



Communication between Citizens and Public Organizations as a means of Public Value Co-creation.

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ABSTRACT

ICT mediated online or offline communication can lead to public value co-creation if citizens' input is taken into account by the government to improve its services. Since existing studies have looked into the co-creation process holistically, there are calls for an in-depth understanding of the role of communication whilst offering conceptual clarity to the co-creation process. This study aims to fill these gaps by employing the grounded theory literature research, to analyse and define co-creation in terms of its properties and relationships to communication and public value concepts. The subsequent conceptual framework integrates all the identified concepts to represent co-creation as the functional relationship between the adjustable communication concepts and the public value responses, which are conceptualized as independent and dependent variables respectively. The enablers and constraints emerged through the analysis are aligned with the co-creation properties and correspond to the initial impeding or facilitating conditions of the co-creation process. The results provide a concise and clear, structured representation of the co-creation process in terms of its interacting concepts and relate the co-created public values to crisp communication properties facilitating the validation and refinement of the derived framework by further empirical research. Amidst contemporary socioeconomic challenges, this study could be used to optimize the co-creative potential of public services in terms of existing enabling - disabling conditions and public value requirements.

CCS CONCEPTS

• Human Centered computing; • Social and professional topics;

KEYWORDS

Co-creation, Communication, Public value, Collaborative intelligence

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1 INTRODUCTION

The co-creation process in the public sector, is regarded as a solution to today's multi-faceted socioeconomic challenges as it makes use of collective dynamics through open collaboration and the exchange of information, in order to align public policy with citizens needs and expectations. In this context, according to [27], co-creation is related to public value as it entails citizens collective contributions in the provision of public services. Moreover, all the co-creation theories acknowledge the role of communication mediated by ICT as an enabler of stakeholder interactions. Specifically, Public service dominant logic (PSDL) considers co-creation as the joint contribution of involved stakeholders [42], while the Service Science (SS) perspective regards the interacting entities as social service ecosystems [23]. Public Service Logic (PSL) focuses on the interacting resources between provider and citizens service logic entities [15, 29] and the Social Constructionist (SC) approach elaborates on the characteristics of social interactions to fine-tune output public value with citizens' expectations [34].

Recent studies have highlighted the role of communication in the co-creation of public value process. Specifically, [39, 40] have looked into citizens' direct feedback concerning public organisations in Rwanda and Sri-Lanka and have suggested that citizens multi-angled contribution to the evaluation of public services is valuable. To achieve co-creation and improve public services, public organizations have gradually employed ways to monitor, crowd-source and analyse citizens' input. For example, the city of Chicago has analysed citizen sourced data to develop and test a working predictive critical food safety violations model, in order to deliver proactive services to the citizens by preventing food born illness outbreaks [25]. Social media monitoring has been suggested to provide real time situational information in crisis events [28], however it is often associated with the lack of effective communication strategies [13, 16, 24]. To this front [16], have conducted a field study to test sensors as means to facilitate citizen sourcing towards data-driven decision making.

There are observed conceptual inconsistencies concerning co-creation as it is often conceptualized in continuum or interchangeably with the similar term co-production [12, 16]. Yet scholars stress the need to demarcate the two conceptually related terms [29, 45], while addressing the role of communication within the co-creation process [10, 17]. In addition, existing research has focused on the holistic overview of the co-creation process, developing a theoretical framework on the basis of actors, processes and content [40, 41]. However, the lack of specificity can hamper understanding of the communication as a factor which influences the co-creation

process and the interrelations between the co-creation elements. Therefore, there is limited research on the patterns, regularities and relationships between communication and co-creation. This study aims to address this research gap by revisiting literature in order to develop a conceptual framework that relates co-creation to communication and public value concepts, define them in terms of their properties and describes their relationships and functions.

2 THEORETICAL BACKGROUND – CO-CREATION OF PUBLIC VALUE THEORY

Essentially, co-creation implies the involvement of different actors working together as active operant resources to determine and create value [15, 43]. Although the co-creation concept was developed within the marketing field, its service dominant logic principles can also relate to the public administration. Hence, according to PSDL, the public services constitute the prime unit of exchange and the tangible operand resources are considered transmitters of the knowledge, skills or services used by citizens in the process of value creation [42, 43]. Hence, public value is co-created by the joint contribution of the public service providers and citizens. Based on this notion, the SS approach considers the formation of different dynamic service ecosystems consisting of people, technology and organizations whose interactions co-create value by integrating their resources [23]. The PSL is based on the principles of PSDL but perceives citizens and government as different service logic entities combining each other's value propositions and claims with their own resources. Co-creation is achieved through the mutual interactions between these service logic entities so as to equate the value-in-use- to the value propositions [15]. The SC considers the co-creation of value in social context which emerges naturally through the interactions of the different stakeholders in order to build relational social systems [34].

2.1 Co-creation – Co-production

The notion of public value as coined by [27], also relates to the concept of co-production which is often used interchangeably with co-creation in the relevant literature. Although the terms present basic similarity in the citizen involvement required to achieve the output public value, scholars have pointed out several differences. Co-production is reportedly a linear logic process owing to the dominant role of the government [29], as opposed to the dynamic and unpredictable co-creation process [9, 35]. Consequently, co-production is associated with the GDL and the implementation stage of public services. Moreover, the citizens' involvement in co-production has been perceived by scholars as unavoidable and a conscious add-on of the service delivery process whereas ambiguity exists over the conceptual position of service evaluation.

