Volunteer Co-production in Emergency Management in Excluded Areas: Using Civil Citizens and Semi-professionals as First Responders

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Abstract: This study explores ICT-enabled co-production using civil citizens and semi-professionals as volunteer first responders in excluded areas, in order to identify key factors and to compare the groups. It shows that volunteers can make a major difference if arriving first at an emergency site, e.g. saving lives, administering CPR and extinguishing fires. The semi-professionals are more protected than civil citizens where challenges relate to individual versus collective engagement, gender aspects, language barriers or insufficient legal protection. However, the citizens have an advantage in relying on easily accessible ICT support installed on their own mobile phones. For the initiatives to expand and enable long-term engagement, calibrated ICT solutions matching competence, role and language with incident and area are needed. The study confirms previous research arguing for the merging of policy science and information systems research in times of rapid digitalized public-sector transformation but adds that they need to be complemented by perspectives from sociology in initiatives involving excluded areas.

Keywords: public-sector innovation, citizen co-production, volunteer engagement, ICT, excluded areas.

1. Introduction

At a governmental level, transformational government refers to an increasing awareness over the past decade of the need to address the broad and complex set of cultural and organizational changes that are needed for ICT to deliver significant benefits to the public sector, including government interaction with civil citizens (Bannister & Connolly, 2011). This is also relevant to local, bottom-up public services and public-sector innovation collaborations, where digitalization has paved the way for various initiatives built around ICT-enabled volunteer engagement. In an e-government context,they are sometimes referred to as "do-it-yourself government" or "we-government" (Linders,

2012). Volunteer engagement has been explored using different perspectives and theoretical lenses; for example, co-production (Alford & O'Flynn, 2012).

The public sector is undergoing rapid transformation in response to increasing global challenges, in terms of such aspects as natural disasters, migration streams, increased socio-economic gaps, urbanization, aging populations, war and terrorism, financial cutbacks and resource shortages (Haddow & Bullock, 2013), which have put an enormous strain on emergency response organizations worldwide. In terms of socio-economic gaps, the tendency in many western countries is towards growing segregation, whereby an increased number of urban sub-areas are characterized by poverty and social exclusion, sometimes to an extent where societal structures are deemed absent and are replaced by parallel structures, and where criminality increases (Guldåker & Hallin, 2014; Chalfin & McCrary, 2017). In such areas, research reveals poorer health and school results, higher unemployment, and, not least, a larger number of emergencies than for the rest of the population (David & Enarsson, 2012). For instance, those exposed to intentional urban fires in Sweden more often live in socio-economically disadvantaged sub-areas (Guldåker & Hallin, 2014). In emergency response, volunteerism initially expanded rapidly within large-scale crisis management (Diaz, Carrol & Aedo, 2016). Over the past decade, organizing citizen volunteers and semi-professionals (i.e. people who have another occupation than first responder but with training, and/or competence in an occupation that could be used for emergency response) as first responders have also gained some attention in relation to common accidents on a smaller scale (Diaz, Carrol & Aedo, 2016). In Sweden, which has been progressive in developing the concept, the idea was first applied in small municipalities where semi-professionals can complement the professional response organizations, and in sparsely populated rural areas where civil citizens are often closer to an incident site than the official organizations (Pilemalm, 2018; Ramsell, Pilemalm & Andersson Granberg, 2018). More recently, it has spread to socially vulnerable municipalities and excluded sub-areas in large cities. The concept is enabled by modern ICT, such as people having access to mobile devices with GPS positioning, which can be integrated with the emergency response organizations' systems for dispatching resources. To date, there have been few if any studies on ICT-enabled volunteer engagement in first response in excluded areas within western countries, since the phenomenon itself is rather new. This study focuses on a brand-new initiative using semi-professional (security guards) and citizen volunteers as first responders in collaboration with the municipal fire services, in two municipalities outside the capital of Stockholm. The initiative is aimed at improving safety and the effectiveness of first response and reducing the consequences of emergencies in areas exposed to high rates of crime and accidents. The initiative is studied here as an example of public-sector, ICT-enabled change under the lens of co-production.

1.1. Study aim and objectives

The aim of this study is to explore the concept of engaging civil citizens and semi-professionals as volunteer first responders in socially vulnerable, excluded areas. Specifically, the objectives include:

- Describing the recruitment and tasks of the volunteers and identifying key factors to implement the concept in terms of benefits, challenges and needs.

- Identifying the distinct features of the ICT artefacts as a catalyst for the initiative.
- Comparing the two volunteer groups to see what aspects of the concepts apply to both groups and what differences there are.

The study is a continuation of a previous study of the initiative's early phases with only the citizen volunteers included, presented in Pilemalm (2019). This study adds data from security guards working as first responders in the studied areas, referred to in the study as semi-professionals, and also a comparison between the two groups. Semi-professionals are also seen as volunteers in the study because, even though their engagement is regulated as a collaboration between the fire rescue services and a private security company, the engagement is voluntary, i.e. each individual chooses whether to engage or not, to receive training for the task or not, and can always choose whether or not to respond to an alert from the fire services. Also, theoretical and practical perspectives from the domains of transformational government, co-production, e-government/e-participation, and how they have thus far been applied to citizen engagement in excluded areas, have been added. The intended audience is researchers and practitioners in emergency response, those involved in public-sector transformation, ICT-enabled change and volunteer co-production initiatives in general, and in excluded areas specifically. The study should have international relevance since both volunteerism and excluded areas are growing globally and since our society shares the challenges, even though various countries' structures, regulations and legal mechanisms differ.

2. Background

In this section, public-sector innovation and co-production are first described from a general perspective, then they are related to emergency response and excluded areas. This is followed by a brief description of the initiative under study.

2.1. Public-sector innovation and co-production

Public-sector innovation can be traced back to the 1960s. Recent decades, however, have seen an increasing trend of replacing random initiatives with more systematic work and planned innovations, as a response to pressing societal challenges in an era when the public sector's own resources are constrained (AvBason, 2018). This can take various forms and involves public–public, public–private, and/or public–third-sector partnerships. Another form concerns citizen engagement, which is described from various perspectives, sometimes depending on research discipline.

In relation to this, it is possible to speak about co-production, where different actors, e.g. volunteers, are increasingly involved in public-service delivery, as part of the conception, design, steering and management of services (Ostrom, 2016; Alford & O'Flynn, 2012). From the perspective of e-government, it has also sometimes been described as a form of "do-it-yourself government" or "we-government," where it is argued that, with digitalization, the possibilities to co-produce have increased (Linders, 2012; de Filippo et al., 2016). In comparison with earlier forms of e-government, we-government implies that a certain group of citizen volunteers takes on certain tasks from the authorities, not only for themselves, but also for their co-citizens. This, in turn, requires that their ICT artifacts are integrated with the authorities' own information systems (IS). Speaking in terms of

IS development and research, co-production and we-government can thus be related to concepts of co-creation, co-design and participatory design (PD) (AvBason, 2018; Ostrom, 2016; Alford & O'Flynn, 2012; Schuler & Namioka, 1993). Of particular relevance to this study, it has been argued that designing for and co-creating with vulnerable groups is a key priority to advance and benefit the contemporary service field (Ostrom et al., 2013). From a wider perspective, volunteer co-production opens up opportunities for interesting mergers of research disciplines; for example, policy science and IS, a cross-fertilization which has recently been pointed out in relation to government and a public sector undergoing change (Gil-Garcia, Dawes & Pardo, 2018; Melin & Wihlborg, 2018; Janowski, Pardo & Davies, 2012). This study therefore applies intertwined co-production/we-government/IS perspectives and relates these to the on-going discussion.

