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Review

Disruptive Technologies for Parliaments: A Literature Review

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Abstract: Exploitation and use of disruptive technologies, such as the Internet of Things, recommender systems, and artificial intelligence, with an ambidextrous balance, are a challenge, nowadays. Users of the technologies, and stakeholders, could be part of a new organisational model that affects business procedures and processes. Additionally, the use of inclusive participatory organisational models is essential for the effective adoption of these technologies. Such models aim to transform organisational structures, as well. Public organisations, such as the parliament, could utilise information systems' personalisation techniques. As there are a lot of efforts to define the framework, the methodology, the techniques, the platforms, and the suitable models for digital technologies adoption in public organisations, this paper aims to provide a literature review for disruptive technology inclusive use in parliaments. The review emphasises the assessment of the applicability of the technologies, their maturity and usefulness, user acceptance, their performance, and their correlation to the adoption of relevant innovative, inclusive organisational models. It is argued that the efficient digital transformation of democratic institutions, such as parliaments, with the use of advanced e-governance tools and disruptive technologies, requires strategic approaches for adoption, acceptance, and inclusive service adaptation.

Keywords: Internet of Things; recommender systems; artificial intelligence; digital transformation; inclusiveness; parliament

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1. Introduction

The increased use of digital technologies in recent years is positively influencing more and more public organisations in the way they deliver their public services to citizens in an accountable and transparent way, but their impact on democracy remains an open issue [1]. On top of that, digital innovations are not affecting all democratic qualities, principles, and democratic innovations from the citizen's perspective, as they are developed primarily with face-to-face forms of engagement [2].

The successful usage of technology for the common good, engaging citizens (civic technology), is based on democratic criteria including inclusiveness, influence, publicity, knowledge production, deliberation, and citizen motivation [3]. However, it is also dependent on several other factors, such as the type of organisation, in correlation with the use of technology [4]. The evolutionary use of Information Communication Technology (ICT) in different workplaces in organisations, resulted in progressively more complex improvement of the organisational knowledge [5], which is, nevertheless, useful for policy making. The use of vast amounts of data [3] over the last two decades has hybridised the use of emerging digital technologies with human activities in organisations [6]. For public organisations, the use of disruptive technologies is satisfactory mostly for the

external users and actors (e.g., citizens, businesses) and not the internal stakeholders, which affects the whole environment efficiency [7]. The use of the term 'disruptive technologies' refers to a set of emerging technologies that drastically transform the processes and operations of the public sector [8]. These technologies include, among others, artificial intelligence (AI), Internet of Things (IoT) and recommender systems (RS). In the end, the organisation could revise the existing organisational status and services and create new user-friendly digital services, with continuous organisation change and disruption [9], satisfying not only the external users but also the internal stakeholders and actors with new forms of services. A key result of this is the expansion of the user base [10] with positive effects in the efficiency and performance of the organisations.

The above constitute a body of evidence as to the reasons why any public sector organisation is obliged to re-balance between innovation and efficiency [11] and also involve users/stakeholders/citizens in the design process of digital democratic innovations, where usability is the most critical criterion [3].

Recent works argue toward the need for organisations to adopt an ambidextrous organisational model with a balance between exploration and exploitation [12], adjust the use of the new technologies with innovative concepts, methods, tools, and services in an inclusive system [13], with an inclusive user-centred perspective in the digital application design process, considering the diversity of end-users and their digital know-how [3].

The scope of this paper is to conduct a literature review for an inclusive use of these digital technologies in public organisations and especially in parliaments, selecting the suitable ones and placing them in the parliamentary organisational context. This work emphasises, in the assessment of the applicability of these technologies, the user acceptance, maturity, usefulness, performance and their correlation with innovative inclusive organisational models, suitable to be adopted mostly by parliaments.

A set of research questions (RQ) could be used to identify the above-mentioned items:

RQ1: How feasible is it to achieve a democracy dynamic transformation using advanced e-governance tools via semantic web disruptive technologies such as IoT and RS, or their enabling technologies (e.g., semantic web, artificial intelligence)

RQ2: Are there any innovative inclusive organisational models having these digital technologies as main pillars that are suitable for organisations such as parliaments?

RQ3: Which is the role of parliaments in the policy cycle and how could parliaments use these disruptive technologies effectively?

The rest of the paper is structured as follows. Section 2 presents the method and the data collection process, as well as the compilation process. Section 3 presents the results derived from the data analysis and an overview of the research background. Section 4 presents a part of inclusive disruptive technologies (IoT, RS, AI) with a focus on IoT. Section 5 presents a user-centric approach for digital technology inclusion in parliaments. Section 6 presents the discussion of the results from this review and addresses the research questions in context. Finally, Section 7 presents the conclusions.

2. Data and Methods

In this paper, we followed part of the guidelines, suggestions, and steps proposed by [14] to evaluate the state and the current status of knowledge for disruptive technologies in parliaments with an emphasis on the IoT. Initially, we used a taxonomy [15] to organise our review as follows:

i. Focus on research paper outcomes and methods with an emphasis on practices in public organisations and especially in parliaments.
ii. The goal of the research strategy is to integrate and make a synthesis of research outcomes.
iii. The perspective is a rather neutral representation of literature interpretations.
iv. The coverage strategy includes research papers that are representative and correlated with many works in several research fields.

v. A conceptual organisation has been used, as research themes with the same abstract have been categorised in historical chronological order.
vi. Finally, the audience addressed could be categorised as policymakers and specialised research audience in e-governance and parliaments, but also in disruptive technologies.

Our approach is integrative, as we follow the steps proposed by Snyder [14]: design, conducting, analysis and writing and the questions proposed that are similar in some cases with the PRISMA checklist [16] having as a broader framework the previous taxonomy. It is a critical and synthesis path, that includes examined domains as they fulfil certain acceptability and relevance requirements. The research questions raised above are rather broad. Therefore, the research strategy that was followed was not systematic, even though it partially follows the PRISMA checklist [16]. Considering the keywords and the above-mentioned research questions, we have created themes (sets of keywords with a broader hyper title) and the relevant research topics (keywords that we want to give emphasis in our research) for the selection of the literature review papers.

