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# AI-Enabled Innovation in the Public Sector: a Framework for Digital Governance and Resilience

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**Abstract.** This article aims to contribute to the theoretical debate on the relationships between digital governance and social innovation, and their impact on policy making for creating and capturing value from effective solutions addressing societal challenges. In particular, we question the drivers and challenges specifically considering the growing number of national strategies for innovation driven by artificial intelligence (AI) and the consequent wave of investments. To this end, a framework is presented aiming, on the one hand, to connect key dimensions and value drivers of digital governance for social innovation and complex systems methods for policy making; on the other hand, to position AI national initiatives with regard to welfare state initiatives. The framework is then applied to the analysis of cases of AI-driven innovation initiatives in Europe to assess their impact on social innovation.

**Keywords:** digital governance, social innovation, social value, crowdsourcing, complex systems, Artificial Intelligence

## 1 Introduction

Digitalization is not anymore an emergent phenomenon but the actual shape of everyday life interactions and transactions [1–3]. Compared to the private sector, where businesses have deployed initiatives to change their infrastructure, governance, and business models to create and exploit value from their digital assets, the public sector is still tied up to a consideration of technology as something separated from public sector reform and policy making. Accordingly, it is still preeminent in the public sector the focus on what can be considered the e-government rhetoric legacy, namely the provision of information and communication technology (ICT) enabled services mainly involving the public administration alone and the translation of administrative procedures in digital format. This view is still present in most countries having officially claimed the adoption of an open government stance towards their initiatives: the result is, in the best case, an efficient public administration, yet still neither inclusive nor fully open, in terms of transparency and accountability [4].

Taking these issues into account, this article aims to contribute to the theoretical debate on the relationships between digital governance and social innovation, and their impact on policy making for creating and capturing value [5] from effective solutions addressing societal challenges. In particular, we question the drivers and challenges specifically considering the growing number of national strategies for innovation driven by artificial intelligence (AI) and the consequent wave of investments. To this end, a framework is presented aiming, on the one hand, to connect key dimensions and value drivers of digital governance for social innovation [6, 7] and complex systems methods for policy making, formerly introduced in another framework called i-Frame [8]; on the other hand, the framework aims to position AI national initiatives with regard to welfare state initiatives for an appropriate analysis of their premises and effects. The framework is then applied to the analysis of cases of AI-driven innovation initiatives in Europe.

The article is structured as follows. First, we discuss the related work positioning the proposal and its contribution, also considering the state-of-the-art frameworks and clarifying the difference with regard to, e.g., maturity models. Then, we present the framework starting with the conceptual model that is at its basis. Subsequently, we apply the model to a sample of four AI initiatives associated with welfare state actions or services from one national agency in continental Europe and three municipalities in different Nordic countries. Finally, the paper concludes outlining future research directions and policy implications.

## 2 Related work

The rhetoric on the benefits of information and communication technologies (ICTs) for governments action is now encompassing the debate on the use of artificial intelligence (AI) solutions for innovating public sector services and decision-making [9–11] with a new emphasis on the need for governance of AI and not by AI [9] that resonates the former claims about the governance of ICTs vs. governance by ICTs [7]. Furthermore, although some kind of public value can be gained [12], the switch to social value from co-production [13, 14], by involving citizens and external actors, is still an ongoing challenge for public administrations willing to have a role in social innovation through the appropriate exploitation of the unprecedented amount of data available from information production, inside and outside public sector information systems [15]. This is particularly relevant when thinking about the use of crowdsourcing for deliberation, regulatory reviews, and policy initiatives [16–18], the development of open innovation in the public sector [19] as well as the emergent challenges of using, e.g., machine learning for deciding on welfare issues [20, 21]. Taking these issues into account, especially in the research area of e-government [22] quite a few scholars have commonly engaged in identifying key themes in the state of the art literature to outline research agendas emphasizing both challenges and opportunities of AI. In particular, Medaglia [22] has pointed out those related to decision-making in the public sector “where environmental variables are constantly changing, and pre-programming cannot account for all possible cases”, further questioning the way “policy makers frame and legitimize AI-supported solutions”. Accordingly, the framework proposed in this paper