In relation to excluded areas, it is sometimes claimed that the social contract between citizens and the authorities is crumbling (Wijkström & Zimmer, 2011). This is especially notable in an increasing number of urban sub-areas characterized by segregation, ethnic diversity and few opportunities for inclusion in society. In these areas, residents experience insecurity and a lack of trust in the authorities and perceive themselves as having little possibility of influencing their environment or even their own lives (Guldåker & Hallin, 2014). Unemployment is usually higher than average, resulting in low socio-economic status, and recruitment to criminality is correspondingly growing, especially among young people (Urinboyev, 2016). Accidents also tend to strike according to patterns related to such aspects as gender, ethnicity, class and living area (Sefyrin & Pilemalm, 2019; David & Enarson, 2012). In this study, these areas are referred to as socially vulnerable areas, or excluded areas. This trend is global and in need of handling. Increased co-production could be one way forward. At the same time, several studies during the recent decade have highlighted that disadvantaged people, such as racial minorities, the less educated and those in lower socio-economic situations, are less willing to participate in co-production (Holmes, 2011). To date, however, there are few if any studies that focus on co-production in the rapidly growing excluded areas in many western countries, e.g. in Scandinavia, simply because they are rather recent phenomena relating to recent global societal development. The same goes for (w)e-government, where there are several studies on citizen engagement in general (e.g. Linders, 2012) but where those on vulnerable or excluded groups tend to focus on the branch of e-participation, often taking place in poor or under-developed countries (e.g., Huffman, 2017; Filho, 2010). There is thus a need to explore co-production (or we-government) in this context, to identify key factors in terms of benefits, challenges and needs and, based on this, to suggest ways forward.

2.2. Volunteer co-production in emergency response in excluded areas

This study took place in the context of Swedish emergency response, referring to actors, technologies, procedures and rules which aim to save lives and minimize human suffering and material damage in emergencies such as traffic accidents, fires and medical situations. In Sweden, various co-production initiatives have been undertaken over the past decade to improve efficiency and overcome long distances by the involvement of various societal resources in day-to-day emergency response, in collaboration with the professional operative response organizations (fire services, ambulance services, and the Public Safety Answering Point (PSAP)). The first example includes cross-

sector collaboration using entirely new occupations; for example, security guards, home-care personnel, taxi drivers and park guards, as first responders. The occupations that are involved have competence and/or equipment suiting first response (e.g. medical training, vehicles) and are already on patrol in society, which means that they might be close to an incident site. Voluntary semi-professionals are employed, or paid, by some level of government (typically local, e.g. municipal) to take on additional tasks in emergency response (SOU, 2018). Thus, they already have their regular full-time employment and add on the new voluntary responsibility as a first responder (Sund & Jaldell, 2018; Venema et al., 2010). The most prevalent group thus far is the collaboration between security guards and the rescue services. In the context of this study, the semi-professionals are guards employed by a large Swedish security company chain, which is privately owned. In public-sector innovation/co-production terms, it is thus a public-private partnership. The concept was first applied in small municipalities which have limited resources at their fire station, or where the fire station was even located in another municipality.

The second example concerns civil volunteers. Citizen volunteers have no formal organizational affiliation (Jaeger et al., 2007; Linders, 2012; Venema et al., 2010; Whittaker et al., 2015). Here, the concept first emerged in sparsely populated rural areas in northern Sweden, where the response organizations are located a long distance from small villages. There is thus a large chance that civil volunteers will arrive first at an emergency site, providing basic first aid while waiting for professional resources (Pilemalm, 2018; Ramsell, Pilemalm & Andersson Granberg, 2018).

Over the past few years, similar initiatives of both kinds have emerged in urban areas, above all located near Stockholm. Stockholm has a population of about ten million people, when the surrounding municipalities are included, and has expanded rapidly in recent decades, due to both urbanization and refugee immigration, not least during 2015-2016. The studied initiative is taking place in two municipalities outside Stockholm, each with about 100 000 inhabitants. Here, the major Swedish Fire Response Association has started an initiative that involves direct collaboration with the two groups of volunteers.

3. Methods

In this section, the general research approach is presented first, followed by the specific data collection methods.

3.1.   Case study and action research

The study can be characterized as a case study inspired by action research. The overall study design is an explorative case study (Flybjerg, 2006) in that it views volunteer co-production in emergency response as the overall phenomenon being studied, with comparisons between two volunteer groups. The part involving the citizen volunteers has the twofold character of action research and case-study research, meaning that the study takes place within a project where the researchers aim to develop and improve the initiative together with the participating actors (Denzin & Lincoln, 1998), including the citizens.

3.2. Data collection: semi-structured interviews, pairwise interviews and focus groups

The study was performed as a qualitative study, including five semi-structured interviews, consisting of four individual interviews and one pairwise interview, and one focus-group interview with five respondents (Table 1). In semi-structured interviews, a template or set of themes is usually applied to guide the interview, but no strict adherence to the template is required and respondents are allowed to make other associations during the course of the interview. Pairwise interviews and focus groups work similarly, but enable interaction of respondents, intra-group dynamics and collective views on a particular phenomenon to emerge from a group whose members have experience or knowledge concerning the topic in question (Myers, 2009). A snowball sample approach (Myers, 2009) was chosen since the initiatives are new, emerging and undergoing expansion. For instance, when the civil citizen project started in spring 2018, only about 10 civil volunteers were involved in the system in the excluded areas and it was deemed important to interview those who had responded to several alerts. It was also deemed necessary to include both the operative and the management level in both volunteer groups.

For the civil volunteer initiative, first, a focus-group interview was held with a fire team consisting of one fire chief and three firefighters. Another fire chief joined for the second half of the interview and continued responding to questions after the team had to respond to an incoming emergency alert. The focus group lasted in total for 90 minutes. All focus-group respondents played a role in the citizen volunteer initiative. This was followed by interviews with the instigator of the initiative and the current project leader, who took over from the instigator (both had a background from the fire services but also experience from the ambulance services), and two civil volunteers who were residents of excluded areas and had acted on several alerts. Each interview lasted about one hour. For the semi-professionals, the pairwise interview included the business developer/project leader for the collaboration from the security company and a security guard who was a volunteer first responder. It lasted for about two hours and was carried out during the same period of time as those with the citizen volunteers, in order to enable comparisons.

