

Does Co-creation Affect the Adoption of IT-enabled Solutions? The Case of a Mobile Application for Emergency Preparedness

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Abstract

Co-creation has been increasingly advocated by both scholars and practitioners in the public sector to enable the development of information technologies driven by citizens' needs. Despite other potential advantages, it is not clear whether co-creation actually influences the adoption of IT-enabled solutions. The current knowledge about the effects of co-creation processes in the public sector is especially limited in non-urban environments. Based on the development of a mobile app for emergency preparedness and response in a rural town, the results of this study show that citizens involved in co-creation helps identifying unique challenges for using the app. Local leadership plays a key role in the participants recruitment, while professionals' facilitation and openness are key during the co-designing of the app. Overall, the co-creation process increases citizens' perceived ease of use and facilitate their adoption of the app.

Keywords: Co-creation, Adoption of IT-enabled solution, Rural area

1. Introduction

The development of IT-enabled solutions has long been an internal process in most organizations, yet over the years, user involvement has increasingly been advocated in the co-creation literature (Aladalah et al., 2018; Simonofski et al., 2019; Tseklevs et al., 2017). According to the literature, the involvement of citizens (often considered as end-users) in the development of IT-enabled solutions is an appropriate strategy to improve user satisfaction, enhance quality of products, and increase users' adoption (Merickova et al., 2016; Rodriguez Müller et al., 2021). In the public sector, citizens are no longer passive actors in the co-creation of innovation, but active contributors who have valuable

experiences, ideas, and resources that can help to spur innovation. They often engage in the design and implementation of IT-enabled solutions to identify unmet social needs, understand urgent problems and challenges, and co-create technological solutions that could not have been envisioned by the professionals in the public sector alone (Voorberg et al., 2015).

Although previous studies have explored the role of citizens, practices to engage citizens, and potential benefits in the co-creation of IT-enabled solutions in the public sector (Baka, 2017; Mačiulienė, 2018; Rodriguez Müller et al., 2021), few of them have explicitly explored the link between participation in co-creation processes and citizens' adoption of the co-created IT-enabled solutions (Tseklevs et al., 2017). Moreover, there is not enough studies exploring the co-creation process in rural areas where citizens may be less familiar with information technologies (Bon et al., 2020; Cornet & Barpanda, 2020). Existing studies emphasize the potential of co-creation in rural contexts, but existing knowledge about citizens' role and co-creation's impact on IT adoption is still limited. This study, therefore, contributes to address this research gap and to answer the following research questions: (1) How are citizens in rural areas involved in the co-creation of IT-enabled solutions? (2) Does co-creation process influence citizens' adoption of IT-enabled solutions?

To answer these research questions, we used a case study approach of co-creation of a mobile application for emergency preparedness and response (the EApp) in the Town of Thurman, a rural community in upstate New York with limited access to Internet (Doke et al., 2020). The co-creation process started in 2017 with participants from local government organizations, University at Albany researchers, and local residents.

The rest of the paper is structured as follows. Section 2 reviews the literature about co-creation and user-driven software development to understand

practices and effects of involving citizens as end-users in the service design process. Section 3 briefly describes the research design and methods used in this paper. Section 4 presents the results and section 5 further discusses the results. We conclude with section 6.

2. Literature review

The literature about service co-creation and co-creation in the public sector have explored how citizens (or end-users) are involved in the development of services. Scholars have explored the role of citizens and some practices to engage with them in co-creation processes. Most of those studies have been conducted in the urban areas, while few talk about rural communities.

2.1. Co-creation in the public sector

The term “co-creation” refers to active involvement of citizens as end-users at a strategic level (Brandsen & Honingh, 2018). According to Voorberg et al. (2015), the term co-creation is reserved for involvement of citizens in the (co-)initiator or co-design level, where citizens take up the initiative to formulate specific services (as co-initiators) and provide inputs regarding the content and process of services (as co-designers). In the strict sense of the term, co-creation in the public sector refers to an interactive process through which professional service providers (e.g., public employees, public service vendors, professional designers, among others) and users of public services apply their different resources and capabilities in its design and development (Brandsen & Honingh, 2018; Osborne et al., 2016).