On the other hand, co-creation falls under the service dominant logic conceptual framework which stands for the improvement and development of public services on the basis of citizens' needs and expectations, thus enhancing democracy and outcome public values. In this vein, co-creation assumes reconfiguration of the traditional top-down hierarchy as it entails citizens' value propositions and resource integration considering citizens as active partners rather than passive service receivers. In fact, literature reports that co-creation involves the conception of public services at a strategic

level implying that the citizens are the initiators and co-designers of the public services whereas the government's role is to provide administrative and expert support on the process [4, 44].

2.2 Communication and the use of ICT

Following the SDL paradigm, stakeholder interactions are regarded as operant resources in the co-creation process which according to [43] produce effects enabling the amplification of value by creating additional operant resources. ICT and innovative smart technologies are considered operand resources which facilitate the exchange of operant resources and the co-creation of public value.

Government communication functions range from information dissemination to citizen consultation, to finally reach citizen active participation and engagement in public discourse. This variation of communication functions corresponds to the gradual increase of the level of citizens interactions and the e-government evolution.

In this context, one-way communication involves the creation of open government portals and websites to increase citizens' awareness, while two-way communication implies bilateral communication and web2.0 services focused on persuading the citizens to accept the government policies and assuming the gradual horizontal and vertical integration of government institutions. Multilateral communication flow builds on the organisational integration to promote democratic processes towards citizens' active participation in decision making.

Digital platforms can encourage highest levels of government or citizen led communication opting for multilateral discussions or stakeholder competition according to their type and degree of openness. In this context, public organisations can use popular commercial platforms (Facebook, Twitter) to combine social and business affordances while encouraging participation diversity which is seen as an important factor for comprehensive problem solving. Conversely, government-initiated platforms can be employed to promote focused public discourse and co-created service provision.

Stakeholders' interactions can be encouraged and analysed by means of various support tools and platform extensions developed with natural language processing and artificial intelligence technology. For example, community trends as captured by sentiment analysis tools can be taken into account in policy planning and decision making, thus promoting transparency.

3 RESEARCH METHODOLOGY

The grounded theory was the selected research strategy as it enables the inductive generation of theory providing insights on areas in need of further scholarly attention. Three fundamental principles guide this research as suggested by [14]: Emergence of theory from contextual data alienated from any predetermined ideas of the researcher, constant comparison of the emerged knowledge to reveal concepts (including core-concepts) their properties and relationships, and theoretical sampling of emerged data directing the exploration and analysis of new data until the point of saturation where no additional concepts can emerge. Grounded theory was informed by literature review for data collection by means of five systematic and iterative stages as suggested by [46] in order ensure rigour in concept-centric data analysis and knowledge building. The method was performed as follows: **Definition stage** where

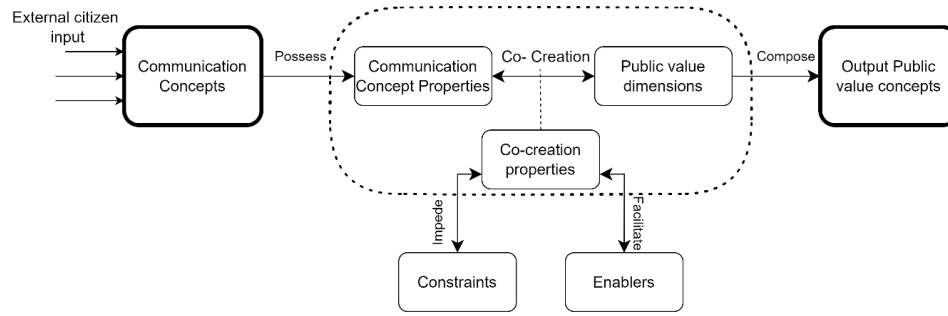


Figure 1: Ontology of the co-creation process

criteria were set according to the scope of the study. The sampling criteria included all types of English language peer reviewed articles (conference, journal, book chapters). Preference criterion was set for the most recent and relevant publications ranging from 2015. The starting year was chosen to capture the application of the formative stages of e-government evolution. The literature sample was sourced from the fields of Information Systems, E-government, Public administration, Public management as these fields relate to the scope of the study. Data sources criteria included two electronic data bases namely, Scopus and Google Scholar as their wide accessibility allows replicable search results. The following search queries were used to align the breadth and relevancy of the search to the scope of the study.