For all data collection, the same basic templates were applied, but adapted depending on whether someone from the fire services, a semi-professional or a civil volunteer was being interviewed. All interviews were audio-taped and transcribed. For the analysis, a thematic approach was used (Myers, 2009), clustering data into overall themes based on the empirical data and in line with the action-research approach, with a focus on development; for example, key factors, perceived benefits, challenges and needs. Two researchers are involved in the study and performed the data collection together. The author of this paper was involved in all the data collection described below, including the construction of interview templates for both groups, carrying out several of the interviews and the data analysis. The author received feedback from the other researcher on the identified themes.

Table 1: Respondents participating in the study.[1]

Focus group	Fire chief (1+1)	Firefighters (3)		5
Interviews	Project instigator (1)	Project leader (1)	Volunteers (2)	4
Pairwise interviews	Project leader from security company (1)		Security Guard (1)	2
Total number of respondents				11

4. Results

The identified themes are presented in the following. They include an overall description of the respective co-production form, the recruitment process, the ICT artefacts used for dispatching, first-response tasks and the identified key factors in terms of benefits, challenges and needs associated with each initiative. A comparison between the two volunteer groups will be integrated throughout the results section.

4.1. Using civil and semi-professional volunteers as first responders

In the first initiative, the fire association recruits citizens living in socially vulnerable/excluded areas as first responders. The volunteers are provided with one day of basic training in such areas as first aid, heart-and-lung rescue (CSPR), extinguishing small fires and acting in single-vehicle traffic accidents. They also receive a backpack containing a first-aid kit, reflective vests, pocket masks and hand-held fire extinguishers. In the second type of initiative, a large security company is hired by the fire association. This collaboration is much more formalized in that the company has signed an agreement and the security guards can also bring their own equipment to the emergency site. For instance, they have uniforms, fire extinguishers and body armor. They also have their own vehicles, provided by the security company for their ordinary occupation, and have their own training programs in addition to the first-response training provided by the fire association.

But there are also similarities between the groups. In both cases, the idea is not to have the volunteers replace the professional response organizations, but rather for them to carry out first response while waiting for the professionals, in order to reduce first-response time. In addition, acting on the alert is always voluntary. The aims of both initiatives are also twofold; firstly, to create a sense of presence, security and social relations in these areas, and to decrease the incidence of intentional fires (mostly in cars), assaults and vandalism. The security guard claims that their presence patrolling the areas is of great importance, not only to prevent incidents but also to hinder them from escalating:

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[1] Table not correctly formatted as to headings in table Should be in bold but this function is dimmed when using table format.

Through my mere presence, I can see to it that they [adolescents] don't do anything against the rescue services or start something else. We have a calming effect. It's taken a few years to achieve this effect, but now we have it.

Secondly, if an emergency occurs, the aim is to have the volunteers act as first responders for certain alerts. To receive alerts, volunteers have to be less than five kilometers away from the emergency site. There is thus the hope of a more effective response if an emergency arises, even if the initiative is taking place in an urban area, where the response times for professional response organizations are relatively short.

4.2. Recruitment of volunteers

During the recruitment process, as for the civil volunteers, the fire services have deemed it important to engage people who have a certain social status in the sub-areas. An example could be the priest of a local church. Another idea is to build on family and social relations; for example, if your relative is a volunteer first responder, you may think twice about setting a car on fire nearby. It has also been shown to be crucial that volunteers who are active in a certain area speak its dominant language and can acts as interpreters, since many people in these areas do not speak Swedish:

A problem was also that everybody believed the entire block was going to burn to the ground. Everybody who lives there ran to their balconies and were about to jump because they thought they were going to die. There were huge problems and no interpreter in place, no one from the fire station. Then I thought, what the hell, it's time to find out if I can be of any help. (Volunteer 1)

A similar motivation is gender related, with the hope that immigrant women will improve their prospects for integration into Swedish society by becoming volunteers. The responders from the fire services described how they have used local-interest associations, the municipalities and related real-estate companies for recruitment campaigns. The volunteers confirmed that they received information about the initiative from their respective real-estate companies. The interest has generally been much higher than the fire services expected. One of the fire chiefs provided an example in which an entire Syrian Orthodox association of about 200 women signed up their interest. This forced the fire services, which pay for all related expenses, to initially turn down many of those who wanted to join in.

An initial fear was that they may recruit individuals who are involved in criminality. Before volunteers undergo training, therefore, they are first checked with the police to discover if they have a criminal record. To date, this fear appears to be groundless:

Even though it is possible that an individual is known to be a criminal by those living in the area but not by us and we recruit them, then they might feel increased trust in us for creating social benefits… Or it will have the reverse effect [on trust] ….it's a break-even.…Those into heavy criminality spreading fear will not show interest; they have so much capital violence to manage, a full-time assignment… (Project leader)

For the semi-professional volunteers, the situation is rather different because the security guards are recruited on the basis of their ordinary job, not because they live in a certain sub-area. Still, the security guard notes that many of the guards who have volunteered for the first response tasks live

in the sub-areas in which they work, and that the security company has actually attracted people with a previous record of juvenile crime:

When….they actively seek us out to get a job. Then we've reached pretty far in our communications with the community residents…(Security Guard)

4.3.   Dispatching of volunteers

The civil citizen volunteers are dispatched by means of a commercial app that was originally developed for security alarms when an elderly person has lost his or her way, and which has been adapted for the current purpose. The volunteers' mobile phone GPS functions are connected to the fire services' system for handling incoming alerts. If the type of emergency is one of those described below, the volunteers will receive an alert with a distinctive signal if they are within a radius of five kilometers of the emergency. The app displays the position coordinates, the address (road, but not specific number), municipality and type of emergency, giving basic information (Figure 1). It also includes a map, and when the alert is triggered a red button appears on the map, indicating the emergency site. Through this button, the volunteers (receivers of the alert) can also communicate with the rescue services and each other, to some extent, and provide updated information about the emergency. It is the fire services' back-office systems that provide the GPS coordinates, the addresses and the information about the emergency, i.e. the volunteers receive the same basic information as the professional first responders.

Figure 1. Dispatching of volunteers through the app. The type of incident here is a single-vehicle traffic accident in which the victim is unconscious.
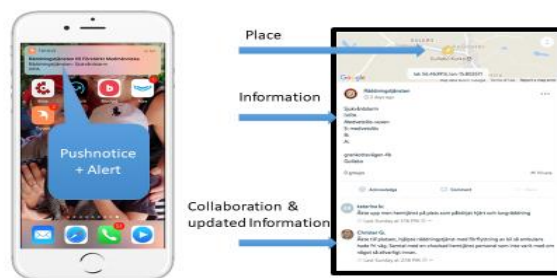
In the case of the semi-professional volunteers, the dispatching is achieved using hand-held RAKEL terminals. RAKEL is the national radio communication system used in Sweden, used by all the blue-light response organizations, e.g. the rescue services, the ambulance services, the police and the public safety answering point (PSAP). This means that they use the same ICT artefact as the professional response organizations and can communicate with all of them, in real-time. On the other hand, RAKEL is primarily for audio communication, the scope for text-based information is much more limited and the possibility to send pictures and movie clips does not exist. RAKEL is currently in transition from analogue to ICT based, implying that semi-professionals may receive and overhear the analogue communication among the professional response organizations.