We have been identified four main keywords (AI, IoT, RS, Parliaments). So, the query was [("parliament" OR "public organi*ation") AND ("Internet of Things OR "Recommender System*" OR "Artificial Intelligence")] AND language ("english") AND type ("article" OR "conference proceedings" OR "book chapter") AND publication years (>2009 AND <2022). The set of sources have been selected primary through Google Scholar, Scopus, ResearchGate and other databases (e.g., Mendeley).

The investigated research papers are articles, books, and other published texts (e.g., studies, position papers, and working papers), mainly from journals and partly from conferences. The results analysis is mostly qualitative, but it also contains quantitative results (e.g., keywords classification). Their evaluation is based on both types of analyses. From these results, we created a taxonomy of literature themes, the topics examined, the role of keywords, the correlation of keywords and the contribution of each research paper, so we also identified the shortcomings and the research gaps. The ultimate scope was to propose and, at the end, conceptualise a theoretical model or framework integrating the research domains. For this reason, we adopted a research method for a focused integrative literature review, with the following concrete steps: (1) research domain(s) identification, (2) research paper selection, (3) research paper classification and relevancies assessment, (4) data selection, and (5) data synthesis and integration.

As a first step, we identified the research domains for the literature review based on the preliminary research questions and a set of main keywords (e.g., IoT, AI, RS, Parliaments) and on top of them we added additional keywords (e.g., Transformation, Disruptive Technologies, Inclusiveness, Users) for different sets of inquiries (with 'or', 'and'). With this addition, ensuring that we have >3 keywords per inquiry, we opened the spectrum and the research coverage, allowing us to select as many articles as possible. After the first batch of research papers' initial identification, we set the literature review objectives to narrow down the field of our research. Beyond the three research questions, we have used a broader research framework to attain the work: can we use these disruptive technologies (AI, IoT, RS) in organisations such as parliaments to implement innovative inclusive organisational models for all users? We collected the search results per keyword, per theme (set of same keywords) and per topic (keywords with high presence in the research papers), trying to combine as many keywords as possible. We have excluded papers that were dedicated to one keyword only (e.g., IoT, digital parliaments, RS, AI) and published before 2014, except a few that were required for historical reference. Then, we classified the papers using the method presented in Table 1:

Table 1. Overview of information collected and method of analysis.

Category	Metadata	Description
Descriptive Info	Paper ID	Study number assigned in a excel sheet
	Author	Names of authors (APA ref style is also available)
	Year	Year of publication
	Source	Full Name of source
	Mean of publication	The type of publication (e.g., Journal, Conference)
	Citation Metrics	Q status from SCIMAGO, Scopus Cite score
Approach classification	Status	Short description of research status and the research questions
	Method	The research method used
	Results	The research contributions
	Shortcomings	Research gaps identification
Analysis	Keywords with a hyper theme	Which keywords could be found? Strong keywords with high presence in research papers highlighted. Hyper theme expresses their role in the research paper
	Relevance	Relevance of the research paper with the current research (High, Medium, Low)
	Accuracy	Number of keywords per research paper / number of total keywords
	Light Keywords	When a keyword is unrepresented in the research paper (less than 2 times)
	Strong Keywords	When a keyword is repeated in all pages of a research paper then it becomes a strong keyword
	Diversification	Number of light keywords per research paper / number of total keywords
	Holistic Topic	Basic keywords will be correlated for holistic Topics identification covering a lot of scientific domains (> 75% accuracy, <25% light keyword)

3. Analysis of the Literature

The initial results of our research provided us with the following statement as a narrative that coincides with the aim of our literature review.

In governmental dimension and especially in organisations such as parliaments, their internal and external users (stakeholders, decision/policy makers, agents, teams, and groups) need an integrated operational framework where an inclusive organisational model uses disruptive technologies such as IoT, RS and AI in its business processes to achieve better public value through an efficient and effective organisational performance for a knowledge-based transformation.

The identified keywords, already underlined above, were derived from the synthesis of the above statement phrases and sentences using the methodology described and the preliminary results of the first step of the method. As a result, we have identified the 12 main keywords that lay out a concrete path to conduct the literature review. On top of that, a set of hyper titles were used as themes that describe the role of keywords in the literature review, as presented in Table 2.

Table 2. Analysis of keywords.

Themes	Keywords	Advanced Search
Dimension	Parliaments, Government	Parliaments or Public Sector or Governmental or Public Management
Users	Stakeholders Agents Teams Groups Decision/Policy Makers	Stakeholders Agents or Individuals Teams Groups Decision/Policy Makers as Users
Framework	Integration	Integrative or integrated or Collaborative or Coordination
Model	Inclusive	Inclusiveness, participatory or including several parameters
Technologies	IoT, AI, RS	Disruptive technologies like IoT and AI and RS with Intelligence and other (e.g., big data, machine learning)
Mean	Process	Focus on business process as a mean or tool
Achievement	Value	Public Value
Measurement	Performance	Efficiency and Effectiveness as Performance measurements
Outcome	Knowledge, Transformation	Transformation through Business Knowledge acquisition

After the keyword finalisation and definition of their broader role in the literature review, we have proceeded in the research papers' final selection as the core body of sources for this work. All the relevant research domains were included and more specifically: disruptive digital technologies with emphasis on IoT, RS and AI, the performance factor and value given by public governance (Parliaments), user inclusiveness in business processes through integrative models, and organisational knowledge acquisition for the organisations' digital transformation. The analysis was performed between June–September 2022. We have identified 106 research papers mostly in RS and IoT technologies, as well as other research domains including digital parliaments, ambidexterity and innovation. The research paper selection included the manuscripts that incorporated the abovementioned narrative of the scope of the literature review that each contained at least one keyword from each theme. As a result, we have selected 48 research papers for our analysis (source: 69% journal, 12% conference, 8% book chapter, 11% working papers publications).

The analysis of the paper content was based on the methodology presented in Table 1 and the respective paragraphs above. Table 3 presents the keyword distribution in the research papers, their diversification with light keywords and the keyword strength.

Table 3. Keywords classification.