The purposes of co-creation in the public sector are associated to improving public service provision, creating innovative public services, and user-driven co-creation (Rodriguez Müller et al., 2021). First, some studies show that co-creation aims to improve public service performance and users’ acceptance and adoption of the public services (Tseklevs et al., 2017). The direct citizen involvement aims to improve users’ satisfaction through both citizens’ insights and feedback (Furenes et al., 2018). Second, other scholars found that co-creation aims to foster public sector innovation (Gascó, 2017; Haug & Mergel, 2021). It is expected to lead to innovative ideas with users in the center of the process, clearly identifying problems and challenges (Sørensen & Torfing, 2018), sharing new insights, and proposing new solutions (Merickova et al., 2016). Third, some scholars also found that co-creation aims to empower citizens (Concilio et al., 2017; Morton & Paice, 2016), enhance trust among users, and improve citizens’ perception on public administrations and reputation of the service providers (Meijer & Boon, 2021).

2.2. Practices and enablers of co-creation

The service co-creation literature has explored diverse practices and enablers of co-creation. Scholars have identified different stages of co-creation processes and roles played by citizens. Other researchers further explored key enablers or barriers to the success of co-creation. Studies focus more on co-creation in urban area than in rural communities.

In practice, most scholars seem to agree that the co-creation process can be divided into four different phases (Bassi et al., 2021; Jamieson & Martin, 2021; Tseklevs et al., 2017) that lead to final services or products: planning, recruiting, designing, and building.

The planning stage is often highly iterative to gain on-going support and commitment to the co-creation process (Lazo-Porras et al., 2020). The literature shows the co-creation can be initiated by either professionals or citizens (Sørensen & Torfing, 2018; Trencher et al., 2013). When initiated by professionals, the projects would start with formative research, such as systematic literature reviews and expert interviews, to gain an initial impression of the underlying problem to be addressed (Trischler et al., 2019). Those insights would then inform the planning of the co-creation process, which includes specification of the purposes, recruitment methods, and design approach. Citizens would be involved as co-explorers to discover or identify problems that are either invisible or unknown to professionals, since formative research may only reflect expert-driven insights (Nambisan & Nambisan, 2013). In contrast, when projects were initiated by citizens, formal research was not the first step. Citizens with the same interests and objectives organized into civic associations and communities, taking initiatives in solving different problems, due to the passivity of public organizations (Merickova et al., 2016).

During recruitment, the literature suggests that professionals need to first find citizens who have the time, ability, and commitment to be involved in the co-creation and then prepare them for reflection on the underlying topic prior to the design stage (Putra & Nazief, 2018). Ideally, recruited citizens are prepared during a designated session prior to the design stage (Tseklevs et al., 2017). It helps to form a basis for participants reflecting on the problems and to trigger their confidence to participate and contribute their insights in the design stage (Trischler et al., 2019).

During the design stage, citizens are invited to attend various workshops as co-designers to share their experiences and seek each other’s opinions that can be further utilized by professionals to re-design services or products (Rodriguez Müller et al., 2021; Tseklevs et al., 2017). Being “closest to the ground,” citizens are likely to provide their experiences, insights, and feedback that

professionals have not been aware of. According to the literature (Ongaro et al., 2021; Sørensen & Torfing, 2018), both digital tools (e.g., websites, forums, online surveys, among others) and analog tools (e.g., interviews, surveys, focus groups, among others) are often used in the (co-)design stage. During co-design sessions, professionals often act as facilitators to lead participants through various activities (Farr, 2019), which helps to cultivate awareness, empathy, and advanced communication that enable joint inquiry and imagination among participants for creative changes (Rill, 2016; Steen, 2013; Trischler et al., 2019).

Finally, in the building stage, citizens' inputs are further reflected and incorporated into building changes in services and products (Morton & Paice, 2016; Trischler et al., 2019). Professionals build the design of services or products upon user-driven idea inputs in iterative consultation with those participants and other relevant stakeholders (e.g., public authorities) who are responsible for final implementation (Trischler et al., 2019). This is often an iterative process because professionals need to repeatedly reflect on the original design task and citizens' inputs.