4.4.   First-response tasks

The civil citizen volunteers are dispatched to the following types of emergency: outdoor fires (e.g. vehicle), fires in buildings, heart failure, single-vehicle traffic accidents and drownings. The emergency should not be risky for them (e.g. uncontrolled fires or a shooting), and they should be able to carry out first response using the kit in their small equipment backpack. The volunteers perform a range of tasks at the emergency site but those reported as most frequent by the volunteers are: extinguishing small fires, checking if the fire has spread and in this case informing the fire services, and backing bystanders and keeping them at a distance when the latter arrives. They have also acted in some single-vehicle traffic accidents and after assaults (but here they must never intervene but await the police) with basic first-aid tasks (band aids, stopping minor bleeding) and providing comfort, and on heart-failure alarms.

The semi-professional volunteers act on a wider range of incidents and perform a broader range of tasks, all of which are regulated in the formal agreement with the fire rescue services. In addition to the types of incidents to which they are alerted, e.g. unintentional fires outside and in buildings and burglar alarms (but this is in collaboration with the police), they are allowed to break into buildings and have the equipment to cut up cars with victims in them. For the semi-professionals, the distinction between what they are and are not allowed to do seems more difficult to control than for the civil volunteers. For instance, the security company's project leader is clear that security guards will not act on suicide alerts. In reality, the security guard interviewed has gone on several of these as he "has never rejected an alert". This is probably a consequence of the guards sometimes overhearing the RAKEL analogue communication among the involved response organizations, which thus enables them to make a personal choice to go, even if this is outside the regulations and they have not been directly alerted. Also, the security guards are not supposed to intervene in assaults. However, the security guard claims that he has been knifed several times. On the other hand, the establishment of successive agreements with the fire services, in other cases, seems to protect the semi-professionals from potential danger:

We found out…that in one of our missions, response operations on drownings were included. But our personnel were not equipped with life jackets, they had not checked this when they trained them. And we ourselves, we never perform swimming tests on our employees. So we basically sent individuals who we had work protection responsibility for, independent of season, to do rescue operations in the water but had not equipped them with life jackets and did not know if they could swim… We have limited this task and written contractual agreements…(Project leader, security company).

The civil volunteers receive a debriefing from fire service personnel immediately after a response operation, but no follow-ups. But, as stated by one of the volunteers, "the fire station is always open". The civil volunteers are collectively insured by the fire association. The semi-professional volunteers, on the other hand, have access to their own debriefing activities, are insured by their own employer and are also provided with vaccination programs, e.g. for Hepatitis B.

4.5. Perceived benefits

In the case of the civil volunteers, it is deemed too early to say whether the major aim of the initiative has been fulfilled. However, it is clear that there is great engagement on the part of the volunteers, and a desire to create a safer neighborhood. Also, when something does happen, volunteers sometimes arrive before the fire services and a single first response can make a major difference, as illustrated by the following quotes:

I was at home and received an alert concerning a fire near a health center. Thought that they wanted to test me to check how I function. I was the first person at the site, it was a car on fire. I extinguished it completely. (Volunteer 1, first alert).

Was at home, 200 meters from me, went there, they are screaming from the balcony that he's died. Seven floors up. He was on the floor, not breathing, I started heart and lung rescue. He comes back, starts breathing. Two minutes later, the ambulance arrives. He's alive. (Volunteer 1, heart failure alert).

Again, communication and acting as an interpreter are central, as well as having knowledge about the area and knowing the people who live there. This is something the fires services and volunteers agree upon:

I believe very much in this. Above all, they might have knowledge of the area and who is the leader, so to speak. When the police take action, the outcomes are often not that good. (Fire chief, focus group, volunteers backing crowds of people)

I have learnt how to "back" a crowd of people. I know the language, I can tell them that this smoke is a cancer risk. (Volunteer 1).

For the semi-professional volunteers, the perceived benefits are very similar, the major reason being that the guards are continually on patrol in the sub-areas so they have no turnout time (the time it takes to leave the fire station). The estimated average time to reach the incident site is 3 minutes and 56 seconds for the entire municipality X, including the most remote areas. For the central municipality, the average time is even shorter.

4.6. Challenges

The major perceived challenge is ensuring that the civil citizen volunteers actually respond to alerts and go to the incident site. Massive interest in recruitment is not the same thing as actually patrolling the neighborhood or taking action when something happens. There are a few enthusiasts who respond to many alerts, but they are often the only ones responding to that particular alert, making first response an individual task. The project leader believes that a potential explanation is that few volunteers know any firefighters and that "the fire services work in an end room". This might result in hesitancy about intervening in an emergency. He also argues that it might have been better to start on a larger scale:

I think I would have started on a larger scale. More volunteers from the very beginning [training/equipping]… to kind of create a feeling of local and not individual engagement.

A related challenge concerns gender aspects. As already mentioned, there was a hope that the initiative would pave the way for women to move into society, and many women did express interest. However, one year later, all the active volunteers are men and the project leader expresses uncertainty when considering how a female volunteer would be seen; for example, when backing people. Also, a common notion among all the fire-service respondents is that communication and learning are top down; i.e., the fire services train the volunteers and tell them what to do, but there is no mechanism for the volunteers to provide feedback or share their knowledge. The project instigator is somewhat self-critical about this:

This is true, and we devoted no time to them teaching us. It's an important point, that this should go both ways…It's not completely unproblematic having a group of more or less ethnic Swedes going to XXX [sub-area] and telling people "this is how it works".

As the initiative progressed, Facebook (FB) groups were started in various sub-areas of the municipalities. However, there is much more activity in those groups that are based in more well-off areas, where the majority of civil volunteers are of Swedish ethnicity. Neither of the two volunteers in the interviews have joined a FB group.

Another perceived challenge is, again, language. It is not optimal to send just any volunteer, but rather one who knows the particular language of those involved in an emergency or the dominant language in the given sub-area. There is also the general challenge of evaluating the concept, both qualitatively and in terms of efficiency; for example, lives saved, response times and monetary value. Since this is an initiative in progress, no such plans had been made at the time of this study. However, they are important for motivating the spread of the concept among municipalities and for decision-making by politicians, among others.