- (“Public value” OR “e-government”) AND “co-creation” AND (“communication” OR “interaction”)
- (“Public value co-creation”) AND “e-government” AND (“social media”)
- (“Public value” AND “communication channels”) AND (“co-creation”) AND (“e-government” OR “social media”)

Search The articles were considered in terms of containing the search terms in their title or abstract. The first two queries returned a limited amount of hits, so the third query was put forward to widen the search while adjusting its relevancy. In total, the three search queries yielded 317 unrefined hits. **Selection stage** Literature search results were cleaned from duplicates and inaccessible papers. Selection of the final 31 papers was based on the relevancy of the article contents to the aim and research questions of the study. Different types of research were included in the literature sample to enable evidenced understanding and multi-angled conceptual interrelations. **Analyse** Open coding involved the generation of all the concepts used in the study. Axial coding involved the identification of concept relationships and further concept categorization by identifying their properties. Selective coding involved concept refinement into two core-concepts “communication” and “public values”, their overlapping conceptual property (co-creation) and the identification of enablers and constraints further categorized in terms of their nature (technical- social). A qualitative software (Atlas.ti) was used for the coding analysis, assisting in the elimination of conceptual inconsistencies by means of tabular and visual coding maps. Finally, the theoretical framework emerged during this stage by assembling all concepts into a diagram that explains co-creation process. **Presentation**, which involves the display of

the key findings and recommendations based on the theoretical sorting of the results.

4 RESULTS

Analysis of the 31 literature papers resulted in an informal ontological model which indicates the main co-creation features as depicted in figure 1. The rounded rectangles represent the elicited concepts, and the highlighted ones represent identified the core-concepts. The arrow lines represent the relationships which emerged through the relational statements found in the literature.

The communication concepts and the public value concepts were identified as the co-creation core-concepts due to their indispensable input and output roles in the co-creation process. They are described in sections 4.1 and 4.2 respectively. The communication concepts possess intrinsic properties described in table 2, while the public value concepts are composite concepts consisting of combinations of public value dimensions summarized in table 4. The manifestations of mutual co-creation properties between specific communication concepts and public value dimensions indicate interactions which determine the co-creation process mechanism. These co-creation links are summarized in section 4.5 in respect to the input communication concepts and output public values. The dashed line marks the interactions within the internal co-creation process context. The enablers and constraints represent the existing state and capabilities of the co-creation process in terms of their interactions with its properties and are described in section 4.6. This ontology model was converted into a UML conceptual framework which is explained in detail in section 4.4.

4.1 Communication concepts

Communication concepts (core-concept): are the higher order entities identified through selective sorting which represent the means of getting involved in co-creation as instantiated by their different properties.

Further details of the communication concept properties are given in table 1

The communication concepts shown in table 1 are explained as follows. **Complaints:** Their purpose is assumed as informative as they are ways used by the citizens to report issues concerning their experience with public services, hoping for future changes and service improvements [18, 40]. Moreover, [25] attest cases of

Table 1: Summary of communication concepts and their properties

Communication concepts					
	Complaints	Q&A	Deliberation (forums)	Polls/ voting/ petitions	Consultation/ feedback
Initiation	C2G	C2G	C2G, G2C	G2C, C2G	G2C
Direction	One way	2way/One way C2C & C2G	multilateral	One way	2 way
Timeliness	Asynchronous	Asynchronous/ real time	Asynchronous/real time	Asynchronous	Asynchronous/real time
Directness	Direct	Direct/indirect	Direct	Direct	Direct/ indirect
Style	Formal/informal	Formal/ informal	Formal/ informal	Formal	Formal/informal
Mode	Online/offline	Online/ offline	Online/ offline	Online/offline	Online/offline
Content	Predictive informative	Informative prescriptive	Informative Supportive	Prescriptive Informative	Informative
Citations	[2, 18, 25, 40]	[2, 21, 40]	[2, 12, 18, 20, 22, 28, 30, 35]	[18, 22, 36, 40]	[2, 12, 18, 33, 40]

using complaints to optimize public service provision. Complaints are initiated online or offline by the citizens [2, 40].

Q&A: These are reciprocal interactions to citizen initiated questions about any related government matter within their interest such as policies or services [2]. Citizens' questions can be answered instantly or in due course in case the response of appropriate department(s) [40]. In either case, the process can involve human-to-human online or offline interaction, chatbot or precomposed FAQ. Q&A can constitute an informal or formal process of informing citizens and in the latter case literature attests that its purpose can be prescriptive [2, 21]. **Forums:** Forums provide the common shared space for multilateral stakeholders' interactions. They can have service (participatory budgeting) or social oriented content and can provide informational and emotional support to involved citizens [2, 18]. In addition to online platforms, living labs and workshops can be considered offline meeting places which, in this case, require synchronous communication. **Polls/ voting/ petitions:** These are opinion expressing interactions initiated either by the government (polls) or by the citizens (petitions), which aim to influence government policies and political decision making. As such, they constitute unidirectional interactions whose effect is based on participation quantity and the collective dynamics generated. They can take place offline however, literature attests that online communication capabilities can facilitate participation due to the ease of use and the reduced costs [18], however, in both cases security measures have to ensure the confidentiality and appropriacy of citizens' input [36]. In addition to providing the government with citizens' information their role is also prescriptive in the case of elections or any other official ballot referendum [40]. **Consultation/ feedback:** Two-way government-initiated interactions entailing the citizens consultation in order to improve service provision. Feedback can be

crowdsourced through social media communication [2, 12], however, IoT technology can be employed to obtain real-time citizen feedback [16]. Moreover, offline feedback can be obtained with the use of real-life surveys. In any case the purpose is to obtain citizens evaluation information which could add value to public services [33, 40]. Table 2 below, gives a description of the communication concept properties grounded in selected literature:

4.2 Public value concepts and their dimensions

In order to describe the multifaceted nature of public value concepts, they were reflected as collections of public value dimensions documented within the literature as "the different claims for public value creation" [17]. These public value dimensions are summarized in table 3

Consequently, the elicited public value concepts representing the citizens expectations concerning the provision of public service according to [27], were described in terms of their contributing public value dimensions. Table 4, summarizes and relates the identified public value concepts to their contributing public value dimensions as reported within the literature.