To enable co-creation, scholars have explored key drivers on both the citizen side and professional side (Voorberg et al., 2015). On the citizen side, both citizens' motivation and ability are important to participate in the co-creation (Loeffler & Bovaird, 2016; Voorberg et al., 2015). Material (e.g., money and reputation) and non-material motivations (joy and self-efficacy) are found equally important (Liu, 2017; Mogstad et al., 2018). However, time and resource constraints are potentially hindering citizens' on-going involvement in co-creation. Further, scholars argue that citizens' knowledge of the topic in the co-creation processes is important so that they are able to weigh arguments and provide useful feedback (Klerkx & Nettle, 2013; Ongaro et al., 2021).

On the professional side, the literature shows that professionals' leadership commitment and support (O'Donnell et al., 2019; Rill, 2016) is critical to maintain continuous and authentic citizen involvement in the co-creation process (Klerkx & Nettle, 2013). Co-creation also needs to be adequately resourced with clear coordination of tasks to avoid duplication of effort (Liu, 2017; O'Donnell et al., 2019). However, the limited will of professionals in activities proposed by other lay actors is one key barrier to invest enough time and money in co-creation (Jenhaug, 2020; Morton & Paice, 2016). The professionals' lack of knowledge about co-creation methods poses another major challenge to interact with users (Simonofski et al., 2019).

Few recent studies have specifically focused on the process and enablers that are important to rural contexts. According to the literature, rural areas are often characterized by limited electricity infrastructure and

poor or absent internet access, high illiteracy rates, and limited purchasing power (Bon et al., 2020; Jagtap, 2021). Facing those contextual features, Bon et al. (2020) find that reducing cultural distance is another important determinant, where professionals embed themselves in the rural context to truly understand the feedback from the perspective of rural citizens and validate their design. Other scholars mention that careful selection of participants is needed to ensure a diversity of views in rural communities where different perspectives co-exist, giving equal weight to proposals from professionals versus the rural community (Lazo-Porrás et al., 2020). In the rural India, Cornet and Barpanda (2020) find that it is particularly important to equip rural citizens with proper knowledge on the matter discussed so that they can relate it to their own problems. Often participants had difficulties doing co-design activities, which had to be adapted to ensure rural citizens could make significant contributions (Coetzee et al., 2012). They are more likely to be motivated by social ties in the rural communities (Bagalkot, 2009). Still, co-creation can be hampered by power imbalance due to age inequality and knowledge deficiencies in low-income communities (Jagtap, 2021; Jarke, 2019).

Despite those studies exploring co-creation in rural communities, our current knowledge does not clearly show how citizens are involved in the co-creation process as well as some important enablers.

2.3. Impacts of co-creation

Current literature has explored both tangible and intangible impacts of co-creation. Tangibly, co-creation often leads to the introduction of innovative services or products and users' adoption of new solutions, while intangibly, there might be improvement in their relationships with service providers.

First, scholars find that co-creation in the public sector results in new ideas and solutions in both urban and rural contexts (Bentzen, 2022; Bentzen et al., 2019; Cornet & Barpanda, 2020). Citizens' inputs help to conceptualize new public services with a variety of expertise or perspectives that have not been discovered before (Putra & van der Knaap, 2020). Bon et al. (2020) find that co-creation generated new business ideas of IT systems to disseminate service information in rural Africa. Bentzen (2022) shows that continuous co-creation leads to new a supervision system (within the context) that are perceived as highly contributing to solve the problem at hand as well as value adding.

Second, in terms of adoption of new solutions, scholars show that co-creation leads to strong commitment and ownership on the part of involved citizens, which further strengthen their intention to adopt and use the final co-created solutions (Bentzen,

2022). According to the literature, new services or products are often perceived as preferred by citizens who are involved in a co-creation process, because the new solutions are influenced by their own inputs and the final co-created solutions are more customized to their needs than other available solutions (Khan & Krishnan, 2021; Loef et al., 2017). Others suggest that the co-creation increases users' confidence in learning new IT-enabled systems so that they find new solutions easy to use (Kyakulumbye & Pather, 2022). It reduces citizens' skepticism of IT due to their unfamiliarity with IT and the potential changes caused by IT. Some scholars further show that co-creation increases reflection on ethical dilemmas to improve perceived legitimacy and fairness in the new solutions so that citizens are more driven to adopt them. (Bharosa et al., 2021). For example, Gupta and De Gasperis (2020) found that citizens involved in co-creation had more trust in a new IT-enabled contact tracing app after their feedback was addressed, and they became champions for adoption.