aims to provide an instrument to support policy-makers facing that question together with a deeper and situated understanding of the impacts of the initiatives that their actions may eventually enforce. However, it is worth noting that for our framework is not a matter of forecasting or predicting what are the future paths traced as maturity or stage models, like the ones that the e-government literature [23–25] have eventually tried to do for the various technology waves in the past, with different outcomes, likewise [26]. On the contrary, with this framework, we aim to consider deeply the intertwining of contextual and individual factors required and often implied by the AI applications in public sector services and initiatives, including the areas suggested by [26] (*technology, public organizations and society, human psychology, politics and public administration*, exception made for history that could be eventually part of future work). Thus, we follow what [26] points out as “the way of the hedgehog” (p 12), resonating the insights by [27], aiming to provide a tool for public managers and policy makers that would prevent the “digital sclerosis” [28] that may be associated with the uptake of AI in the public sector.

### **3 The interpretive framework**

In this paper, we propose a framework that extends to the AI the arguments at the basis of other state of the art proposals [6] used to analyze cases of ICT-enabled innovation of Social Protection Systems. At its basis we have defined a conceptual model that, on the one hand, moves to a general perspective on *social value*; on the other hand, it aims to link government initiatives to the micro level of individuals everyday life and the environment that contain it, eventually also co-created by the interactions with the Internet of things (IoT) and the technology making up the infrastructure of the so-called “smart cities” [29]. In this Section, we first provide a summary of the main constructs and components making up the model shown in Fig. 1.

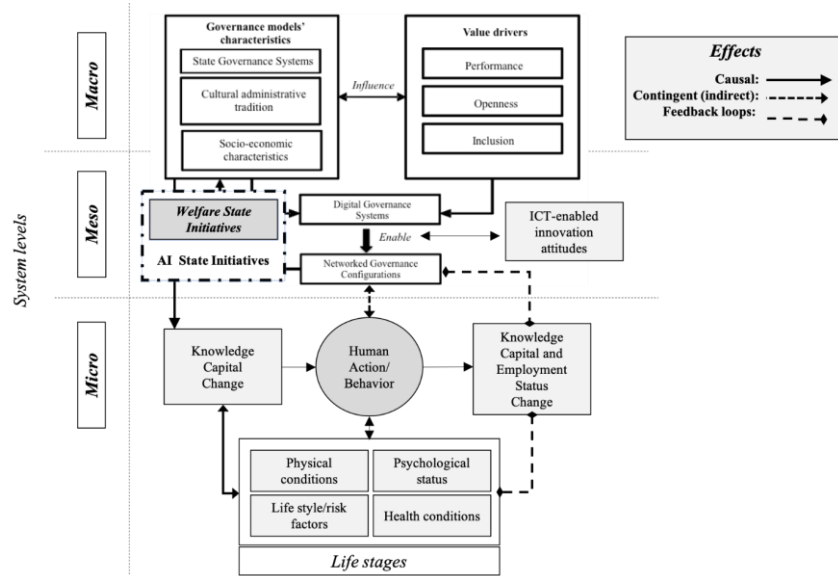
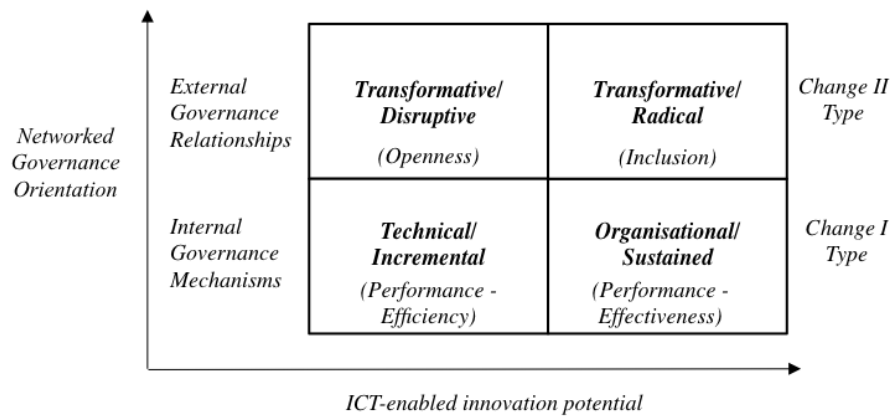