For the semi-professional volunteers, the associated challenges seem rather different. Two-way communication is provided in real-time through the RAKEL system, both with the professional response organizations, and among the security guards themselves. Thus, even though a security guard is trained to go on a mission by him- or herself, also in their ordinary occupation, first response often becomes a collective engagement. The security guard interviewed mentions that he has two colleagues patrolling in the same areas on similar time schedules and that, often, all three of them show up at the site. Neither, somewhat surprisingly, language is not mentioned as a problem; but there is also a difference here because the semi-professionals do not patrol a specific sub-area but rotate between them. As mentioned before, several of them have also been recruited from their own neighborhoods. The semi-professional volunteers also have their own FB groups administrated through the security company. For the security guards, the perceived challenges rather revolve around the agreements regulating their first-response missions and tasks. As mentioned earlier, it has happened that security guards are dispatched to types of incidents for which they are not prepared (e.g. drownings), since this is stipulated in their contracts. Conversely, they sometimes go to incident types that they should not attent, based on personal judgements. Suicide has been mentioned; another example is traffic accidents on the highway E4 passing through one of the municipalities. The security guards' cars are not supposed to go because they do not possess emergency response vehicles and there might be a potential danger to passing traffic if they stop. Nevertheless,

it has happened that guards go on these alerts. Also, in Sweden, the Public Procurement Act currently stipulates that the Swedish municipalities that want to use security guards must in the future perform procurement processes. The security guard company's project leader argues that this may lead to a situation in which those companies providing the service for the lowest price will receive the assignment since no other quality indicators currently exist:

The Public Procurement Act with pricing makes it more difficult for us... I have difficulties imagining that there are companies or branches that have succeeded so well in their integration work as XXX [company name] or the security branch. Because we recruit people from the areas in which we receive the assignment…from the societal categories in which we are and work. Which means that often someone knows someone and so on. And if you can then use them, it's a strength…so that we actually have the possibility to work with an economy so that we can work preventively.

There is thus a fear that the Procurement Act will not only lead to a lower-quality response but that the preventive work, i.e. patrolling the area and talking to young people, preventing them from engaging in crime and creating social relations perhaps leading to recruitment, will diminish.

4.7. Needs

The fire-service respondents agree that the major need is to expand the initiative, in terms of having more civil volunteers acting as safety persons/first responders, making it locality-based rather than individual-based, as expressed by the project leader. The volunteers also see the need to expand, and one of them suggested that they could take part in the recruitment process; for example, by engaging colleagues at their workplace so that they could go on alerts together, knowing each other beforehand.

Apart from this, the volunteers did not express many needs, even though they were asked explicitly. One of them mentioned a warmer jacket and that exercises are good. A concrete need, however, concerns the ICT solution. In the app, the supplier has included a map to more easily navigate to the site. However, the volunteers being interviewed mentioned that they sometimes receive the wrong address from the rescue services, a problem they share with the fire services (since it is the back-office systems that sometimes send incorrect coordinates or information e.g. indicating roads), thus delaying response time:

I don't always know exactly what building or tenement. With a straight address, it would be perfect. In…[sub-area] there are two roads that are often mixed up in the SMSs. Not even the fire station always knows. [Volunteer 2]

The volunteers would thus like to have an extended app version that includes an inbuilt GPS guidance system to the emergency site.

The project leader also mentioned the importance of the app but added that some structure, templates and matching are needed to send the "right" volunteer to the "right" site, reaching different roles, competences and language groups:

If a certain group of immigrants becomes so dominant that we can't reach that group, then we would need an app that could reach that specific group.

As regards the semi-professional volunteers, the need for quality indicators and clear regulations is repeatedly stated by project manager, as described previously. As for ICT, the security guard is content with being able to communicate with the other response organizations through RAKEL, but still describes it as heavy, old-fashioned and clumsy. He requests Android-based mobile solutions through which he can send text-based information, pictures and even video recordings from the incident site, in order to prepare the arriving response organizations better. The project manager suggests a common app/platform for all security guards in Sweden that has taken on first-response tasks, not the least to exchange experiences.

Also, it is likely that the semi-professional volunteers would benefit from the same calibrations of ICT solutions as the civil-citizen volunteers. By matching competence with situation, they might avoid potential risky situations they sometimes encounter today.

The most distinct similarities and differences perceived between the two volunteer groups are summarized in Table 2.

Theme	Similarities	Differences between civil citizens/semi-professional volunteers
Basic assignment	• Prevention and response • Voluntary and IVPR	• Level of equipment and training • Agreements versus absence of agreements
Recruitment	• In own sub-area	• Gender and social relations aspects more pronounced in case of civil citizens
ICT/dispatch	• Co-production enabled by GPS functionality • ICT support needs to include calibration	• RAKEL radio-communication system versus mobile phones and app
First-response tasks	• First response and aid in relation to e.g. intentional fires, traffic accidents, heart failure	• Semi-professionals are alerted on a broader range of incidents and tasks
Benefits	• On-patrol and near incident lead to shorter response times and sometimes saving lives	• Semi-professional engagement is collective, based on two-way communication, which creates protection and a sense of security.
Challenges	• N/A	• Civil citizens' first response: few individuals may lead to a fear to act, top-down communication, language barriers and low activity on social media • Semi-professionals' first response: agreements, the Public Procurement Act

Needs	• Expanded functionality and calibration of ICT support	• Civil volunteers: basic equipment • Semi-professionals: quality indicators and complementary ICT support with text and picture-based information

5. Discussion

In this section, first co-production and we-government in excluded areas is discussed, including comparisons of the various volunteer groups. The co-production experiences are then related to co-creation and end-user involvement in the design of ICT artefacts. This is followed by a more general discussion of digitalization as an enabler of public-sector innovation and co-production and a more comprehensive comparison of how different volunteer groups can complement and learn from each other.

5.1.   Co-production in excluded areas

Public-sector innovation is rapidly transforming our society at a global level, as are initiatives directed specifically towards co-production (Linders, 2012; Alford & O'Flynn, 2012). At the same time, socially vulnerable and/or excluded areas are not new phenomena, in either western or non-western countries, and parallel societal structures and gang criminality have been studied for a long time (Chalfin & McCrary, 2017; Klein & Maxson, 2006). Relating this to co-production, there are studies arguing that security in these areas is not delivered by the police or an authoritarian attitude, but is rather the product of relationships, negotiation and collaboration (Holmes, 2011). Rather, initiatives from "the inside", whereby a community's own residents are recruited to handle criminality and to work with (instead of against) the police have long existed, for example, in shantytowns across the world; albeit not without challenges. Boonyabancha and Keerr (2018), for example, define co-production as:

a process that opens space for poor communities to work with their local governments and other public and private stakeholders to deliver various development goods. (p.44)

However, as mentioned in the background section, several researchers claim that it is more difficult to engage citizens in poor areas in co-production, and these researchers fear that this will strengthen inequality between such residents and citizens living in wealthier areas. Thijssen and van Dooren (2015) argue that more research is needed on how city neighborhoods, social capital and status affect the will to engage in co-production. At the same time, the majority of recent studies on co-production in relation to disadvantaged groups in terms of ethnicity have tended to take place in non-western and/or underdeveloped countries (Holmes, 2011). However, socio-economic gaps are expanding rapidly and related challenges now also include countries where thus far they have not been so tangible. Sweden is a typical example. The country took many immigrants during the refugee streams of 2012–2016 and is currently struggling to provide them with opportunities for integration and access to the Swedish labor market. The term we-government stems from the e-government field, and was coined by Linders (2012) to refer to digitalized citizen co-production, but it has

no current widespread use. Also, when taking the e-government perspective, studies on poor communities or excluded areas also tend to take place in non-western parts of the world and often in studies on e-participation to enhance democracy (e.g. , Huffman, 2017; Filho, 2010). In conclusion, regardless of what term or perspective we choose to apply, studies like this one, reflecting recent societal developments, seem to be needed.