In summary, the literature has explored the process and potential impacts of co-creation in the public sector. However, our current knowledge does not show how citizens are specifically involved, particularly in the rural context. In addition, whether and how co-creation influences the adoption of IT-enabled solutions is still under explored. This study, therefore, contributes to address this research gap by answering these research questions: (1) How are citizens in rural communities involved in the co-creation of IT-enabled solutions? (2) Does the involvement in the co-creation process influence citizens' adoption of IT-enabled solutions?

3. Research design

To explore the research questions, we used a case study of the co-creation of a mobile application (the EApp) for emergency preparedness and response in the Town of Thurman, a rural community in New York State with limited access to Internet (Doke et al., 2020). A single case study is a suitable approach to explore our research questions as it is particularly useful to respond to "why" or "how" questions. It allows us to explore the iterative interaction between citizens and professionals in depth, while leaving room for unexpected findings that can form the basis for new hypotheses to be tested in future research (Marshall & Rossman, 2014; Yin, 2009). This is particularly useful when there is not enough existing research on the topic, as is the case here.

The co-creation of the EApp was consistent with the Information Systems Design Science Research Guidelines (Hevner et al., 2004). First, the result of the co-creation process was a purposeful IT artifact, the EApp, created to address an important public problem, which was to support the collection of emergency

information from different sources and the dissemination of it to local residents (Guideline 1). This problem was particularly relevant to the Town of Thurman (Guideline 2) since it has experienced emergencies caused by severe weather (e.g., snowstorm or flood) but with limited access to the Internet to share emergency information (Yuan et al., 2022). The co-creation aimed to improve information sharing through the construction of the EApp.

Second, the co-creation the EApp can be defined as a search process to discover an effective solution to a problem (Guideline 6) (Hevner et al., 2004). It started in 2017 with the participation of local government organizations, researchers at the University at Albany, and residents of the Town of Thurman. As the development of the EApp requires sources of emergency information and access to the local community, local government partners played a key role by providing access to multiple sources of emergency advisories, alerts, and preparedness information. The university research team acted as the professional designers and developers of the EApp. Citizens in Thurman were co-designers.

To understand available resources and local needs for emergency information, four focus groups were conducted with 15 local citizens and first responders between March and October in 2019. They were involved from the beginning in order to understand what specific local emergency information they need and various sources to obtain such information. Their inputs helped to illustrate the purposes of the EApp and available emergency information to develop the EApp.

Third, evaluation in the co-creation of the EApp was a crucial component (Guideline 3). From November 2021 to May 2022, a small deployment of the prototype of the EApp was conducted for testing. In total, 23 local residents were recruited to test the EApp on an Android cell phone offered by the University research team. They were asked to test user interface and functionality of the EApp, such as the layout, alert notification, and message display, among others.

The evaluation of the EApp used observational methods with case study and field study. We interviewed eight residents in May 2022 to evaluate the design of the EApp. Among them, six attended focus groups, while two did not. The two constructs in the Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh et al., 2003), the perceived usefulness and the perceived ease of use, were used as evaluation components to understand residents' intention to use the EApp in the future. The TAM presents a framework for predicting and explaining why a particular information system will or will not be accepted in a given setting. Therefore, it provides components by which a designed information system can be evaluated (Guideline 4 and

5). The residents were asked about the timeliness and accuracy of the emergency information to indicate the usefulness of the EApp, and the presentation and navigation of the information to indicate the ease of use.

Finally, 11 interviews were conducted to shed light on the process, drivers, and challenges of co-creation. Among them, four interviews were conducted with the residents of Thurman who participated in the co-design process. In addition, three interviews were conducted with public employees from the Town of Thurman and Warren County, and four interviews were conducted with researchers from the University at Albany. The interviews asked for the experience of different actors in the co-creation process as well as about their motivations, challenges, and the benefits they felt were achieved during the process.