4.3 Co-creation properties

The co-creation properties, which emerged through theoretical sorting, describe the main perceived characteristics of co-creation which affect its actualization for the different communication concepts. The properties can explain how the communication and public value concepts interact and change through the co-creation process.

4.3.1 Process dynamics. Co-creation is described as a dynamic process [29, 30]; therefore, its properties can offer more in depth understanding about the co-creation dynamic effects.

Table 2: Descriptions of the communication concept properties.

Citations	Description of the communication concept properties
[2, 5, 21, 28, 30]	Initiation: C2G indicates bottom up unsolicited citizen communication which can increase the government listening skills [2, 5, 28]. G2C initiated communication which is reached by people in need of specific information [30].
[35]	Direction: This property denotes the direction of communication flow and can be one way, bilateral or multilateral involving interactions among all involved stakeholders [35]
[7, 33]	Timeliness: Denoting synchronous or asynchronous communication responses and is related to the quality of the output services [7]
[3]	Directness: Direct communication is defined as the absence of automatic communication practices (human-to-human interactions) [3]
[28]	Style: This property is distinguished in formal oral or written communication (based on legal or technical institutional provisions or informal content interactions involving socially oriented conversations and variety of communication methods (videos, storytelling) [28]
[2, 33]	Mode: Online virtual or offline physical interactions pertaining short term loosely coupled or long term citizen-to government relationships respectively [2, 33]
[2, 24]	Content: Informative content involving the exchange of information, knowledge and experiences [2, 12]. Prescriptive: Interactions suggesting legally binding or mandatory action [28] Supportive/emotional: Generated to offer emotional support, it can assist the establishment of relationship between the citizens and the public organizations [24]

Table 3: Descriptions of public value dimensions

Citations	Description of Public value dimensions
[2, 17]	Social (Community) public value: Denotes the social cohesion achieved by social interactions towards common goals [17] As reported in literature, the sense of belonging can enhance the citizen engagement in community public value creation [2].
[12, 31, 32]	Democratic public value: This dimension refers to citizens right to participate in public discourse and collective decision making. [12]. It relies on inclusive interaction strategies and broad citizen participation [31, 32]
[7, 38]	Citizens' satisfaction – service effectiveness: This dimension refers to the compatibility of the public service delivery to citizens' needs and expectations, resulting in citizens' satisfaction [7]. It is related to the quality of public services as perceived by the citizens
[3, 7, 22]	Legitimacy public value: Refers to the feeling of acceptance and respect of government processes which is related to the alleviation of information asymmetries and the government accountability and transparency.
[1, 7, 32, 35]	Service delivery quality: This dimension is defined as the comparison of perceived service performance in respect to perceived citizens' expectations. It is related to the perceived ease of use and usage behaviour of services [7] as well as to communication characteristics such as timeliness [1, 32, 35]
[30, 35]	Service efficiency: It denotes the ability to deliver the expected public services with minimal resource waste [30]. The lean government principles are reportedly related to service efficiency [35]
[2, 12, 26]	Financial performance: This dimension signifies the resources used to generate public value and it has been compared to shareholder value by Moore (1995). Although the primary concern for financial assets was criticized in respect to the co-creation process, the fact that communication can contribute to financial performance by reducing coordination and transaction costs was generally acknowledged [2, 12, 26]
[3, 33]	Citizen empowerment: It is defined as the encouragement of citizens to participate in decision making co-creation activities and assumes the delegation of power to the citizens
[11, 12]	Organizational outcomes: This dimension implies the transformation of public organizational structure in order to improve service provision, strengthen democratic processes and increase citizens' appreciation

Amplification: Co-creation process is characterized by the amplification of outcome public value owing to the network effect and the growing number of network users. To this front, Intelligent Information technology can enhance the network effect by facilitating stakeholder interactions and improving the public service accessibility and delivery quality [2, 36].

Unpredictability: The unpredictability of the co-creation process is the dynamic yet balancing effect of the desired diversity of citizens input which may involve conflicting citizen input [11, 17, 35]. As pointed out by [3], the output value-in-use is uniquely formulated according to the communication context.

Table 4: Summary of public value concepts in terms of their contributing public value dimensions.

