issues, therefore improving fairness in access. Technologies such as RSS feeds allow the user to subscribe to sites and get a feed of content updates. An example is Ushahidi which is being developed by Ushahidi Inc in Nairobi, Africa. It is an application that allows users to upload real-time data, respond to issues, election monitoring, and crisis response [30, 84].
- b) The problem of transparency: Tools that distribute information contribute to make decision processes more transparent and expand the number of people

who have access to knowledge. Emails lists, mobile computing and P2P networks, such as the open data services cooperative developed by Tim Davies and his team in the UK help people publish and use open data to support activities that promote social impact [30, 73, 80].

- c) The imperfection of the representative political system: As information about processes gets distributed, more people become aware of processes that affect their interests. Portals, websites, and knowledge sharing tools allow users and organizations to publish and share information. Most modern governments make use of this kind of portals [24, 30, 66].
- d) Inefficient government services: By leveraging tools for the distribution of information it is possible to keep governmental employees aware of important information that they require to be more efficient at their job. Moreover, obtaining feedback is important to improve efficiency in governmental services. Blockchain can be used for all kinds of public services such as health and welfare payments without the need for central validation or human intervention. For example, the Dutch Government is exploring blockchain in several pilot projects, such as digital identity, income tax, autonomous vehicles, logistics, and debt counselling [23]. This redistributes power away from central decision-makers, makes service delivery more efficient, and increases transparency [11, 30, 75, 77].
- e) Lack of participation: Distribution of information expands the number of individuals who obtain knowledge on processes that directly affect their interests. This stimulates participation [30].

- f) Lack of education: Distribution of information using tools stimulate knowledge sharing [30].

Geography information systems applications take advantage of the recent development and general availability of online maps with high-resolution imagery of the earth to improve services provided by the state, such as land registry and other services where geographical data is relevant [27, 42]. They can be used to solve the following problems (see Table [2](#)):

- a) The problem of transparency: The use of geographical information systems allows people to visualize information. This intuitive way of looking at information makes it easier to see incorrect information and interpret it. For example, catching tax evaders by recognizing signs of wealth such as swimming pools. Another example is visualizing voting patterns by reviewing how electoral districts voted at the polls [31, 34].
- b) Inefficient government services: The use of geographic information systems applications in government services allows information to be represented and displayed in a more understandable format and can improve the quality of several public services. For example, encouraging citizen involvement through web-based applications for the redistricting process (Redistricting QGIS Plugin) [31, 34].

3. Expert Assessment of the Conceptual Artefacts

In assessing the conceptual framework proposed above, experts agreed that low levels of political participation constitute a lasting and critical limitation of contemporary democracy. As argued, citizens are largely disconnected from the decision-making process, perceive government services as inefficient and ineffective and question the return on their paid taxes. Questioned if any important problems of democracy were missing from the above table, two of the nine experts mentioned the problem of accountability. Another missing problem was the lack of trust, which, according to the experts, aggravates the low levels of political participation, especially among young people.

All experts strongly agreed that information systems help to foster the elements of democracy under examination. Furthermore, they argued that IS will be a necessary venue in the future of practice and in problem-solving. However, interviewees pointed out that, when assessing the role of IS in democracy, the risk of manipulation must be

considered. It is imperative to examine how and who is using information systems and what the intentions are when using IS.

All experts agreed that the proposed categorization of information systems technologies is valid but pointed out open data as an important and missing element of the conceptual framework. Accordingly, open data is a necessary condition to ensure the fairness of political systems and government services, and essential to promote transparency. One expert suggested that simulations technologies and chats bots for public services should be added to the conceptual framework (see Table 3):

Table 3. Revised conceptual framework

		Problems of Democracy															
		Not being fair	No input	Not all	There	Unstable	Unfair	Corrupt	Public	Accountability	The imperfection of the representation of the population or	The opacity of the reports, which does not protect the	Inefficient government services	Suppression and the	Lack of participation	Lack of education	Lack of trust
Technologies	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Technologies	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Technologies	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Public Services	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

All experts except one agreed that web 2.0 and the sub-categories defined above play a determining role in solving the examined problems of democracy. One expert claimed that web 2.0 has also contributed to making problems worse, as revealed for example by foreign interference in US elections. Experts also argued that social media technologies have improved the possibilities of communicating within a community, but at the same time have been misused.