4. Findings

Our findings show that citizens act as co-designers of the EApp. The findings first describe how citizens were recruited and engaged to co-create the EApp. Then, we present some findings that show the impact of the co-creation process on the adoption of the EApp.

4.1. Practices and enablers of co-creation

The findings show that there were four main phases in the co-creation of the EApp with citizens in the Town of Thurman: planning, recruiting, (co-)designing, and building the EApp. Table 1 shows an overview of each phase including a description of the applied methods and the participants involved.

In the planning phase, the university research team first conducted desk-top research on emergency preparedness and response to understand multiple types of emergency information and sources of such information at the local, state, and federal level. Second, the university research team collaborated with the Town of Thurman, the Thurman Fire Company, the Warren County Office of Emergency Management to further understand the specific needs of Thurman in terms of emergency-related information. The most pressing needs in Thurman were the limited access to the up-to-date emergency information regarding severe weather (e.g., snowstorm or flood). This led to a more in-depth understanding of local needs and helped to inform the purpose of co-design focus groups, design of the specific methods, and the connection with local leaders for recruitment of participants.

In the recruiting phase, the university team iteratively reached out to and recruited local citizens through townhall meetings and word-of-mouth. The university team hosted town hall meetings to introduce

the project directly to citizens. According to interviews, these introductory meetings enabled citizens to have a clearer understanding of how new technologies work and raised their interest to participate in the co-creation of the EApp. In addition, the university team encouraged citizens to share information about the co-creation process with their friends and family members to recruit more participants for the co-design stage. Such communication was iterative and focused on clarifying the purpose of collaboration with citizens, sharing accurate information about the EApp, and building residents' shared understanding about the purpose of the EApp and commitment with the co-creation process.

Table 1. Overview of the co-creation process

Phase	Description
Planning	The university team worked with the Town of Thurman, the Thurman Fire Company, the Warren County Office of Emergency Management to address the needs and challenges in sharing emergency preparedness and response information in rural areas.
Recruiting	Citizens were recruited through town hall meetings, word-of-mouth, and other local gatherings. A total of 15 citizens were recruited.
(Co-) Designing	Four focus groups were conducted. Researchers asked citizens' needs of emergency information and interface features in the EApp. Citizens shared their feedback on functionality of the EApp. An emulation of the EApp was used to demonstrate the initial design.
Building	University team analyzed citizens' feedback to develop initial prototype. A Development Tracker was created to identify new features to be developed. Feasibility of citizens' ideas was assessed by the university team and local authorities.

Connection with the county emergency service coordinator and the town leadership played an important role to recruit citizens for the co-creation process. Leadership at both levels managed to broadcast and spread information about the project to attract more participants. The organizations helped to clarify the purpose of the project by using plain language so that citizens could understand the relevance of the project in their daily life and be encouraged to attend the focus groups during the co-design stage. Further, the community members' trust toward the local leaders allowed the university research team, by connecting with town and county leaders, to build initial trust with

local citizens. The university’s researchers were able to leverage the trust that citizens had in local leaders, which helped them to overcome some of the initial challenges they had connecting with the community.

However, time availability was a major barrier in the co-creation process. Most of the participants were retired and senior citizens who had time to engage in the co-design focus groups. Younger people and those who work were hard to recruit. Residents mentioned that there were limited ways to reach out to a broad range of citizens in the town other than through word-of-mouth. The lack of ways to broadly advertise the co-creation opportunity limited the spread of the project information and thus limited recruitment of new participants. In addition, in the Town of Thurman, a good portion of citizens did not seem to be interested in using information technologies, and thus had limited interest in the co-creation process.

In the co-design phase, multiple facilitation methods were used to solicit citizens’ feedback. First, the researchers acted as facilitators in the focus groups to ask participants for their needs in terms of emergency information and to encourage envisioning some of the EApp features. The university team kept an open mindset to encourage participants to share their own experiences, insights, or ideas about emergency incidents and what information and features should be included in the EApp. The group discussion revealed participants’ shared interests in the functionality of the EApp that were specific to the context of Thurman (e.g., alerts from multiple specific sources, user-friendly interface for senior citizens, and customization based on location and other user preferences. According to the interviews, being open and responsive to citizens’ questions about the EApp encouraged citizens to share their real thoughts freely and stimulate more input from different perspectives. Table 2 shows the main ideas of the EApp generated from the co-design focus groups.