Citations	Public value concepts	Contributing dimensions
[7, 12, 22, 33, 37]	Accountability – Transparency: Citizen’s expectations which co-creation initiatives can help satisfy by means of communication	Legitimacy: Achieve public acceptance and attenuate corruption through openness Citizens’ satisfaction – service effectiveness: Tailoring services to citizens’ needs Citizen empowerment: Empowering citizens can increase accountability and trust in government actions Organizational outcome: Organisational transformation leads to openness and transparency
[3, 18, 19, 30, 32, 38]	Sustainability: The resilience of co-creation processes over time assisted with the use of communication.	Community (social value): Socially just and ethical values can strengthen social coherency and establish long-term G2C relationships. Efficiency: Optimum resource allocation and collective intelligence through co-creation can support sustainable governance in tackling complex socioeconomic challenges Financial performance: The economic value can contribute to sustainability as it denotes economic health and long-term economic capacity of a public organization.
[6, 11, 26, 30, 36]	Innovation: The development of solutions and services based on new original ideas in order to benefit citizens engage them in co-creation initiatives and improve service quality.	Organizational outcomes: Contributes to innovation by restructuring the public services both in terms of technology and culture Citizens’ satisfaction – service effectiveness: Innovation can facilitate the understanding of citizens’ needs Service delivery quality: Innovation can result from new forms of public service delivery which can create yet more innovation.
[3, 30, 32, 35, 41]	Collaboration: Signifies the flawless communication across internal and external organizational boundaries and among all involved stakeholders.	Citizens’ empowerment: The provision of tools and mechanisms to enable communication and collaboration Organizational outcomes: Assumes the organizational changes and stakeholder roles to achieve collaboration Community (social) value: Collaboration is related to community value in solving common problems and achieving community goals.
[11, 17, 24, 31, 41]	Equity – Inclusion: The promotion of social justice and fairness by addressing the variety and diversity of citizen’s needs	Citizen satisfaction – service effectiveness: Including the widest possible range of citizens denotes more accurate representation of citizens’ needs hence the co-created public value leads to more effective services Democratic values: These relate to the democratic quality of the co-creation process by providing appropriate participation opportunities to citizens according to their situation and needs.

4.3.2 Citizen centricity. This perspective bases the decision-making process on citizens collective intelligence such as crowd-sourcing, regarding citizens as partners rather than clients [3, 26].

Permanence: Literature attests that the permanent availability of communication concept instantiations (like forums) denotes the political predisposition towards a citizen-centric governance model and the willingness of the government to align decision making with citizens’ opinions [33, 35]. The consequent continuity of stakeholders’ active involvement in co-creation could account for the success of the co-creation process as noted by [3].

Heterogeneity: Heterogeneity indicates the diversity of the stakeholders involved in the co-creation process which relates to the effectiveness of the co-creation process as the citizens’ input reflects the variety and complexity of real life societal systems [11, 16]. Social oriented platforms favour heterogeneity according to [24].

4.3.3 Active participation and engagement. Literature suggests that the co-creation process is based on the citizens’ active participation

for shaping public policies and services [30, 33]. Therefore, it is considered as an important factor for the success of the co-creation process.

Participation frequency: This co-creation property refers to the citizens iterative interactions with the government indicating effective communication of citizens’ needs and improved citizen satisfaction [24, 30].

Participation Volume: The quantity of citizens input indicates the significant issues to direct the co-creation activities [40]. Typically, platforms can facilitate the concentration of large citizen numbers of interacting citizens adding value to the output service provided [26].

4.4 The co-creation conceptual model

The results of the theoretical sorting were consolidated in a conceptual co-creation model shown in figure 2. UML was the preferred

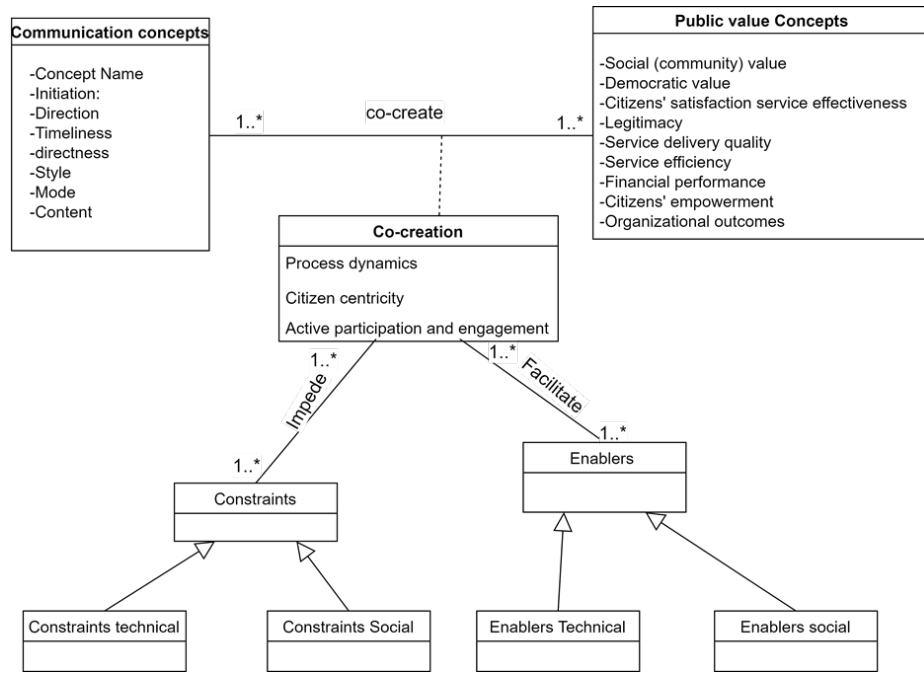


Figure 2: Co-creation conceptual model

modelling language as the emerged concepts, their variations and associations can be represented concisely and accurately.