According to the interviewees, crowdfunding platforms for e-government purposes have been designed to make processes faster and easier, by matching relevant problems with governmental funding. Furthermore, they have stimulated active participation. Experts also noted that participative budgeting platforms are growing in city halls and, more generally, a concept that is gaining momentum.

On electronic voting, 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. Accordingly, electronic voting introduces strong challenges but also great opportunities for government to increase participation by making people believe their vote is important.

Most of the experts argue that Web 2.0 technologies can also contribute to solving the problem of inefficient government services, by making public services less bureaucratic, allowing citizens to report issues and allowing public services to incorporate feedback.

Experts pointed out that the Internet of things/Ubiquitous Computing and their sub-categories 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 claim, transparency increases, the quality of services improves, and citizens deal with simpler procedures.

According to interviewees, artificial intelligence capabilities will be fundamental in solving problems of authentication, detecting fraud rapidly, measuring people sentiment on what the government is doing, wants to do or has done. This will ensure the participation of citizens in governmental projects. Experts also claimed that systems

integration and inter-operability technologies constitute one of the most fundamental technologies - together with AI and the distribution of information - in implementing e-government solutions. Accordingly, one of the resilient challenges of e-government is to connect different services within public administration and to connect the services with citizens as well. Experts argued that the referred technologies can increase the efficiency of government services with just one click. Ultimately, interviewees claimed, this will also contribute to increase transparency and to make citizens see the value for money in government services, therefore increasing participation.

According to experts, the distribution of information technologies will be at the core of trust and security. All agreed that open data and blockchain concepts will change the way citizens think, feel and behave in online processes and services. As stated, transparency will be part of political culture, and fraud will decrease and be easier to detect. This will improve trust in e-government services and increase political participation.

To conclude, experts argued that geographic information systems can mitigate democratic problems such as not being fair. Interviewees claimed that, for example, building systems that use ubiquity computing, mobile technologies, geographical information systems, 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. Citizens can vote on a topic related to a location or point of interest and be part of the decision-making process. 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. Police and the ministry of health use them too.

Table [3](#) displays the revised conceptual framework and paired artefacts resulting from the experts' assessment of our original proposal.

4. Conclusion

Over the past decade, the spread of digital technologies and the use of social media as channels for individual expression, political debate, and social mobilization has transformed democratic practice and lowered the transaction costs of political participation. In order to understand if, how and under what conditions these new technological tools contribute to improving the historically resilient and unresolved problems of democracy, we began our research by identifying a set of challenges of contemporary democracy. Next, we examined specific applications of information systems that aim to address those problems and developed the conceptual pairs between the constructs. We then tested the resulting conceptual framework against an assessment by a set of experts.

The conceptual pairing of problems and information's systems solutions suggests that the combined adoption of artificial intelligence, systems integration, and blockchain technologies will play a determining role in the capacitating public delivery of smart, citizen-centric services, and will contribute to encouraging citizen trust and political participation. In stimulating transparency and making fraud easier to detect, open data is expected to transform the way citizens think, feel and behave while engaging in online processes, ultimately fostering citizen confidence in participatory venues. Web 2.0 technologies, geography information systems and collaboration tools are expected to stimulate information sharing and learning between public organizations that have traditionally operated in silos, as well as between public administrations and citizens.

In analysing the functional relations between specific information technologies and identifiable problems of democracy, the study aims to contribute to a better

understanding of how democracy and information systems work together. The preliminary findings of the study aim open a methodological agenda that will help select effective combinations of tools to address specific problems of democracy, as well as design public policies that stimulate and coordinate the intervention of technology in society and politics. Theoretically, the study also offers contributions on how democracy is expected to evolve in the digital era.