Second, an emulator of the EApp was used to demonstrate its interface and functionality of the EApp prototype in the second round of the co-design focus groups. Participants commented on the prototype of the EApp and the university team collected that feedback in detail. Interviewees mentioned that the emulator provided a straightforward image of the app, enabled them to play with the app, and to stimulate more inputs.

In the building phase, citizens’ inputs and feedback were further analyzed and reflected by the university team to brainstorm core features and functionality of the EApp. A Development Tracker was created to identify insights learnt from the co-design focus groups and potential functions of the EApp to be developed to meet citizens’ specific needs. The feasibility of those ideas was further assessed iteratively to design and modify the initial prototype. The reflection found that most citizens’

insights could be implemented to modify the EApp incrementally, yet the idea of communication among local residents seemed too challenging in the validation of the information and unfit for the original purpose of the EApp. Figure 1 shows the interface of the prototype of the EApp being tested.

Table 2. Inputs from the co-design focus groups

Inputs	Description
User settings	Customize the types of information and alerts they would receive according to users’ preferences.
Alerts	Receive multiple types of emergency alerts: weather, road closures, hazardous materials, medical/health, fire, and missing persons. Alerts from FEMA, New York Alerts (NYAlert), and Warren County.
Prepared-ness	Provide information about emergency preparedness: evacuation routes, first aid procedures, self-help guides for specific types of emergencies, service facility locations (e.g., hospitals and clinics), and shelters near Thurman
Communi-cation	Establish communication between local residents and first responders as well as between residents Share emergency information through posting photos of incidents Risks to include false information shared by local residents
Interface	High-contrasting color and large font size are preferred to be user-friendly, especially to the elderly in the town. Customize the interface according to their visual and audio needs.

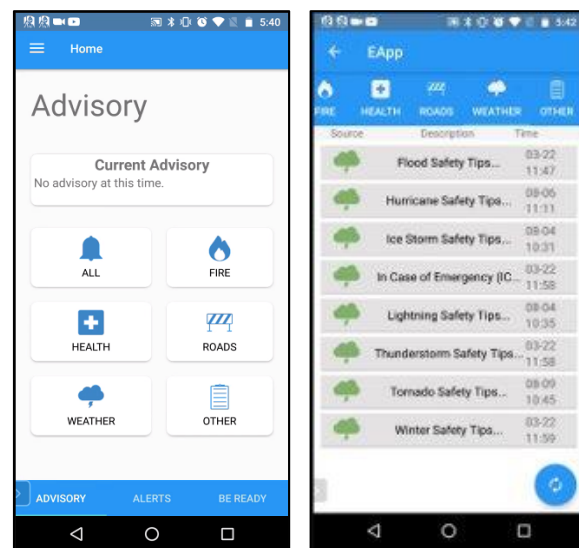


Figure 1. Prototype of the EApp

4.2. Effects on adoption of the EApp

Our findings show that the prototype of the EApp was adopted by most of the citizens as test users. At the beginning of the piloting period, citizens opened the EApp at least once a day to check emergency advisory and alerts. According to the interviews, advisories and alerts about weather and road conditions were viewed the most and were perceived as the most relevant to citizens' needs of emergency information, since they were most concerned about road closures caused by snowstorms or by flooding. Some of the citizens checked emergency alerts to prepare in case of a potential road closure for their trips outside of Thurman.

However, a few citizens reduced their use of the EApp as the piloting evolved. According to interviews, three main reasons decreased their use of the EApp. First, those citizens did not perceive the emergency information as local enough to the Town of Thurman to be useful. Second, they found the emergency information was not up to date enough and was about half an hour late after the emergency was already known to them. Third, public health notifications, such as those regarding COVID-19, seemed overwhelming and squeezed out other information that really matters to local citizens.