Relating the above research to this study's results, it is clear that the civil volunteers seem willing to engage but do not always feel secure about acting as a safety person or first responder. When making a brief comparison with sparsely populated areas dominated by people of Swedish ethnicity, a different picture emerges (a full comparison is not possible since these studies have spanned longer time periods with more volunteer respondents). Here, volunteerism is a collective effort based on long-term social relations, sometimes also including the victims of accidents. Volunteers never go on an alert alone, and they have been more active in putting explicit requests to the fire services; for example, for trauma support (while one of the volunteers in this study claimed that this is not needed because he had seen worse things in his home country). They also suggested added functionality to their dispatch ICT solutions, sometimes even implementing their own functions (Ramsell, Pilemalm & Andersson Granberg, 2018). This is also true for well-off rural areas surrounding Stockholm, where the same concept is applied within the same fire association initiative and where the civil volunteers are also very active on social media channels (FB groups for each volunteer area).

Of specific interest for this study is also a comparison with the semi-professional volunteers as co-producers of first response. Here, the co-production is rather based on a public-private partnership (Avbason, 2018) where first response is voluntary but where the semi-professionals are much more protected as a volunteer group by the infrastructure and regulations provided by their own employer. For the security guards, taking on first-response tasks implies doing things that are often familiar from their own occupation, but it also denotes acquiring higher status since many guards initially aspired to become firefighters or police officers. Also, first response is much more of a collective effort, based on direct, two-way communication with the professional response organizations. As to co-production, we acknowledge that the choice to see semi-professionals as co-producers in the study context, might be challenged. As argued by Brandsen et al (2018), co-production as applied e.g. in economics and public administration, usually refer to citizen engagement and involvement in public service delivery, not to occupational categories signing up for security contracts with a public authority. At the same time, they point out how increased multi-disciplinary spreading of the concept has caused some blurredness around it and its original definition. In this study, we chose to take the co-production perspective also on the semi-professionals, based on their engagement as voluntary (even though contracts they can always choose to go on they dispatch or not, can always prioritize their ordinary work tasks and do not replace professional response organizations). While we see that this choice might be up to debate, it also opens up for interesting potential of expansion of the co-production concept use, especially in relation to cross-fertilization of various related research disciplines, as discussed in 5.3. Also, the future of semi-professionals in, in this case, emergency response, will play a role in the discussion. For the time being, the security guard company involved in this study have plans for further formalization and steering of the collaboration with the rescue services, which may make them move away from co-production. On the other hand,

in Sweden an increasing number of occupations are seen as candidates for semi-professional re-
sponse e.g. home care personnel and taxi-drivers. Also, in the (at the time of writing) on-going
Covid-19 pandemics, medical students are currently signing up for voluntary work at the hospitals
without contracts, thus blurring the concept between semi-professional and voluntary/citizens en-
gagement even more.

A conclusion regardless of what we chose to call it, is that the civil citizen volunteer concept can
learn from the concept of semi-professionals in relation to these aspects, e.g. by developing two-way
communication and learning with the rescue services and by aiming for collective, larger-scale re-
cruitment through the snowball effect. Such active support for collective, long-term engagement
might reduce the potential fear about acting on an alert, and thus reduce some of the challenges
faced by citizen co-production in excluded areas, as suggested by the research above. Some of these
support measures have also been suggested by the respondents themselves. Another suggestion is
that civil citizen volunteers could receive some kind of certification to put on their CVs, stating that
they have received basic first-response training and acted on alerts. This could motivate and stim-
ulate long-term integration into working life, or even enable their engagement as part-time fire fight-
ers, of whom there is an insufficient number in Sweden. In the USA, the government has tried a
similar approach with CERT projects, referring to certified volunteers who are trained to work in
emergency response teams (Brennan, 2005). Certification aspects also relate to gender aspects, even
though the gender issue seems tricky and requires many more aspects to be considered in the re-
cruitment and engagement process.

5.2.   Co-creation and end-user involvement

Co-production is often related to co-creation (Alford & O'Flynn, 2015) but as increasing numbers of
ICT applications are easily available off the shelf from commercial suppliers, co-creation of the arti-
fact itself is often forgotten. This is also evident in this study, where the commercial app has thus far
not been created together with users, and does not include the functions for GPS navigation, cali-
bration, language or withdrawal suggested by participants in this study. Additionally, the stand-
ardized RAKEL radio communication system has been handed over to the semi-professionals with-
out their co-creation; and even though, overall, the two respondents seem content with, primarily,
the function of real-time communication with the professional response organizations, they miss
functions related to the transfer of text and pictures from the incident site, and have requested
smartphone solutions. Of interest when comparing the two volunteer groups is Ramsell, Andersson
Granberg and Pilemalm's (2019) work, in which a mobile app prototype was developed together
with semi-professional and civil volunteer first responders in rural areas (end-users), along with the
surrounding infrastructure (e.g. training, equipment, legal aspects), even though commercial appli-
cations for the purpose existed. First, this resulted in additional and partially different functions
from those available in the app in this study, which were based on user needs and in line with other
features of the collaborations, which might contribute to a more efficient first response and long-
term engagement. Second, the study suggests that the same ICT solution, with only slight modifica-
tions, will function with both volunteer groups. In the study, basic functions had been developed
and tested, and these tests gave rise to new suggestions about needs and functions; for example, to

receive information about when professional responders will arrive, to be able to see which equipment the responders are bringing, to detect when a responder has arrived and log this automatically, and the ability to send coordinates, pictures and video from the incident site. This strongly reflects the needs identified by this study and was discussed by both voluntary groups. Differences among the two groups related rather to the prioritization of importance of various functions and some design features. This indicates that, even though the incident types, tasks and, above all, the surrounding infrastructure of the respective volunteer groups differ to a certain extent, the same or very similar ICT artefacts and functions apply. An interesting, but challenging, future co-creation task is to determine how to combine the best of both solutions; i.e. RAKEL's direct communication possibilities and straight connection to the back-office systems of various response organizations with the advantages of the mobile app solutions, and whether this is feasible, both practically and legally.