Fig. 1. The conceptual model

The macro and meso components include i) the digital governance model and the ii) typology of ICT-enabled innovation attitudes presented and discussed by [4, 7], to which we refer the reader for the full details about them. As shown in Fig. 1 the conceptual model comprises three key value drivers (*Performance*, *Openness*, and *Inclusion*) as well as their connection with a set of governance model characteristics, i.e., *State governance system*, *Cultural administrative tradition* and *Socio-economic characteristics* of the context of intervention. These elements influence each other and constitute the political, administrative, and socio-economic context embedding the enacted digital systems for e-government and e-governance [30, 31]. Furthermore, these systems mediate the interaction of public administrations with constituencies and the consequent potential outcome of the use of ICTs for their innovation.



**Fig. 2.** Typology of changes for exploiting ICT-enabled innovation potential

It is worth noting that the degree of maturity of those systems (both at IT and government levels [24, 32]) is an input to the AI-and welfare state initiatives and may consequently enable different networked governance configurations related to their characteristics and impact on the micro-level. Those configurations also correspond to the various degrees of *openness* or *inclusion* reached by the public sector as well as the participation of the citizens. Consequently, the different digital governance systems have different impacts on the governance configuration of the stakeholders' networks, which may require or enforce innovation to a given context for certain governance models characteristics. Moreover, those systems and platforms represent the point where *openness*, *generativity*, and specific *affordances* [33] involved in the interactions with citizens lead to a change in the use of ICTs from e-government to "digital" government. As pointed out by [34] "these new digital technologies embrace ICT systems such as virtualization, mobility, and analytical systems and are integrated with back-office ICT", thus moving from a focus on the management of ICT infrastructure to "the interface with or fully on the side of customers" [35] or citizens in the case of public administration. Thus, in what follows we consider AI as another kind of ICT-enabled innovation, having its own characteristics, yet not independent from the ICT capabilities eventually developed for previous configurations of digital governance.

Taking those issues into account, each digital governance configuration corresponds to a type of innovation attitude within the public administration that can be identified for the considered domain of intervention, required to enable that governance configuration and/or enabled by that specific innovation (see Fig. 2).

According to the typology, ICT-enabled innovation can produce changes in governance processes in four ways (and a consequent set of innovation types or attitudes): *Technical/Incremental* change; *Organizational/Sustained* change; *Transformative/Disruptive* change; *Transformative/Radical* change. As a consequence of the above discussion, it is worth emphasizing here that the framework assumes as a key argument that

ICT-enabled innovation cannot be decoupled from a public administration reform [4, 7, 36], thus encompassing public services and their impact on welfare [see also, 37]. The same can be applied at the meso level to the evolution of the government interests toward the adoption of AI solutions through dedicated innovation initiatives, which eventually move from simply accompanying or supporting welfare systems initiatives to actually substitute them (dotted lines in Fig. 1) or to leverage smart cities and digital initiatives to control and contain the spreading of epidemics among the population [38, 39].