Keywords	Presence in Papers	Diversification	Strength
Parliaments, Government	65%	19%	48%
Users	96%	26%	22%
Integration	79%	21%	5%
Inclusive	58%	50%	18%
IoT	67%	13%	69%
RS	35%	12%	71%

AI	63%	33%	17%
Process	96%	9%	35%
Value	81%	28%	8%
Performance	98%	32%	9%
Knowledge	81%	21%	17%
Transformation	63%	43%	26%

It is evident that the term 'inclusive' does not have strong presence in the identified research papers, while the term 'performance' is under-presented as a strong keyword. Moreover, the term 'value' that corresponds to the broader term of public value has a significant presence, but it is not very strong in comparison with other strong terms. Among the digital disruptive technologies, IoT seems to be the most concrete, so IoT could be characterised as a 'dominant' or 'key' technology. RS and AI were found in several IoT papers, therefore, for the purpose of this research domain, they can be characterised as 'secondary' or 'additional' disruptive technologies.

Moreover, we have identified four keywords (Users, Process, Integration, Knowledge) that can be characterised as 'major topics'. They provide the basis for a holistic approach in our research, since they are overrepresented in most of the research papers of our literature review, as they cover two constraints in their presence in the research papers: (>75% accuracy and <25% light keyword). Hence, they act as interconnectors and facilitators among digital disruptive technologies and management science. Based on that, 30 out of 48 research papers (62.5%) follow this holistic approach, where the technology-driven research papers are the majority of our sources (95%), but only 9 of them (20%) examined all the disruptive technologies (IoT, RS, AI) as a whole. So, we observe that neither this holistic approach is present in all research papers, nor all the disruptive technologies are examined in a holistic, integrated way. Seven research papers (15%) combine disruptive technologies and parliaments, but only four of them (8%) also follow the holistic approach mentioned above. The research questions that are presented in the introduction were addressed in an integrative way [14]. The following tables present a part of the research papers results that synthesise the emerging topic of disruptive technologies in parliaments. In the following section, we present inclusive disruptive technologies and a user-centric approach in parliaments, as derived from the selected research papers and their correlated references.

In the next table, we have identified the research papers that follow the holistic approach, where the keywords 'Users', 'Process', 'Integration', 'Knowledge' are their major topics. The synthesis of the results from these papers presents the way that the narrative is answered.

Based on the aforementioned Table 4, we identified that AI and IoT are the disruptive technologies that correspond to the majority of research work (70%), RS is present to a lesser extent. The holistic keywords (Users, Process, Integration, Knowledge) are present in all research papers, as well as performance as measurement. Figure 1 details the findings as a visual aggregation summary for the Table 4 items.

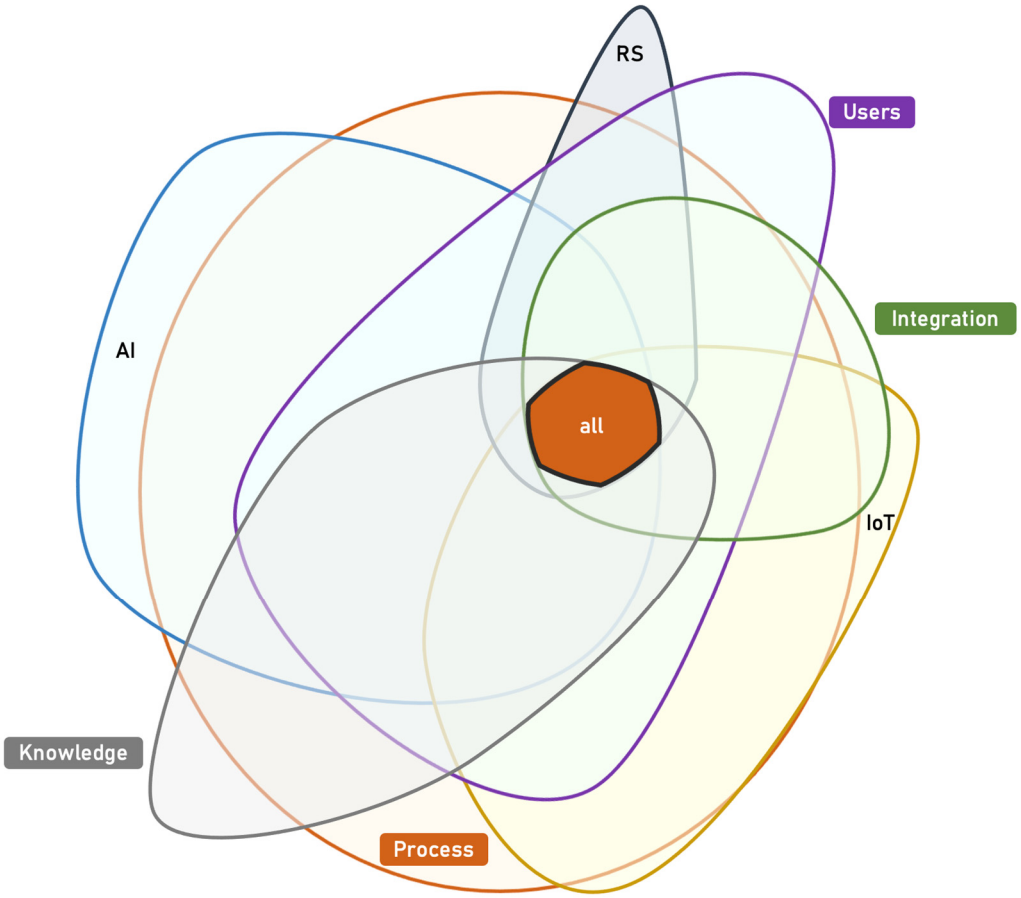

Figure 1. Research themes (keywords) and disruptive technologies presence for the papers in Table 4. Performance is overarching, therefore not depicted in the figure.

Table 4. Holistic Research Papers for Research Themes and Scientific Domains.