From a wider perspective, co-creation has become something of a buzzword, not the least in urban governance and often for the purpose of including and empowering marginalized groups (Hedensted Lund, 2018). Corresponding IS development approaches that include user involvement rely on the active participation of users, when developing both the ICT artifacts themselves and the surrounding infrastructure (Schuler & Namioka, 1993; Hillgren, Seravalli & Emilson, 2011). In particular, Participatory Design (PD), which has clear political and ideological roots, has been applied to provide exposed societal groups with an opportunity to influence their own situation and environment; for example, in urban planning, in third-world countries and among charities working for homeless people (Halskov & Brodersen Hansen, 2015). Gender relations have also been highlighted by the PD community; for example, how they affect power structures in design groups (Balka, 1997). The need to achieve the co-creation/PD of the collaboration and ICT support is also highlighted by this study. But this implies that you have volunteers to work with in the first place. To date, relatively few citizen volunteers go on the alerts and female volunteers do not exist at all. This reveals a distinct difference from the semi-professionals, many of whom have chosen to take on the tasks, including female security guards. It was also perceived to be difficult to access the citizen volunteers as study respondents (they did not want to be interviewed, which may have been due to such issues as language barriers). These challenges are in line with a recent study on six co-design sessions, suggesting that vulnerable user groups cannot be approached in the same way as in conventional user-involvement processes, and proposing alternative design frameworks involving various games and card exercises, along with intersectional perspectives (Dietrich et al., 2017). On the other hand, Hedensted Lund (2018) concludes that there might be benefits to gain from including citizens in innovation and co-creation processes based on their knowledge, resources, assets and competences, rather than as representatives of certain societal groups, at the same time as this implies a risk of urban development becoming depoliticized.

In conclusion, applying co-creation, co-design and PD alternative frameworks and methods to encourage user involvement may certainly be considered in any future expansion of the collaboration and design of related infrastructure and ICT artefacts in the studied initiative, above all to overcome potential language barriers. However, since the study results rather suggest that the most significant challenge is to involve the citizen volunteers in the first place, it seems much more important to view them as assets based on their achieved competence and experience of first response. Here, it is also possible to consider workshops bringing together the rescue services, semi-professionals and

citizen volunteers. Having the rescue services act as a kind of facilitator between researchers and citizen volunteers might contribute to overcoming barriers, and mixing the two volunteer groups might add to the dynamics and joint design of future ICT applications. On the other hand, this must be carried out carefully because there might also be competitiveness between the two groups. In particular, the project leader from the security guards stated that he saw citizen volunteers in general as a risky group to involve in first response and that semi-professional volunteers are more suited to the task.

5.3. Digitalization as an enabler of public-sector innovation and co-production

The emerging trends all feature digitalization and modern ICT as an enabler. Nevertheless, as argued by Ramsell, Pilemalm and Andersson Granberg (2018) there are relatively few studies that focus explicitly on the direct relation between co-production and ICT artifacts, even though it has been pointed out that ICT can support co-production (Verschuere, Brandsen & Pestoff, 2012). In emergency response, Díaz, Carroll and Aedo's (2016) study is an exception. Even fewer, if any, studies focus explicitly on the ICT artifact itself as a catalyst of co-production. This is true for public-sector innovation in general, including in emergency response. The increased importance of effective emergency response, the transformation of over-stretched public-sector organizations in general having to serve increasing populations in an area of social unrest, and this study's findings, illustrate the need to bridge this gap.

At first glance, the citizen volunteer initiative seems broad and the ICT artifact plays a less-than-central role, with a basic app solution working sufficiently in most cases, even though GPS guidance has been requested. However, the data analysis indicates that, for the initiative to be successful and to expand, the design of the ICT artifact can contribute significantly. Future app solutions should be able to handle calibration of the volunteer concept by adding functions that allow for dynamic resource dispatching, as outlined in the results section. This is also the case for semi-professional volunteers. Although, at first glance, RAKEL seems an effective communication system, lack of calibration and steering actually provides the semi-professionals with the possibility to go on alerts which they are not allowed to act upon, and they sometimes do so. Also, it is interesting that the civil volunteers have Android solutions with more modern interfaces and the possibility to communicate by text and send pictures. In contrast, the semi-professionals have an older solution that provides them with direct communication to the response organizations and with geographical positioning but lacks the above, and where the remaining analogue information sometimes actually exposes them to danger. Again, ICT solutions incorporating the best functions of the two may positively affect both collaborations. In order for the whole system to work, there is also a corresponding need for a thorough analysis of the necessary features and interfaces in the fire services' back-office systems which are to provide this information. Also, here, the overall infrastructure needs to be handled, not least because the office systems sometimes provide the wrong address and/or inexact coordinates. In terms of service design, an emergency response process can be divided into two parts, the service-providing process and the service-supporting process (Kling, McKim & King, 2003). Paying attention to both these processes, including giving correct information to mobile solutions with attractive, easy-to-handle interfaces, and offering improved communication between the fire ser-

vices and volunteers, may also contribute to more volunteers acting on the alerts. This in turn includes the necessity to involve additional stakeholders, such as the fire services, the PSAP, the suppliers of the back-office systems and possibly the ambulance services.

In many sub-areas there are frequent alerts but few civil volunteers responding to them. A more secure solution, with an added function allowing withdrawal if an emergency should turn into something that is dangerous to the volunteers (e.g. toxic fumes, gunfire), may reduce fear about responding to an alert and stimulate long-term engagement. For the semi-professional volunteers, a withdrawal function also seems suitable, but in this case it should also prevent them from going to events at which they should never be present in the first place. In relation to this, similar studies in rural areas (Ramsell, Pilemalm & Andersson Granberg, 2018) have shown that, even when collective insurance is provided, the volunteers are not sufficiently protected by the current Swedish legal system. It seems even more important to address policy and liability issues in areas exposed to high rates of criminality risk, and this may also influence civil volunteer engagement in a positive way.

From a wider, public-sector perspective, the bi-directional influence of technology and various forms of governance has been recognized for over a decade, and was again pointed out recently (Shan, Wang & Li, 2012; Loukis et al., 2016). Relating this to the research field of IS, the discipline has often drawn upon other disciplines when needed (Watson et al., 1997). Several recent studies have claimed the benefits of and need for a cross-fertilization of policy science and IS research perspectives, relating explicitly to emerging forms of government in this era of digitalization (Gil-Garcia, Dawes & Pardo, 2018; Melin & Wihlborg, 2018; Janowski, Pardo & Davies, 2012). This study's findings are in line with this research since digitalization/ICT development needs to consider such issues as the regulations and laws determining what volunteers are allowed to do and what information the alerts can and cannot include. The author of this study has previously argued that there is a need for pronounced interdisciplinary development teams in the case of emerging collaborative forms of public-sector innovation, including cross-sector collaboration and the use of volunteers (Pilemalm, 2018). Adding the above competences to more traditional systems (or business) development teams seems crucial in the context of the current study. On a more theoretical level, it is also interesting to note the dual use of co-production and we-government stemming from the e-government in this study, even though co-production may be viewed as a perspective or theory, while we-government is a term that is used in only a limited number of studies (e.g. de Filippo et al., 2016; Linders, 2012). However, they refer to the same phenomenon and the distinction between them does not seem clear, even though digitalization is more pronounced in the case of we-government. The same goes for the more practical level, where co-creation and participatory design actually set out to do the same basic things, often with ideological connotations, even though they stem from different research fields. Also, as discussed in 4.1., there might be a need to expand on the co-production concept itself with regards to how it relates to volunteerism. Finally, and taking this one step further, this study argues for an even wider exploration and integration of research disciplines, especially when turning to excluded areas, and initiatives involving the residents living there. From both a co-production and a co-creation perspective, it is plausible that the initiatives would benefit from adding research perspectives from other disciplines, in order to expand the knowledge base and enable participation. Examples may include sociology, intersectional perspectives and criminology.