The communication and public value concepts were represented as classes and instantiated by their different property combinations. Co-creation was identified as a conceptual overlap of the communication and public value concepts and owing to its dynamic nature, it was modelled as an association of the two core concepts, defined by its association class attributes. The enablers and constraints were integrated in the framework as classes directly connected to the co-creation association class each containing social and technical category sub-classes.

4.5 Co-creation links

Based on the derived conceptual framework in figure 1, the communication concepts are associated with the coded "Public value concepts" such that one communication concept can contribute to one or more public value dimensions. This association of the two classes which represents the shared interactions among their attributes is conceptualized as the co-creation of public value. The following table 5, summarizes the analysis results, thus demonstrating the indirect communication to public value concept property co-creation interactions. As it can be seen, there is a different variation of the interacting communication concept properties for each public value concept. It can therefore be assumed that as these property variations indicate interactions with the corresponding public value concepts, the communication concepts whose properties match these variations can offer important contributions to the co-creation of the respective public values.

Transparency and accountability are based on openness which in turn depends on citizens' empowerment to actively engage in

communication with the government. Hence [11, 32, 35] multilateral and bidirectional communication help overcome accountability challenges and establish transparency. Also, increased citizen's satisfaction is related to short service delivery processes due to its immediate interaction effects [30], and to online communication as it facilitates accessibility [7]. Indirect communication can reduce response times while supporting data-driven decision making contributing to legitimacy and transparency [16]. Moreover, informative and supportive communication content can alleviate information asymmetries and establish a shared set of values with the citizens, leading to trust and legitimacy [3, 22], whereas formal personalized recommendations can improve service effectiveness [12, 18].

Sustainability relates to community value in aligning to dynamic interaction of digital ecosystems through multilateral communication [22]. Multilateral C2C communication can increase service efficiency in providing an alternative way to alleviate some government's workload [2]. Also, timely responses can improve the process performance and service efficiency by providing services at the right time [31]. Online communication relates to resource conservation while indirect communication contributes to sustainable economic growth [7, 26]. Collective intelligence is considered a sustainable practice for the mitigation of future and present challenges [36].

Innovation is related to improved citizens' satisfaction through collective citizens' information input [2, 26]. Online citizens' communication can promote service delivery quality by reducing service times and enabling multidirectional communication internally

Table 5: Public value concept relationships to communication concepts through their interacting properties

Public value concept	Public value dimensions	Interacting Communication concept property values	Communication concepts
Accountability- Transparency	Citizens' Satisfaction- Service effectiveness Legitimacy Citizens' Empowerment Organisational outcomes	Online, Real-time, Informative, Prescriptive, supportive, Formal, indirect, Multilateral, Bidirectional	Forums, Consultation/Feedback, Polls/Voting/Petitions, Complaints, Q&A
Sustainability	Social (community) value Service efficiency Financial performance	Multilateral, Bidirectional, Online, Real-time, Informative, Indirect	Forums, Consultation/Feedback, Q&A
Innovation	Citizens' Satisfaction – Service effectiveness Service delivery quality Organizational Outcomes	Multilateral, One-way, informative, Online, Real-time, Indirect, Citizen-initiated	Forums, complaints, Consultation/Feedback
Collaboration	Social community value Citizens' Empowerment Organizational value	Direct, Informative, Online, Multilateral, Two-way	Forums
Equity- Inclusion	Democratic value Citizens' satisfaction-Service effectiveness	Citizen-initiated, Multilateral, Online, Informative, Indirect	Forums, Complaints, Polls/Voting/Petitions, Consultation/Feedback

across fractured silos and externally throughout the involved stakeholders [2, 21]. Moreover, self-service communication can transform the traditional communication flow, service times and delivery process into an innovative citizens' experience based on improved organisational public value.

Collaboration can be nurtured by citizen's solidarity and the co-creation of community value for a common goal [20]. This way, knowledge can be co-created through multilateral, direct deliberation achieving potential negotiations among the diverse input in view of the common benefit [3]. Online communication can empower citizens to join in collaborative initiatives and increase organisational value by loosening institutional boundaries due to the facilitation of information transfer and its distanceless collaboration capabilities [3]. In this context, government's role can be shifted to a collaborative model involving citizens in decision making.

The relationship between the government and the citizens implies the citizen involvement in the decision making on equal terms granting them the right to initiate and get involved in multilateral public deliberation [35, 41]. To this front online communication can increase the level of citizens inclusion and equity by connecting dispersed populations or people with physical disabilities with the government [31]. Moreover, indirect automatic citizen interactions can adapt service provision to citizens needs increasing service effectiveness and co-creating equity [21, 40].

4.6 Enablers and constraints

Several existing preconditions can facilitate or impede the co-creation process [38]. These are identified as enablers and constraints, and are represented as abstract super classes, instantiated by the corresponding "technical" or "social" child subclasses as shown in figure 2. These identified entities which emerged through

selective grounded theory coding are summarized in the following tables in terms of their effect on co-creation properties.