Year	Author (s)	Title	Research Themes	Missing Keywords	Outputs
2022	Fitsilis, von Lucke, Etscheid [17]	Prioritisation of Artificial Intelligence Technologies in Law-Making for the Parliamentary Workspace	AI Technologies, Parliamentary dimension, Law Making Process	IoT, RS	Prioritisation of AI-based technologies within the parliamentary environment
2022	Fitsilis, Koryzis, Schefbeck [18]	Legal Informatics Tools for Evidence-Based Policy Creation in Parliaments	Parliamentary dimension, Law Making Process	IoT	A clear digital strategy changes the organisational and operational culture in parliaments and AI technologies could be applied in the decision-making processes
2022	Tsaramirsis, Kantaros, Al-Darraji, Piromalis, Apostolopoulos, Pavlopoulou, Alrammal, Ismail, Buhari, Stojmenovic, Tamimi, Randhawa, Patel, Khan [19]	A Modern Approach towards an Industry 4.0 Model: From Driving Technologies to Management	IoT Technology in Industrial Process	RS, Governance Parliaments	Confluence of Industry 4.0 technologies in a single model factory with less jobs
2021	Hopster [20]	What are socially disruptive technologies?	Disruptive Technologies	IoT, Inclusive, RS	Techno-social disruption be conceptualized with notions of "disruptor" and "disruptiveness" and provoke uncertainty with a substantial "degree of social disruptiveness" of different emerging technologies
2021	Aliyev [21]	Methodological Basis of the Comparative Evaluation of Inclusiveness Level of Economic Development	Inclusive Models	RS, Transformation	IoT, Big Data, cloud and soft computing, as technologies of the 4.0 Industrial Revolution will increase the level of inclusion with joint societal activities
2021	Koryzis, Dalas, Spiliotopoulos, Fitsilis [22]	ParlTech: Transformation Framework for the Digital Parliament	Users, Parliamentary dimension, Digital Transformation	-	Tools and disruptive technologies for development and implementation of parliamentary digital transformation are set and highlighted in a framework

2021	Zuiderwijk, Chen, Salem [23]	Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda	Policy making Process, Governance	IoT, RS	Inclusive use of AI has tangible benefits in governance but is also challenging. AI enhance user experience with AI services in public policy cycle
2020	Baptista, Stein, Klein, Mary Watson-Manheim, Lee [6]	Digital work and organisational transformation: Emergent Digital/Human work configurations in modern organisations	Organisational Transformation	IoT, RS	Link of technologies with transformation with effects in workplace (performance, roles and work nature lead to transformation) with structural changes. Digital features assembling with human intent is needed for better performance.
2020	Brous, Janssen, Herder [4]	The dual effects of the Internet of Things (IoT): A systematic review of the benefits and risks of IoT adoption by organisations	IoT Technology, Organisational Process	RS, AI	Benefits and risks from the IoT adoption led to organisational structural transformational changes in process and systems, so there is a need to ensure that IoT fits the organisation's purposes.
2020	Anastasiadou, Santos, Montargil [1]	Which technology to which challenge in democratic governance? An approach using design science research	Democratic Governance, Policy making Process, Citizens (Users)	RS	Conceptual pairing of challenges in democratic governance with IS's integration (AI, blockchain), with transparent and accountable way, in the delivery of better public services encouraging citizen trust and participation in policy making processes
2020	Wimmer, Viale Pereira, Ronzhyn, Spitzer [8]	Transforming Government by Leveraging Disruptive Technologies: Identification of Research and Training Needs	AI & IoT Technology, Digital Transformation, Governance, Operational Process	RS, Inclusive	Disruptive Technologies (IoT, AI, VR, AR, Big Data) will change societies' cultures and behaviour, so there is an impact how government interact with citizens, increasing the users' training needs
2020	Pliatsios, Goumopoulos, Kotis [24]	A Review on IoT Frameworks Supporting Multi-Level Interoperability—The Semantic Social Network of Things Framework	IoT Technology, Knowledge driven, Systems Integration	RS, Governance Parliaments, Inclusive	Semantic Social Network of Things (SSNT) is introduced specifying device-to-device collaborative services based on the social interaction between smart objects by establishing social relationships and taking collaborative actions, supporting users to achieve their goals.

2020	Altulyan, Yao, Wang, Huang, and Z Sheng [25]	Recommender Systems for the Internet of Things: A survey	IoT & RS Technology, Knowledge-based, Business Process, Users	Governance Parliaments,	Limitations of applying recommendation systems (RS) to IoT so it is proposed a unified RS framework for IoT (data acquisition, data process with rich information, event generator, rule composer for accurate recommendations)
2020	Lye, Cheng, Tan, Hung, Chen [26]	Creating Personalized Recommendations in a Smart Community by Performing User Trajectory Analysis through Social Internet of Things Deployment	IoT & RS Technology, Knowledge-based, Business Process, Performance	AI, Transformation, Inclusive, Governance	Development of a unique personalized recommender engine that is based on the knowledge–desire–intention model and is suitable for service discovery in a smart community
2020	Nawara, Kashef [27]	IoT-based Recommendation Systems—An Overview	IoT & RS Technology	AI, Value, Inclusive, Transformation, Governance Parliaments	RS provide IoT based recommendations enable an efficient decision-making process by suggesting relevant products, resources, and information
2020	Anthony [28]	A case-based reasoning recommender system for sustainable smart city development	RS, Knowledge-based	-	Case Base Recommender system with knowledge-based approach in relation to how the system provides best practice recommendations and retaining of smart city initiatives
2019	Hani Zulkifli Abai, Yahaya, Deraman, Razak Hamdan, Mansor, Yah Jusoh, [11]	Integrating Business Intelligence and Analytics in Managing Public Sector Performance: An Empirical Study	Performance	IoT, RS, Inclusive	Skills, documentation, visualisation, work culture as factors of Business Intelligence Operational Performance Measurement implementation
2019	Mergel, Edelmann, Haug [10]	Defining digital transformation: Results from expert interviews	Digital Transformation, Business Process, Governance, Public Value	IoT, AI, RS	Develop conceptual framework (reasons, processes, outcomes) of digital transformation in the public sector
2019	Pauget, Ahmed Dammak [29]	The implementation of the Internet of Things: What impact on organisations?	IoT	RS, AI, Inclusive, Governance,	3 trends/perspectives (upstream, bureaucratic, participatory) in health care using IoT using 4 approaches (local, organisational, extended, global) where