Citizens who have participated in the co-creation process found the interface of the EApp familiar and easy to navigate. They remembered their ideas shared during the co-design focus groups and what each section was designed for and how to open and read emergency messages in each section. They felt it was easy to navigate and to read information they were interested in.

However, citizens who participated in the co-design focus groups had higher expectation in the EApp and their perceived usefulness of the EApp was mixed. Some of them found it useful and well fit their needs to check weather and road conditions to improve their emergency preparedness, while others had higher expectations in terms of the customization of emergency information according to their location or other preferences. They mentioned they wanted the EApp to focus on information specific to Thurman, yet the EApp seemed to fail at reaching such expectation. They did not express a strong faith in using the EApp to help them prepare for emergencies beforehand or respond to ongoing emergencies. The higher expectation among citizens involved in the EApp co-design seemed to reduce the perceived usefulness of the EApp.

In contrast, among citizens who did not participate in the co-design focus groups, the results show that they were not familiar with the interface of the EApp. It took them a while to understand what each section stands for and to learn how to identify different types of emergency information. Some citizens mentioned that

they did not check the EApp very often since they were not used to the phone with an Android operating system. Instead, after their familiarization with the EApp, they found it useful to learn about emergency advisory and alerts from a single channel and helped them to obtain information with limited access to the Internet in a rural town such as Thurman.

5. Discussion

By conducting a case study, we identified four key phases in the co-creation process with citizens and how co-creation influenced citizens' perceived usefulness and ease of use of the EApp.

Regarding citizens' involvement in the co-creation process, our results confirm arguments in public sector co-creation literature that citizens act as co-designers to discover problems and to provide their experiences, insights, and feedback to re-design services or products (Nambisan & Nambisan, 2013; Voorberg et al., 2015). According to the literature, being "closest to the ground," they are likely to be more aware of current or emerging problems with emergency communication that are either invisible or unknown to public organizations (Ongaro et al., 2021; Sørensen & Torfing, 2018), such as the County authorities and the University research team.

This importance of citizens as co-designers increases as more local knowledge is needed in the development of IT-enabled solutions. This reflects the argument in the service co-creation literature that local knowledge is critical to customize new services to users with unique needs (Kyakulumbye & Pather, 2022). In this case, rural communities present unique challenges and culture that add complexity to IT adoption and use in emergency preparedness and management (Gulatee et al., 2020). Involving citizens as co-designers is essential for professionals to obtain an in-depth understanding of local needs or core issues from citizens' perspectives. This partnership enables professionals to untangle complexity in those issues and develop useful solutions for emergency communication.

Our findings further contribute to service co-creation and public sector co-creation literature by identifying key enablers that are especially important in the recruiting phase. Compared to previous literature which respectively explores individual citizens' motivation (Loeffler & Bovaird, 2016; Voorberg et al., 2015) and professional leadership (O'Donnell et al., 2019; Rill, 2016), our results indicate the connection between two factors and the importance of local leadership in the motivating citizens for the co-design. To convey the correct ideas and to develop a shared understanding with local citizens, local leaders' relationships and knowledge became key to translate co-creation in a way that citizens could understand and

relate to. At the same time, citizens' trust and connections with leaders are especially important for actors from outside the community (i.e., the university team) to connect with citizens and recruit participants in the co-creation process. In this sense, local leaders acted as key liaisons to motivate citizens' motivation

Our results also contribute to the literature by showing co-creation methods to address culture difference between professionals and citizens. Literature on service co-creation and public sector co-creation suggests it is an important issue (Bon et al., 2020; Cornet & Barpanda, 2020). In the service co-creation, the difference may hinder users from authentically expressing their ideas and professionals from truly understanding users' needs (Jagtap, 2021; Jarke, 2019). It seems more so in the public sector since public employees may disregard lay person's suggestions (Jenhaug, 2020; Morton & Paice, 2016).