Accordingly, the model also considers the structural connection [40] between the above-discussed elements (*governance models, digital systems, networked configurations*), the agency implied by welfare state initiatives (see Fig. 1) as discussed by [6] (namely: social protection, social investment, social innovation), and the impact on individuals classified here in terms of life stage (e.g., childhood, adulthood, etc.). Innovation, advance in digital systems (e.g., through AI), and networked governance may also enable bottom-up welfare state initiatives that may be produced and promoted by social enterprises/entrepreneurs, non-governmental organizations, etc. Also, it is worth noting that the described dynamics can lead to a change, e.g., in the government model's characteristics (see Fig. 1) that, on the one hand, enable or constraint the AI-welfare initiatives; on the other hand, they may require further reforms due to the emerging alignment or misalignment related to their current impact on each life stage. The same can be said for "value drivers" (see Fig. 1), which require to fit both the AI – welfare state initiatives and the current politics in place at micro-level, eventually leading to a tension between values that should be recursively solved by the government (either a central or local one).

Moreover, Table 1 provides an analytic view on the connection between the above elements, the types of resilience (*absorptive, adaptive, transformative* [6]), and value drivers per type of ICT-enabled innovation. Notwithstanding the effort by governments and institutions acting, e.g., at the European Union level [41], current initiatives are still mainly focused on performance as a value driver and a type of innovation that can be associated with social protection and early social innovation initiatives. These latter are

**Table 1.** Welfare state initiatives, type of resilience and value driver per type of ICT-enabled innovation

Welfare State initiative	Type of resilience	Value driver	Networked governance orientation	ICT-enabled innovation
Social protection	Absorptive	Performance (Efficiency)	Internal governance relationship	Technical/ Incremental
Social investment	Adaptive	Performance (Effectiveness)		Organizational/ Sustained
Social innovation	Transformative	Openness	External governance relationship	Transformative/ Disruptive
		Inclusion		Transformative/ Radical

not aligned with the need for knowledge capital change required to fully exploit the effects of digitalization and AI, thus, risking to exclude people without personal means and capabilities, such as, e.g., workers raised within the framework of social protection typical of the industrial production model of the second half of the 20<sup>th</sup> century, and currently facing the challenges of digitalized social services often without adequate skills and digital literacy [42–44].

## 4 Cases

In this Section, we are going to apply the framework that we have above discussed to a sample of cases of AI initiatives associated with welfare state actions or services, some of them especially considering their administrative processes. To this end, we have considered one national agency in continental Europe and three municipalities in different Nordic countries. We briefly present them on the basis of the secondary data and discussion by [45]

In 2014, Kind & Gezin (Child and Family) [46], a Flemish public agency in Belgium for support and advice on children's well-being has developed a predictive AI system to identify day-care services in need of further inspection to keep their quality high to improve the wellbeing of children. It is worth noting here that the agency does the inspections in collaboration with the regional Health Care Inspection of the Department of Welfare, Public Health and Family.

Looking now at the Nordic countries, since 2016 the municipality of Trelleborg has used AI for automated-decision making in various social assistance pronouncements [see also 47]. In particular, it was an early adopter of Robotic Process Automation (RPA) for the management of applications for homecare, sickness benefits, unemployment benefits, and taxes. In the current diffused landscape of practices for testing future societies [48], the municipality of Espoo started in 2015 an AI experiment, funded also by the Six City Strategy, on the social and health data from all the Espoo residents to carry out a data-based segmentation aiming to predict the service paths of each individual. As for the future development of the experiment, the plans include the use of data of private health care services and the Kela database [49] with statistics on basic social protection in Finland.

Finally, the municipality of Gladsaxe in Denmark has developed an AI system in 2018 to tackle ‘parallel societies’ in less developed and vulnerable areas. The project was part of a preventive risk assessment program for the automatic recognition of children in situations that eventually may lead to a disadvantaged condition. The system employed ~200 risk indicators from several data sources on health, social, employment, and education to assess the families’ risk of social vulnerability. Then, children identified as at risk of abuse could be subject to intervention, eventually resulting in the forced removal from their original family.