				Transfor-mation	organisational functions and participatory schemes are combined
2019	Leitner, Stiefmueller [30]	Disruptive Technologies and the Public Sector: The Changing Dynamics of Governance	AI Technology	RS	Key policy and regulatory issues emerge from the disruptive nature of the technologies so government needs to assess and monitor the allocation of roles and responsibilities between public and private sectors and discusses their implications on public governance with legitimacy, accountability, legality, transparency
2019	Chatfield, Reddick [31]	A framework for Internet of Things-enabled smart government: A case of IoT cybersecurity policies and use cases in US federal government	IoT, Governance	RS	The adoption of the IoT technologies, applications, and services is not systemic or uniform across the US federal government agencies, so there is a need for IoT cybersecurity policies, guidelines, and standards, even the attempts in funding and partnering with sub-national governments in promoting the IoT use
2019	Mohammadi, Rahmani, Darwesh, Sahafi [32]	Trust-based recommendation systems in Internet of Things: a systematic literature review	Users, Performance, IoT, RS, Business Process	Governance	Advantages, disadvantages and open issues for 3 IoT layers (physical, network, application) with evidence recognized trust as a flourishing paradigm to ascend the accuracy of recommendation in IoT
2019	Kankanhalli Charalabidis, Mellouli [33]	IoT and AI for Smart Government: A Research Agenda	IoT, Governance	RS	Comprehensive research framework, which includes both IoT and AI elements for smart government transformation and the challenges arisen
2018	Shore, Cleveland, Sanchez [34]	Inclusive workplaces: A review and model	Inclusiveness	IoT, RS, AI Governance, Transfor-mation	Model of inclusion that integrates existing HR literature practices with inclusion experiences to offer greater clarity as part of organisational system
2018	Li, Alqahtani, Solaiman, Perera, Jayaraman,	A Unified Knowledge Representation and Context-aware Recommender System in Internet of Things	RS, IoT, Knowledge	AI, Value, Governance	Context-Aware recommendation system to facilitate incremental knowledge

	Benatallah, Ranjan [35]				acquisition and declarative context driven knowledge recommendation
2018	Androutsopoulou, Karacapilidis, Loukis, Charalabidis [36]	Transforming the communication between citizens and government through AI-guided chatbots	Users, Governance	-	Develop a new digital channel of communication between citizens and government making use of appropriately structured and semantically annotated data
2018	Felfernig, Polat-Erdeniz, Reiterer, Atas, Tran, Azzoni, Kiraly, Dolui [37]	An overview of recommender systems in the internet of things	Users, IoT, RS	Inclusive, Governance, Transformation	New recommendation techniques on the basis of real-world IoT scenarios
2016	Campos, Miranda, Rodrigues de Assis [38]	Initiatives of Knowledge Management in Brazilian Chamber of Deputies	Knowledge Management, Parliament	Inclusive, IoT, RS, Transformation	Lack integrated knowledge management techniques and models, due to diversity of people involved in the internal processes and the discontinuity of plans
2015	Brous, Janssen [39]	Advancing e-Government Using the Internet of Things: A Systematic Review of Benefits	Governance, IoT, Knowledge, Performance, Operational Process	RS, Transformation	IoT has a variety of expected political, strategic, tactical and operational benefits which implies that IoT enables effective knowledge management, sharing and collaboration between domains and divisions at all levels of the organisation, as well as between government and citizens
2009	van Buuren [40]	Knowledge for Governance, Governance of Knowledge: Inclusive Knowledge Management in Collaborative Governance Processes	Users, Governance Process, Knowledge Management, Inclusiveness, Public Value	IoT, RS, AI, Transformation	Inclusion of various ways of knowing (WOK) with knowledge components for a success of collaborative governance process is a matter of conscious strategies and it is the result of an emergent interaction process between stakeholders, experts, and officials within various WOKs as an emergent, interactive, and mainly a self-organizing process between them

From the analysis of Table 4 and the assessment of the remaining 18 research papers, further to the core 30 holistic research papers, the following section presents the inclusive disruptive technologies and the application of a user-centric approach and their inclusiveness in organisations such as parliaments.

4. Inclusive Disruptive Technologies

IoT, Machine Learning (ML), AI, and Big Data are the main (foundation) novel technologies of Industry 4.0 and drivers for the sufficient management of modern organisations and enterprises, transforming them in the evolving complex digital scene [19]. On the other hand, such technologies (e.g., ML, Blockchain, AI, Luxembourg City, Luxembourg) could be paired with democratic governance principles such as openness, transparency, fairness, accountability, user-friendly trustworthy public services, citizen engagement and political participation [1].

Consequently, disruptive digital technologies such as AI, ML, Big Data, Blockchain, and IoT play a significant role in public organisations and, more specifically, in the policy-making process, having a more responsive, and inclusive role, as the technology adoption cycle needs public consensus [30], where a lot of users, policy makers, and stakeholders are involved in these policy processes. In their review, Shore et al. [34] presented a model for inclusive organisations that suits a complex world in a changing environment, with workforce diversity. That is why van Bueren [40] proposed the inclusion of different ways of knowing for a collaborative governance, where all processes are incorporated in an inclusive knowledge management model. In a knowledge-based economy, there is a need of the adoption of use of inclusion technologies with suitable platforms and tools such as IoT, Big Data and Cloud Computing that affect a lot of citizens and support economic development, as part of Industry 4.0, that will create additional dynamic development opportunities increasing the level of citizen inclusion [21].

A sustainable development example for smart governance in a local level, integrates case-based reasoning (CBR), utilising the experiences and the knowledge from previous cases to apply a knowledge-based system that uses artificial intelligence (AI) techniques to develop a recommender system (RS) for smart city planning as part of a knowledge management implication ensuring citizen involvement, participation-enhancing advanced public services based on disruptive technologies such as RS, IT and AI [28].

The digital emerging technologies called 'disruptive', such as AI, IoT, robotics, smart sensors, 3D-printing, Big Data analytics, Virtual and Augmented Reality (VR, AR) and many more presented above, that create interactions between technology and society provoke techno-social disruptions [20]. Moreover, disruptive technologies such as AI, ML, IoT, Big Data, VR, AR, gamification and simulation alter the way public services operate; so there is a set of training needs for their use in the public sector by respective stakeholders, users, decision/policy makers [8], in correlation with the timely selection of suitable technologies, to make appropriate changes in organisational culture and structure, mitigating the risks of their adoption, being compatible with the public interest and the common good [30].