Blockchain technology can reportedly amplify co-creation capabilities by instilling citizens' confidence in their interactions with the government raising participation feasibility [36]. Data analytics can boost value-in-use improving government services leading to unpredictable problem-solving according to citizens' needs. Institutionalization of data analytics is a requirement for data-driven policy based on co-created public value [1]. Gamification can motivate citizens' participation [1, 18]. OGD and the digital service delivery give the opportunity to either the citizen or the government to create new resources, thus amplifying their initial value. Permanence is important for attracting citizens participation and OGD-intensive decision making [25]. Digital platforms can encourage citizens' participation and knowledge accretion by means of their design, governance model and structure [2, 16]. Moreover, they can encourage stakeholders' heterogeneity according to their architecture, implying the unpredictability of the final co-creation outcome [9, 26]. Automatic communication practices can enhance the network effect while achieving heterogeneous, community wide participation [7]. Cloud technologies can boost service efficiency by shifting legacy systems to better technological solutions reducing maintenance costs [36]. Crowdsourcing and opensourcing can create operant resources through cooperation or competition (hackathons) using the collaborative or competition dynamics to amplify the output co-created value [3]. Multi-channel service delivery, encompassing both traditional and smart communication methods can encourage citizens' participation and heterogeneity while its amalgamation with data-driven processes can enhance interoperability within the public sector [1]. A summary of the technical enablers can be seen in table 6.

Table 6: Summary of technical enablers in terms of their interacting co-creation properties

Enablers technical	Interacting co-creation properties	Citations
Blockchain technology	Amplification, Permanence, Participation	[36]
Data analytics and validation process	Unpredictability Amplification, Permanence	[1, 13]
Gamification	Permanence, Participation (volume, frequency),	[1, 18, 30]
OGD – digital service delivery	Amplification Permanence, Participation	[3, 11, 12, 25]
Open architecture	Unpredictability, Amplification Heterogeneity, Participation (volume)	[2, 3, 9, 26, 36]
Crowdsourcing and Open sourcing	Unpredictability, Amplification Heterogeneity, Participation (volume)	[3, 9, 16, 30]
Automatic communication practices (AI, IOT)	Amplification, Permanence Unpredictability, Heterogeneity Participation	[1, 7, 16, 20, 36]
Ubiquitous services	Amplification, Permanence	[1, 36]
Hackathons	Amplification, Heterogeneity	[3, 26]
Digital platforms	Amplification, Unpredictability, Permanence, Heterogeneity Participation	[2, 11, 16, 24, 28, 36]
Multi-channel service delivery	Heterogeneity, Participation, Permanence	[1, 16]

Table 7: Summary of social enablers in terms of their interacting co-creation properties

Enablers Social	Interacting Co-creation properties	Citations
Political support	Permanence Participation	[3, 16, 17, 35]
Openness	Amplification, Unpredictability Permanence Heterogeneity Participation	[2, 3, 5, 12, 16, 25, 32, 33, 36]
Increase absorptive capacity	Amplification, Permanence	[3, 19, 32]
Public sector transformation	Amplification Permanence	[19]
Sense of belonging	Amplification Permanence, Participation	[3, 6, 18, 22, 26]
Perceived usability and usefulness	Heterogeneity, Participation	[7, 16, 30, 31]

Social enablers are summarized in table 7. Political support is required to establish permanent communication structures which would encourage citizens' participation [20, 35]. Government openness is related to inclusion and citizens' increased participation, while reconsideration of the government's role is required to take advantage of the accumulated citizen's knowledge in order to improve the public services [36]. The absorptive capacity of an organization can maximize its effectiveness depending on its permanent capability to subsume citizens' input. In this context, public sector transformation implies the integration of processes, reconsideration of roles and establishment of appropriate resources (ICT infrastructure and OGD) to achieve flawless internal and external communication leading to service efficiency and effectiveness amplification [19]. The sense of ownership can amplify community public value by working towards a common goal while stimulating participation [22]. Finally, the perceived usability and usefulness influences the citizens' attitude towards broad or heterogeneity or domain specific participation according to the aims of the co-creation project [7, 30].

As seen in table 8, literature attests that the collection and management of big citizens' data can raise privacy and security issues resulting in negative public value. These issues are related to distrust in government actions which can affect citizens' participation in co-creation initiatives [21]. The GDPR which was put forward to establish a transparent legal framework for the protection of collected citizens' data, has also received criticism on the basis of obstructing the co-creation process due to restrictions on private data usage [1, 36]. Financial, infrastructure and operational problems are related to respective inadequacies in the technological and human capital which in turns affect citizens' participation and heterogeneity potentials [9]. Also, insufficient support of co-creation initiatives due to resource deficiencies can accumulate frictions with existing regulations and social groups [36]. Inadequate data accessibility is related to insufficient network density or institutional and legal system inefficiency to reasonably adjust the provision of information to citizen's needs [31]. As a result, accessibility issues may limit the scope and participation rate of the co-creation initiatives.