ANNEX 1

Table 4: Conceptual Framework

		Problems of Democracy														
		Not being fair			The problem of transparency			The imperfection of the representative political system		Inefficient government services		Lack of education				
		No equal distribution of influence	Not all voices are being heard	There are not equal rights to access Democracy	Globalization and Money	Corruption	Public services	Accountability	The tyranny of the majority, which does not protect the minorities and human rights	Inefficient bureaucratic processes	Expensive cost for public services and processes	Lack of participation of the young people in general	The officers	The representatives		
Technologies	Forum of (Transp) / (Innovation) / (Complexity)	Forums, discussion boards	x	x	x			x	x			x	x	x	x	
		Social Networks	x	x	x				x				x	x	x	x
		Wikis, collaborative platforms, knowledge sharing tools	x	x	x				x	x			x	x	x	x
	Web 2.0	Maps, Micro-blogging	x	x	x				x				x	x	x	x
		Participative budgeting platforms	x	x	x				x	x			x	x	x	x
		Automatic voters					x	x	x	x		x		x		
	Electronic voting	E-voting	x	x	x				x	x			x	x		
		Handing	x	x	x				x	x			x	x		
		Big data analysis, Cognitive services	x	x	x	x	x	x	x		x	x				
	Artificial Intelligence	Textual data, Automated sentiment	x	x	x	x	x	x	x		x	x				
		Anomalies detection, Fraud detection	x	x	x	x	x	x	x		x	x				
		Web services, data standards				x	x	x	x		x	x				
	Systems Integration / Interoperability	Public key infrastructure, smart identity cards				x	x	x	x		x	x				
		RSS feeds	x	x	x				x	x		x	x	x	x	x
		Portable/ weblogs/knowledge sharing tools	x	x	x				x	x		x	x	x	x	x
	Distribution of Information	Mobile computing	x	x	x				x	x		x	x	x	x	x
		Blockchain Technologies	x	x	x	x	x	x	x		x	x	x	x	x	x
		Pear to Pear networks	x	x	x				x	x		x	x	x	x	x
US applications	Geographic information systems				x	x	x			x	x					

ANNEX 2

Table 5: Revised conceptual framework

		Problems of Democracy														
		Not being fair	The problem of transparency			The imperfection of the representative political system		Inefficient government services		Lack of participation		Lack of education		Lack of trust		
		No equal distribution of influence	There are not equal rights to access Democracy	Globalization and Money	Corruption	Public services	Accountability	The tyranny of the majority, which does not protect the minorities and human rights	Inefficient bureaucratic processes	Expensive cost for public services and processes	Lack of participation of the young people in general	The officers	The representatives	Public sector	Political system	
Technologies	Forum of (Transp) / (Innovation) / (Complexity)	Forums, discussion boards	x	x	x			x	x			x	x	x	x	
		Social Networks	x	x	x				x				x	x	x	x
		Wikis, collaborative platforms, knowledge sharing tools	x	x	x				x	x			x	x	x	x
	Web 2.0	Maps, Micro-blogging	x	x	x				x				x	x	x	x
		Participative budgeting platforms	x	x	x				x	x			x	x	x	x
		Automatic voters					x	x	x	x		x		x		
	Electronic voting	E-voting	x	x	x				x	x			x	x		
		Handing	x	x	x				x	x			x	x		
		Big data analysis, Cognitive services	x	x	x	x	x	x	x		x	x				
	Artificial Intelligence	Textual data, Automated sentiment	x	x	x	x	x	x	x		x	x				
		Anomalies detection, Fraud detection	x	x	x	x	x	x	x		x	x				
		Web services, data standards				x	x	x	x		x	x				
	Systems Integration / Interoperability	Public key infrastructure, smart identity cards				x	x	x	x		x	x				
		RSS feeds	x	x	x				x	x		x	x	x	x	x
		Portable/ weblogs/knowledge sharing tools	x	x	x				x	x		x	x	x	x	x
	Distribution of Information	Mobile computing	x	x	x				x	x		x	x	x	x	x
		Blockchain Technologies	x	x	x	x	x	x	x		x	x	x	x	x	x
		Pear to Pear networks	x	x	x				x	x		x	x	x	x	x
US applications	Geographic information systems				x	x	x			x	x					

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