4.1. Internet of Things

IoT is a technology that could transform economies and promote public good, economic development and social well-being in correlation with technology evolution and generate economic value [41]. IoT technologies allow for the connection, communication, data exchange of internet-enabled miscellaneous devices [25] and objects, with standardised communication protocols [42], creating a remotely visible world, where people, process and technology are interconnected, enabling the intercommunication of devices and 'smart' objects [31], and remote monitoring and manipulation [43]. This can be achieved by creating a digital platform that sustains rich data sources, incorporating the physical world with virtual spaces and real things are treated as web resources [25], as part of cyberphysical systems such as a smart ecosystem [19], with valuable insights for the

organisations that adopt this emerging technology. The public organisations could also benefit from using IoT through the adoption of these collaborative digital platforms, capable of delivering policies and services of public interest and public value [31]. To sum up, IoT can be seen as the synthesis of the three main domains *Things*, *Internet*, and *Semantics* [37], where IoT is a self-organised infrastructure of virtual 'things' which seamlessly interact with their neighbour nodes in a dynamic manner [32].

The recent literature on IoT has moved the orientation from objects to human computer interactions, correlating systems' technical characteristics to the relational ones, differentiating the human networks to supporting technologies. Their impact on the organisational context, however, has not been analysed thoroughly. It is observed that IoT increases the horizontal organisational participation and (internal and external) stakeholder involvement and binding [29]. The extensive use of IoT and related digital technologies that are embedded in the real world, is closely related with big open data collection and data adaptation to several intelligent systems and devices with collaborative schemes suitable for several users, supporting them to achieve the organisational operational goals [24].

IoT is a major disruptive digital technology with innovative characteristics applied in different industries and business sectors, also aiming to optimise business process with a holistic point of view, transform business operations, and create structural organisational transformation changes [4], transforming the way the users operate [42], work, connect and communicate in complex organisational systems [31]. As the organisations are more dynamic and their organisational structures involves more and more into IoT environments using several devices beyond the standard social environment, they need intelligent and automated user-friendly approaches for their users, and especially the decision-makers that require support in their decisions with the appropriate and adequate knowledge provided by the analysis of information and data available through IoT networks [44].

On top of that, the classic triangle of data–information–knowledge is creating intelligent societies with informational values based on a hybrid biotechnological system [45]. So, there is a need to interconnect, integrate and homogenise the real world with the digital one in a way in which technologies, such as the IoT, utilise unified models incorporating heterogeneous objects, services, and tools, but traditional RS fail to exploit the ever-growing, dynamic, and heterogeneous IoT data [25], as user knowledge plays vital role for them. As Lye et al. [26] noted, IoT applications are trying to solve specific problems and usually do not share and use data from other IoT services to generate recommendations, so there is a need to use Social IoT with heterogenous communicating devices based on common user interests, characteristics, and preferences, by referring to the data accessibility in each object profile.

The aim of the IoT is the information exchange and update and, consequently, achieving the desirable better performance for the whole system [43], based mostly on user preferences and behaviours. For this reason, according to Forouzandeh et al. [46], the three key factors include the user, the object, and the service, as well as the relationship (e.g., similarities) between them, that describe the user information, preference, and behaviour.

IoT provides intelligent information to the user, engaging citizens in the policy making process, enhancing governmental transparency with more efficient regulatory enforcement, improving the efficiency, effectiveness, and flexibility of governmental services in all levels (political, tactical, operational) with reduced cost [39]. IoT devices collect different types of datasets, sharing them with public, empowering the citizens participation in policy making [33]. Several governments are also actively engaging in projects based on the IoT [43], even though there is a lack of IoT adoption in US governmental agencies in the last decade [47].

There are a lot of challenges for the IoT technology adoption in several levels (geographical, organisational, contextual, and economical) using a variety of smart objects and services, especially in meta-governance prospects [48]. The adoption of these technologies could diminish social and economic inequalities, even though unbalanced access to digital technologies, such as the IoT, generate social and economic value in key public sectors, such

as in education and in healthcare [41]. As a real-life example, IoT is a significant technology enactor for helping the elderly and disabled to live a better life, with self-sufficiency [37].

Saha et al. [43] noted the necessity to really thrive in vendors and customers embracing open standards that improve device monitoring and management, big data information gathering and analytics, and overall network communications. IoT devices interact with the physical environment, sensing communicating, processing, analysing, and acting in complex systems [31]. According to Blackstock and Lea [49], there is a need for seamless integration of the physical world with the digital world in the IoT, in an interoperable way. It is, therefore, essential that all the data and services provided by these devices are defined in a homogeneous way and seamless manner [35].

There are several challenges of IoT adoption that could unlock the potential creation of a digital government, creating a smart and data-driven government with the capability to offer policies and services with enhanced public interest and public value in several dynamic public domains [31]. Chatfield et al. [31] proposed a framework for smart governance performance-developing IoT capabilities, based on IoT security policy and digital technology policy, that support and promote governmental digital transformation.

The use of real-time IoT data and analytics create IoT-enabled dynamic—sometimes entrepreneurial—capabilities in governments developing and deploying citizen-centric services with several competencies, in a collaborative environment with innovative coordinated actions [31].

4.2. Recommender Systems

There are several types of RS that could be divided into two major groups, including content-based filtering and collaborative filtering [46], with the filtering system based on user behaviour and past preferences, where their similarity plays a significant role, so interests and users with similar profiles have same preferences when they choose the most suitable services, but also to knowledge-based, demographic-based, hybrid [50] and group recommendations [37]. RS have several utilities and functionalities to handle data, such as addressed domain and knowledge used to identify patterns in huge datasets [28], location movements, users' preferences, items' properties, and users' ratings, providing as many accurate recommendations as possible to users [32,51].