The university team's use of facilitation techniques and being open and encouraging alleviated such barriers. As in the rural areas there is an existing and unique culture of self-reliance that leads to a pride and trust in the rural community (Gulatee et al., 2020), IT professionals need to be open to and show respect for such culture so that they are able to cultivate empathy with citizens and to connect emotionally with them (Rill, 2016; Steen, 2013; Trischler et al., 2019). Professionals need to be de-centered in the co-creation and understand rural contexts from citizens' perspectives. This strategy reduces the power distance among professionals and citizens and helps build rapport for joint inquiry and collaboration among participants for creative changes.

Regarding the impact of co-creation on the adoption of IT-enabled solutions, our results first indicate the usefulness of the two constructs in the TAM as evaluation components to assess a designed information system (Hevner et al., 2004). This adds to the system co-creation literature (Khan & Krishnan, 2021; Loef et al., 2017), as IT artifacts need to be evaluated not only in terms of functionality, accuracy, and reliability, but also in terms of their fit with the context they are embedded in. The perceived usefulness and perceived ease of use represent a combination of technology-based factors and human-based factors that are necessary to address acceptance issues and to assess quality of an IT-enabled solution.

Second, our results indicate a more nuanced effect of co-creation on the two constructs of the TAM. In terms of perceived usefulness, our results indicate the importance of the gap between citizens' inputs and the final IT-enabled solutions. Previous studies seem to assume that all citizens' inputs in the co-creation process are met by the new IT-enabled solutions and thus perceived usefulness increases (Bentzen, 2022; Bharosa et al., 2021). Yet, co-creation may only

increase citizens' expectation of new solutions but may not necessarily satisfy all the needs. Often, citizens' inputs are too "radical", "different", or "expensive" to be incorporated into the design of final products (Trischler et al., 2019). When assessed by feasibility criteria, some citizen-generated ideas may be dropped or substantially modified by professionals in order to build prototypes. The gap between the expectation and final IT-enabled solutions, often caused by the lack of feasibility, may reduce the perceived usefulness from citizens' perspectives. Therefore, our results suggest that co-creation may have positive impact on the perceived usefulness of IT-enabled solutions when there is no gap between the expectation and final IT-enabled solutions. To reduce the gap, professional developers need to either met all citizens' inputs in the final solutions or adjust citizens' expectation in terms of the feasibility of their specific ideas and overall feedback by communicating the challenges to fulfill their needs.

In terms of perceived ease of use, our findings indicate a positive effect of co-creation. As suggested by previous studies (Simonofski et al., 2019; Trischler et al., 2019), involvement in the co-creation process allows citizens to have more knowledge about the final co-created products and to become more familiar with them. This increases the perceived ease of use and encourages citizens to explore functionality of new IT to assess its usefulness. Particularly in rural areas with limited access to Internet, the perceived ease of use seems a first step to increase citizens' adoption of IT-enabled solutions. In this sense, co-creation positively influences the adoption through increasing perceived ease of use.

6. Conclusion

This study examined the co-creation process of an IT-enabled solution in a rural town and its influence on the adoption of that solution by local citizens. Our results show that citizens mainly acted as co-designers who helped to identify unique challenges and cultural characteristics useful for the development process. In rural areas, local leaders play a key role in the recruitment of citizens, while professionals' facilitation and openness are key to a fruitful co-design process with citizens. There is a positive impact on perceived ease of use, which could facilitate citizens' adoption of IT-enabled solutions.

The study is not without limitations. First, the study needs to recruit participants with sociodemographic diversity to collect insights from multiple perspectives. In the next testing phase, the research team would recruit more working population in the local town to test the EApp. Second, the generalizability of the findings is limited due to the use of a single case study. Future research could adopt a multiple case study approach to

further strengthen the argument between co-creation and adoption of IT-enabled solutions. Future studies could also statistically test the effect of co-creation on perceived usefulness and ease of use in the TAM, taking into account the gap between citizens' inputs and final IT-enabled solutions. Third, the study suggests that citizens' expectation management seems key to moderate the effect of co-creation on the perceived usefulness of IT-enabled solutions. Future studies could further explore how strategies and tools for expectations management could increase perceived usefulness in the co-creation process. Finally, the study put more emphasis on the first three stages of the co-creation process, while less on the building phase. Future research could further explore the building phase through an agile development view to explore more in depth how to incorporate citizen-generated ideas.

7. Reference

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