6. Conclusion and future work

This study set out to explore the concept of volunteer co-production, engaging volunteers as civil citizens or semi-professional first responders in socially vulnerable areas, with a focus on identifying the key factors to consider in the implementation aspects and with the ICT artifact as a catalyst. The study also includes a brief comparison between the two groups.

The study concludes that volunteers with basic equipment and training can make a significant difference if they arrive first at an emergency site. The major challenge is actually having civil volunteers respond to an alert and go to the site. Other challenges relate to gender and increasing the opportunities for immigrant women in Swedish society, to language barriers, and to changing the one-way communication from the fire services to volunteers into a two-way flow. Semi-professional volunteers are much more protected because they already belong to a private-public co-production partnership within which their own organization provides regulations, training, debriefing, complementary equipment and so on. Here, the challenges relate rather to quality indicators, handling the Swedish Procurement Act and actually, in contrast to citizen volunteers, preventing eager volunteers from acting on alerts they are not allowed to attend. The ICT solutions provided for citizen volunteers are basic and accessible because they are installed on the volunteers' own mobile phones. Still, they are central to engagement, allowing for the dispatching of volunteers who are near to an emergency. Current solutions for both groups work sufficiently well, but for optimal usage and expansion of the initiative, ICT solutions supporting dynamic resource allocation (role, competence, language, situation), communication among volunteers that also employs text and pictures, and withdrawal functions are suggested. It is interesting to note that, even though the semi-professionals in the study to a certain extent saw the citizen volunteers as competitors, if they could complement and learn from each other (e.g. providing language knowledge versus equipment) and act jointly, both groups, emergency response, victims, the public sector and society as a whole would be likely to benefit.

Previous research has argued that the need to mix perspectives from IS research with policy science becomes particularly pressing in a public sector where new forms of government relying on digitalization – for example, governance, policy networks, co-production/we-government and citizen engagement – are rapidly emerging (Gil-Garcia, Dawes & Pardo, 2018; Melin & Wihlborg, 2018). In particular, policy and liability issues need to be addressed in the emerging volunteer first-responder initiatives. Perhaps most importantly, the issue of directing volunteers to the right situations, i.e., those that do not put them in danger (e.g. shootings) or incidents that they are not psychosocially prepared to handle (e.g. suicide) must be addressed urgently. As mentioned earlier, the past decade of studies of co-production in excluded areas have thus far almost exclusively focused on shantytowns and/or poor countries (e.g. Cepiku & Filippo Giordano, 2014). The same goes for the (w)e-government perspective, where digitalization has often been seen as an enabler of e-participation and online citizen engagement (e.g. voting) aimed at increasing democracy in poor countries. This is nothing remarkable given that excluded areas in many well-off western countries like Sweden are a phenomenon that has emerged and expanded rapidly only during the past five years. Nevertheless, if something happened to a volunteer, this would probably endanger the entire initiative, especially in the case of civil volunteers that are not currently sufficiently legally protected.

Since the initial version of this study (Pilemalm, 2019) was written, it has occurred that also citizen volunteers have been exposed suicide alerts by mistake (but not sent since the dispatching is overheard by the PSAP). Again, the ICT artefact and the surrounding back-office systems are central to the entire collaboration since they notify, dispatch and direct the volunteers. A conclusion drawn from this study, taking the empirical data into a wider public-sector innovation context, is also that many theoretical aspects, approaches, concepts and terminologies used in policy science and IS research, respectively -- for example, co-production/we-government, co-creation/participatory design -- overlap in many respects. More research in terms of distinctions, similarities, differences and potential synergy effects (or challenges) of using them in complementary ways, is needed. Also, relating to the definitions and discussion by Brandsen et al (2018), and in times of volunteerism urgently needed in public service delivery, not the least in emergency response and crisis management, co-production stands at the cross-roads. An expansion and renewal of the concept might be needed. An additional conclusion is that additional intersectional perspectives and disciplines, not least from the field of sociology, become equally important, in this and similar initiatives, in a society where their number is likely to increase.

6.1. Future work

A limitation of this study is that only two citizen volunteers and two semi-professionals were interviewed, and thus the perspective of the fire services is most prevalent. At the same time, the pictures painted by the fire services and the civil volunteers overlap in many respects, somewhat compensating for this. Since this study was performed, more interviews with more civil volunteers, e.g. pointing at similar needs for working with all ICT solutions involved, to avoid incorrect or risky dispatching. In the case of semi-professionals, more security guards at the operative level should be interviewed to provide a more comprehensive picture. Relating current limitation to future work, the app is currently being further developed and also connected to fire detectors in a number of selected tenements, allowing it to also include unintentional fires, for which excluded areas are also over-represented (Sefyrin & Pilemalm, 2016). Research and co-creation/co-design will be continued, with specific attention being given to vulnerable groups; for example, in upcoming workshops and focus groups, to reach more volunteers (both civil and semi-professionals), the municipalities, the fire services, the PSAP and other relevant stakeholders, in order to address the challenges and needs identified in this study. The gender and ethnicity aspects will be addressed by involving a researcher who has studied them previously in IS, public-sector and emergency-response contexts and by working closely with a person employed by the involved real-estate company to involve more female volunteers. Qualitative and quantitative variables are currently being identified and integrated into the app solution, in order to be able to evaluate the citizen initiative and its transferability to other, similar contexts, both in Sweden and internationally.

At a more general level, it is of specific interest to look further into how the original concept, first developed in sparsely-populated, rural areas (civil volunteers) or small municipalities (semi-professionals), can be transferred to urban contexts, what modifications should take place, and also whether the volunteer groups can learn from each other and work together. Sweden is perceived as progressive in terms of organized, long-term, volunteer engagement in emergency response, while

most international studies tend to focus on issues such as on-site volunteers, large-scale crisis management and crowdsourcing (Ramsell, Pilemalm &Andersson Granberg, 2018). As pointed out by these authors, the types of emergencies have both similarities and differences, but being able to use the same volunteers in all of them would be beneficial, because they would be accustomed to the ICT solutions and work procedures. In relation to large-scale crises, future research could thus focus on this dual use of volunteers, not least in Sweden since the government is currently planning for the large-scale digitalized coordination of volunteers, in the aftermath of the widespread wild forest fires in 2014 and 2018 and, not the least, the ongoing COVID- 19 pandemics.

Finally, in the general context of public-sector innovation and digitalized transformation, it would be of interest to perform a conceptual study of how various research disciplines, theories and practices relate to and can enrich each other in the fields of policy science, IS and (w)e-government.

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