A summary of the identified social constraints is presented in table 9. Misinformation can distort the co-creation process outcome

Table 8: Summary of technical constraints in terms of their interacting co-creation properties

Constraints technical	Interacting Co-creation properties	Citations
Privacy and Security issues	Amplification Permanence, Participation	[1, 7, 13, 21, 31, 36]
Financial, infrastructure and operational problems	No amplification Insufficient Heterogeneity (interoperability issues)	[1, 9, 13, 36]
Accessibility	Permanence issues Reduced participation Lack of accessible data provision, Lack of heterogeneity, Reduced Participation	[13, 20, 26, 31]

Table 9: Summary of social constraints in terms of their interacting co-creation properties

Constraints social	Interacting Co-creation properties.	Citations
Misinformation	Amplification Permanence	[2, 13, 28]
Administrative tradition – view citizens as clients	No Amplification, Outmoded policies and standards, Discouraging Participation	[1, 3, 13, 24, 28, 36, 37]
Lack of trained personnel	Dysfunctional process dynamics, Dysfunctional communication strategy, Problem clarity and choice of design, Reduced participation	[13, 16, 24, 40]
Fractured organizational silos	No networks no sharing, No permanent integration and interoperability	[13, 36, 37]
Conflicting perceptions of public value	Co-destruction of public value, Step out of the co-creation process	[17, 41]
Digital divide	No heterogeneity, Participation	[13, 16, 31]

by amplifying false information through online informal networks [2]. Viewing citizens as clients can diminish citizens' participation as they are deprived from their responsibility to respond to government's actions [3]. Moreover, adherence to outmoded government-centric policies can lead to overlooking the benefits of citizens' accumulated experience and knowledge [1]. Lack of trained personnel can result in dysfunctional co-creation process dynamics, and incoherent or misaligned communication strategies leading to reduced citizens' participation [13]. The digital divide phenomenon has been related to accessibility and infrastructure inadequacies affecting citizens' participation and broad inclusion (heterogeneity) [31]. Fractured organizational silos can cause interoperability problems affecting permanent integration and the establishment of common standards [37]. Conflicting perceptions of value can lead to potential co-destruction of public value demotivating citizens' participation in co-creation projects [17, 41].

5 PRACTICAL APPLICATION

The practical relevance of the derived framework lies in the proposed guidelines for the implementation of co-creation strategies aligned with citizens' needs. The process can start by considering citizens' expectations, raised through analysis of the communication between the citizens and public organisations, as indicators of desired public value concepts. These are regarded as the generic co-creation objectives driven by citizens' needs. The decomposition of public values into their component dimensions (table 4) can provide a more accurate reading of citizens' expectations and their impact on the co-creation process. Next, appropriate communication concepts can be implemented by reference to table 5. Further,

the organizational capacity in terms of existing enabling and constraining factors can be assessed. Depending on the co-creation scope, the effect of individual enablers and constraints on the process can vary based on the suitability of their interacting co-creation properties. For example, openness which is identified as an enabler, can be a constraint for domain-specific co-creation projects emphasizing expert opinion sharing. Conversely, the absence of an enabler can turn it into a constraint. Therefore, risk assessment methods could be employed to consider the combined enabler - constraint effect on the co-creation process, to compromise their observed interdependencies. The final step involves improving the expected co-creation performance by leveraging appropriate enabling factors while mitigating unwanted barriers.

6 DISCUSSION AND IMPLICATIONS

The analysis and derived framework, present an in-depth perspective of the way communication between citizens and public organisations contributes to the co-creation of public value. To define clear semantics for the co-creation framework, the identified theoretical sorting results were mapped into ontological concepts. Specifically, two core-concepts were identified namely; the communication concepts instantiated by their shared characteristics, and the public value concepts which were defined according to the combination of their constituent public value dimensions.

In line with the grounded theory method [8], the relationships between the core concepts were described by the interactions between their respective properties, evidenced by relevant relational statements found within the selected literature. Likewise, the facilitating or impeding influence of the enablers and constraints

was rooted in their evidenced interactions with the co-creation attributes.

Thereby, a theory incorporating the derived concepts and relationships was developed by building a conceptual framework to explain the co-creation process. For this purpose, the object-oriented UML was employed so as to represent the concept-centric grounded theory analysis codes and relationships accurately. The framework models the co-creation process as a complex sociotechnical system, depicting communication and public value concepts as the independent and dependent variables of the system respectively. Since co-creation was described in the literature as a dynamic process occurring when the communication and public value concepts are in active existence, it was modelled as an association representing the functional relationship of these core concepts. The co-creation properties were conceptualized as a set of principles which can explain the variable interactions and changes induced. The enablers and constraints were also modelled as initial conditions inflicting positive or negative impact on the co-creation process.

Based on the emerged connections of public value concepts to communication attribute variations as summarized in table, it is understood that adjusting the independent communication variables can achieve optimal public value responses according to set requirements, and possibly counteract any identified initial constraints. Further, the identified enablers and constraints and the ways they interact with the co-creation properties can offer a policy implementation reference of the co-creation potential of public organizations.

The structure of the derived framework allows continuous extension and modifications with additional concepts and properties as they may emerge from future research so as to align with latest communication practices. The connection of public values to concrete communication attributes can facilitate further research on empirical validation and refinement of the emerging theory. To this front, research hypotheses can be drawn upon the derived framework, so as to investigate the influence of the communication concept attributes on public value co-creation. Finally, further research opportunities may arise in transforming the conceptual framework into a mathematical model in order to simulate the dynamic behaviour of the co-creation process. In this case, operationalization of the latent public value variables is required.

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