**Table 2.** AI and welfare state initiatives, drivers, type of resilience, governance, innovation and changes for impact at individual level

AI Initiative	Organization	Welfare State initiative	Type of resilience	Value driver	Networked governance orientation	ICT-enabled innovation	Type of Change	Individual conditions / life stage
AI to predict day-care services inspection	Flemish Agency for Child and Family (Belgium)	Social protection	Absorptive	Performance (Effectiveness)	Internal governance relationship	Organizational/Sustained	Knowledge capital	Health (Childhood)
Robotic Process Automation (RPA) to handle welfare services applications and payments	Trelleborg, (Sweden)	Social protection	Absorptive	Performance (Effectiveness)	Internal governance relationship	Technical/Incremental	Knowledge capital and employment status	Physical / Psychological (Adulthood)
AI prediction and clustering for service paths	Municipality of Espoo (Finland)	Social investment	Adaptive	Performance (Effectiveness)	Internal governance relationship	Organizational/Sustained	Knowledge capital and employment status	Health/ Physical / Psychological (Adulthood)
AI for 'parallel societies'	Municipality of Gladsaxe (Denmark)	Social innovation	Transformative	Inclusion	External governance relationship	Transformative/Radical	Knowledge capital	Life style / Risk factors (Childhood)

Looking now at Table 2, what we observe is that most of the AI initiatives considered in our sample are oriented toward the better performance of public services mainly focused on social protection and social investment. At first, only the case of Denmark could be classified as somewhat related to social innovation with a kind of “inclusion” as value driver; although here and in the other cases there is a potential risk of enforcement of “algocracy”, not in line with democratic values [50]. Also, most of the initiatives are guided by internal governance needs, involving mainly administrations or agencies, thus raising the ethical concerns AI such as trust by citizens (rather better considered by an external governance perspective), data security and privacy, not mentioning the bias potentially related to social protection and investment decisions [20]. It is worth noting, that from the initiatives seem also to emerge a specific attention to individual health and childhood as a life stage. Considering now the type of innovation paths, it emerges a general orientation toward an “organizational/sustained” type, also in cases such as the one of Trelleborg where the priority seems for a “technical/incremental” one, requiring a change in knowledge capital and employment status for public employees. Finally, the Danish experience results in a “transformative/radical” path toward social innovation, although with the above-mentioned risks of “algocracy” and a consequent normative perspective on the meaning of “inclusion”.

## 5 Conclusion and future work

In this paper we have proposed a framework to connect, on the one hand, macro and meso elements enacting digital systems (in our case AI initiatives) and their related networked governance configurations; on the other hand, the framework aims to provide a view on how the choices made at macro and meso levels (instantiated in the welfare state and AI initiatives) impact (constraints/enable) knowledge capital and employment status change. Those choices frame the action/behavior of individuals (citizens) at micro level as well as their physical/health conditions, psychological status, and lifestyle/risk factors along the different stages of their life (see the bottom part of Fig. 1). Then, it is worth noting that the action/behavior of individuals (citizens) in terms of participation is both bounded and enacted by the changes to networked governance configurations and digital governance systems. As a consequence, different scenarios may require or enforce a specific innovation type of change in a given context as well as certain governance models characteristics (see left-hand side of Fig. 1). Thus, the framework discussed in this article may provide a richer and holistic/systemic representation for understanding which policies can be designed for appropriate governance of (AI as part of) digital innovation initiatives and reforms in the public sector suitable to enable a sustainable and resilient social innovation. In future work we are going to empirically apply the framework to further ongoing initiatives of AI innovation in Europe, thus complementing the limited testing set of cases discussed in this article; the goal is to deeply understand their implication for the welfare state and social innovation as well as to have a larger map of the current state of the art initiatives, including their potential effects and impact.

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## Disclaimer

The views expressed in this paper are purely those of the authors and may not in any circumstances be regarded as stating an official position of the European Commission.

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