This knowledge-based approach may enable a CBR system to use tacit knowledge from previous similar problems/issues and cases [52] and provide suggestions and solutions on reusing the knowledge and adapting it so the recommendations, based mostly on users' preferences, are meaningful [28].

4.3. Artificial Intelligence

AI and ML are growing disruptive technologies that also pair well with Natural Language Processing (NLP) as a natural interface between human and device [37]. On the other hand, IoT could be combined with AI and ML, using advanced data analytic capabilities and tools [31]. The IoT devices may use the knowledge derived from the data provided using AI techniques, data analytics, and advanced algorithms, so that governmental agencies could provide added value to their public services to citizens, by optimising the IoT use in a smart government environment [33], where technologies such as IoT and AI could improve governmental efficiency and, consequently, the quality of life of citizens [53].

Public organisations cannot directly adopt digital transformation strategies from the private sector, since the latter give emphasis to AI plans for economic gain, while the public sector aims to maximise public value, instead [54]. Industry 4.0 applications gain added capabilities (faster, safer, better) with the use of AI, IoT, and ML, resulting in inclusive organisational changes triggered by the digital disruption, when the organisation is transformed at all management and production levels with intelligent decisions and Big Data use [19].

There are several challenges of AI use in governmental agencies, such as transparency in decision-making, trustworthiness, accountability, and black-box systems. There is

a need to focus on AI implications for public governance, especially with the utilisation of AI to automate the identification and classification of open data governmental portals, on the enhancement of AI into public policy cycles, and on improvement of user experience with governmental services, provided mostly by AI-based self-service technology [23]. Androutsopoulou et al. [36] proposed a novel approach and architecture with a platform to transform the way of communication between citizens and governmental agencies through AI-guided chatbots, developing a knowledge base with multiple data (legislative, governmental, and operational) to support complexity, ambiguity, and uncertainty in interactions, due to lack of richness of governmental digital communication channels.

4.4. IoT and Recommender Systems

The dynamic IoT features and their emerging technology nature create a challenge for the design of the appropriate RS for them, so different solutions, frameworks and models have been proposed, where cognitive systems have the potential to be the most suitable approach, learning from past user experiences, to improve the user decisions based on recommendations [55].

There is also a need to have a trust-based recommendation model that guarantees the security, authentication, authorization, and confidentiality of connected things and offers worthwhile information to the users via trust of the recommendations' accuracy in IoT, measured with the user belief and willingness, based on its previous competence and parameters such as honesty, competence, security, reliability, dependability, and timeliness [32].

Recommendation functionalities and approaches tailored to user preferences are used in the IoT domain [27]. They focus on recommending the most relevant items to users, enhancing their experience, by considering any additional contextual information, which is useful in most IoT cases [37].

IoT uses data collected from a multitude of applications, to enhance the outcome of RS with decision-making processes in various application domains creating data sets suitable for RS that provide suggestions to users and are compatible with the operational goals of the organisation [27]. So, the IoT uses RS to optimize mostly the IoT user preferences and behaviours to analyse knowledge from data and devices [56].

The Social Internet of Things (SIoT) builds a profile of objects that have direct relationship with social networks and circles based on IoT application data that can be exchanged within the SIoT network. SIoT is also accessible to other IoT applications, provides recommendation of reusable services with data collected and analysed among various IoT applications, improving user experience, as IoT services are adapted based on the user needs [57]. This concept of SIoT can be exploited for recommendation services.

Li et al. [35] proposed a unified knowledge-based model for an IoT context-aware RS that captures the knowledge of IoT resource configuration artifacts, using a declarative language, and then implement it in a recommender service on top of a relational data model. Yap et al. [44] have brought to attention that there are unique challenges derived from the IoT and envisioned a conceptual framework for enabling effective recommendation of things of interest for the IoT, involving observations, perceptions, knowledge discovery, and intelligent reasoning.

HamlAbadi et al. [55] proposed a framework for cognitive RS, suitable for IoT, where the recommender engine observes the sensors used in IoT devices, with the goal to determine the objectives to be optimised and finally to predict and solve any problem or issue, using the information acquired and processed.

Due to the heterogeneity of the IoT environment, trust computing mechanisms for RS still require more investigation [32]. There are several layers for IoT data processing for a productive recommendation analysis to the end-user [25], so this research proposes the use of RS in IoT-based systems, as they proactively deliver things of interest to the users, based on their preferences.

5. User-Centric Approaches and Inclusiveness in Parliaments

Considering human activities in the recent years, a user-centric approach has been adopted in smart and intelligent environments, capable of detecting user actions, motions, and gestures so that the services required can be provided automatically with safety [58]. For this reason, new recommendation techniques based on real-world IoT scenarios have been developed [37].

Context-aware RS could be utilised as user preferences and behaviour influenced by extremal factors. They are closely related with IoT observations, so sequential recommendations could be introduced in IoT scenarios with a generalised user behaviour model, which directly use the above mentioned learned behaviour model and suggest the most likely actions the user will take next [59]. Inclusive technologies using IoT devices (mobile, sensors) and data mining techniques can help to build new models of socio-economic growth and development, based mainly on frequency analysis to measure position trajectories of the 'humanitarian sensor' [60].

Technology assessment in an inclusive way has been introduced in parliaments during the last decades, where technologies and innovative actions, in organisations such as parliaments, modelled their activities in combination with technology at the interplay among four spheres: parliament, government, science and technology, and society, so the technologies used act as mediators among the actors, stakeholders, users involved and the knowledge that is produced [61]. The methods, tools and practices used for the analysis, interaction and communication of the users (MPs, officials, decision-makers, experts, stakeholders, citizens) involved in these spheres have a wide spectrum and approaches from desk research, meetings, focus groups, and interviews [62]. Ganzevles et al. [61] pointed out the need to connect the different spheres and their user engagement distinctions, so that the different types of institutional models of Parliamentary Technological Assessment may engage actors from all societal spheres. The growing complexity of public policy is a direct result of innovation actions and is a challenge that requires technologies like AI in various fields of human activities within the parliament, increasing the use of digital tools for civic participation in parliamentary procedures, and exploring inclusion measures [63].

The use of disruptive technologies in complex organisations such as parliaments need to be included in a broader digital transformation framework, with a tangible digital strategy, where the users', stakeholders', decision/policy makers' needs, and the emerging technology trends match with the societal needs for accountability of policy actions [22]. Moreover, in this research paper, the adoption of emerging technologies, such as IoT, RS, and AI, has been presented using a ParlTech hype cycle, having a significant high score for their usefulness, where their maturity and applicability had rather lower scores.

The use of ML to build content-based RS for documents (e.g., bills, questions) for Members of Parliament (MPs) is essential but, as many researchers reported, disruptive technologies such as content-based RS, built using either information retrieval-based methods [64] or ML algorithms for learning user models [65], have limited application in parliamentary environments [66], since essentially only information retrieval-based methods have been used, thus far.

There are several potential AI tools, fields of application, usage scenarios, and requirements with a disruptive usage, to apply in organisations such as parliaments. However, parliaments build up their own competencies with the respective prototypes and initial solutions so they will have to wait even longer for commercial products in a limited market [17]. Parliaments are trying to use advance legal informatics tools with the use of disruptive technologies and their users and the respective several stakeholders in the policy-making process are being encouraged to adopt these solutions, even though the use of AI-based services requires digital literacy for the algorithm interpretation, where RS in parliaments are used for semantic annotation of regulation rules [18]. AI, especially in the parliamentary environment, constitutes a super-set of technologies and models aimed at

tackling different types of problems, such as to reveal patterns or extract characteristic information out of large amounts of parliamentary data, based on several algorithms [67].

Regarding parliamentary entities, Kullmann [68] had a completely different point of view, with an image of the parliamentary things landscape that reconciles the divergence between *things* that happen in buildings and *things* that unfold in the landscape, providing another perspective as to how parliaments are incorporated as the shapes of things with an architectural point of view.

6. Discussion

This section addresses the set of research questions posed in the beginning of this literature review. The dynamic transformation of democratic policy cycle, using advanced e-governance tools via semantic web disruptive technologies such as IoT, RS, AI and other supportive disruptive technologies (e.g., ML, Big Data, blockchain) is feasible [8] for the delivery of better public services, encouraging citizen trust and participation in policy making processes [1] and the technologies are applicable in parliaments [22].

A lot of types of disruptive technologies are used and adopted with several frameworks [24,31], which include both IoT and AI elements for smart government transformation [33], as AI services in public policy cycle enhance user experience. More specifically, in Table 3, a classification of keywords is shown for the 48 research papers chosen out of 106. In Table 4, 30 research papers are selected with a holistic approach, where 5 keywords (Users, Process, Integration, Knowledge, Performance) are present in all of them. Furthermore, IoT as a disruptive technology has presence in 67% of these papers, while AI is referred to in 73% and RS in 33% of the works. A noticeable characteristic is that for all the RS related research papers, IoT is also present as a keyword. As users play a central/holistic role in all papers (100%), 67% of them also refer to parliaments and governance. Finally, inclusive models can be found in 70% of the works, but only three out of four of them combine with a user-centric inclusive approach.

The implications of the disruptive technologies on public governance create dynamics with legitimacy, accountability, legality, transparency [30] to enable change in culture and behaviour in a society. So, there is a certain impact in how a government can interact with citizens, increasing the users' needs [8], but also ensuring not to provoke uncertainty with a substantial 'degree of social disruptiveness' from the technologies [20].

There are several innovative inclusive organisational models, approaches and frameworks having these digital technologies as main pillars that are suitable for such kinds of organisations [21]. There are several techniques, especially in recent years, for the effective use of these disruptive technologies in organisations such as parliaments [17,18,22,67]. Reference [6] tried to identify the emerging digital vs. human configurations needed (e.g., organisational needs, training, personal skills) to overcome the effects of new technologies, but there is still a lack of research on this subject. Moreover, Mergel et al. [10] could not find out how digital transformation leads to public value, changing the users' relationships, due to complexity of public services. On top of that, the effect and impact of disruptive technologies, such as the IoT, and their long-term consequences that lead to organisational changes, should also be examined [4], as the latter remains scarce [29] due to drawbacks in their effective implementation, especially in e-governance [8]. Leitner and Stiefmueller [30] proposed that a successful and broad consensus among citizens will minimise these effects. There is a need to harness these technologies, especially in organisations such as parliaments, where the use of an ethical framework and collaboration agenda for disruptive technologies is virtually non-existent [17] and the technology parameters will have to be set in the near future [22].

In transforming the communication between citizens and public organisations, there is a need to justify the information capacity, the existing knowledge representation, and available resources [36], using real life scenarios for the adoption of democratic innovations in a user-centred environment [3]. Further research is needed on terms including expert systems, rule-based systems, chatbots, agent-based systems, and algorithms [23].

7. Conclusions and Future Work

This work explored how disruptive technologies can be adopted by public organisations that are traditionally not eager to adopt new technologies and may exhibit high resistance to change. This review provided the opportunity to view IoT, RS, and AI as key technologies for parliament value creation and platforms for digital transformation. These technologies also rely on and support user-centric inclusive approaches with personalisation techniques, which results in extended applicability [69,70]. This paper also identified shortcomings and gaps in the parliamentary transformation process, as well as the opportunity to lay the ground for the definition and adoption of the term 'smart parliament' [71]. There are limitations in our research, as we focus only on parliaments and related public organisations in the policy-making process. Furthermore, our research does not cover all the disruptive technologies. On top of this, there is a need to update previous research [22] assessing the use of these technologies.

The identified limits and risks [4,8,17,20,22,23,29] of the use of disruptive technologies for parliaments and the organisational strategy considerations provided a contextual frame for understanding the requirements for the digital transformation of democratic institutions such as the parliament.

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Abbreviations

Information Communication Technology (ICT), Artificial Intelligence (AI), Internet of Things (IoT) and Recommender Systems (RS), Research Questions (RQ), American Psychology Association (APA), Human Resources (HR), Virtual Reality (VR), Augmented Reality (AR), Semantic Social Network of Things (SSNT), Ways of Knowing (WOK), Machine Learning (ML), Case-based reasoning (CBR), Natural Language Processing (NLP), Social Internet of Things (SIoT), Members of Parliament (MPs), United States (US).

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