From Traditional to Agile E-Government Service Development: Starting from Practitioners' Challenges

Completed Research

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Abstract

E-government refers to the use of Information and Communication Technologies by governments to deliver their information and services in an optimal way. For a long time, traditional systems development methods such as the waterfall model have been prevailing in the development of e-government services. However, these methods fail to welcome the changing requirements of citizens and to facilitate collaboration with a higher number of stakeholders. Agile software development methods implement practices that can increase responsiveness and collaboration. However, the implementation of agile methods faces challenges sometimes linked with intrinsic characteristics of governments. In this paper, we identify and validate challenges that practitioners face when developing e-government services in an Agile way. In order to reach that goal, we have organized three focus groups with practitioners in Belgium. The identification of these challenges will set the foundation for the tailoring of agile methods to the specificities of e-government.

Keywords : e-government, agile, challenges, focus groups.

Introduction

In recent years, new developments in Information and Communication Technologies (ICT) have enabled organizations to deliver their information and services in novel ways. In governments, these new developments have led to the emergence of the e-government concept, referring to the use of ICT by governmental entities to deliver their information and services in more optimal ways to their users (citizens, businesses and also other governmental organizations) (Andersen and Henriksen, 2006). Traditional systems development approaches, such as the Waterfall model, seemed to prevail for a long time in the development of e-government services. No complete study has been found on current software development practices in governments but authors have underlined the predominance of the waterfall model (Følstad et al., 2004; Pardo and Scholl, 2002). Such methods highly rely on thorough planning and process standardization and assume that the requirements remain static throughout the development process. They prevent public organizations from quickly adapting their processes regarding the changing requirements of e-government users. Moreover, they make connections between citizens, government representatives and other stakeholders difficult.

Nonetheless, over the last decade, some governmental organizations are becoming interested in a number of new techniques and approaches, such as agile development, to enhance responsiveness and collaboration. New work habits such as the new ways of working and recent political movements (such as Open Government) that suggest a more collaborative work environment in governments have both established the need for increased user participation and internal collaboration in e-government (Lee and Kwak, 2012). Agile software development refers to a group of flexible and lightweight methodologies that rely on a set of principles and practices for the development of software (e.g., time-boxed iterations, customer involvement, daily meetings, continuous process

improvement…) (Beck et al., 2001). However, the implementation of such principles and practices in an e-government context may be problematic because of the intrinsic characteristics of government: regulatory compliance, lack of operational support, reluctance to change, etc.

By identifying clearly these challenges, we will be able to refine and adapt the agile methodologies to make them more easily usable. Indeed, the long-term goal for which this paper sets the foundations resides in the tailoring of agile methods according to the specificities of e-government. As a first step, the objective of this paper is to examine which challenges practitioners face when trying to implement agile methods in an e-government context. In that regard, the research question that this paper aims at answering is: *"Which challenges, in an e-government context, impact the work of practitioners when implementing agile software development methods ?"*. In order to answer that question, we have conducted three focus groups with practitioners following the Grounded Theory approach in order to find out and validate the context-specific challenges that could impede the agile development of e-government services.

The paper is structured as follows. In the "Background" section, we present some information about e-government service development and agile methods as well as previous work that guided us in this paper. In the "Methodology" section, we detail the research design we applied to determine and validate the e-government specific challenges. In the "Results" section, we present the challenges that emerged from the organized focus groups. In the "Discussion, Limitations and Future Directions" section, we reflect on the findings by providing leads for solutions, inherent limitations of the study and future directions to tackle the identified challenges. Finally, in the "Conclusion", we present some closing comments as well as the next research activities we will perform in the future.

Background

This research is at the intersection of two lines of research: the development of e-government services and the tailoring of agile software development methods. There have been many attempts in scientific literature to define the concept of "e-government service" (Lindgren and Jansson, 2013). In this paper, we consider an e-government service as any interaction, through the use of ICT networks, between the government and its users in order to deliver a service, with the purpose of meeting needs in the general interest. In today's work environment, traditional software (or, in this case, e-government service) development methods might not be fully adequate. (van Velsen et al., 2009) has underlined some specificities of the e-government domain that can impact software development practices: the heterogeneous and large user group that are the citizens, the complicated processes and contents of e-government services or the crucial need for interoperability between the systems of different governmental bodies. Furthermore, in recent years, the changing and higher requirements of citizens towards governments have been a driving factor behind new evolutions in the development of e-government services. The importance of user participation in e-government service development has already been underlined before (Axelsson et al., 2010) . In fact, according to (Lindgren, 2014), e-government service development should involve all stakeholders that will be affected by the systems at different levels: the end-users, the management team and the top management. Thus, citizens, public servants, higher governmental positions and political representatives should be considered as part of development process. Furthermore, other papers have examined the need for an increased collaboration in the back-office of government when developing e-government services between these stakeholders (Anthopoulos et al., 2007). A more recent study has examined the need for innovation in the processes of governments and in their digital strategy (Holgersson et al., 2017).

In summary, the willingness to engage citizens in the development of public services demonstrate that there has been a general shift towards new collaborative and innovative ways of working. In particular, (Mergel, 2016) states that e-government organizations have shown a particular interest in implementing agile software development approaches in order to achieve a more iterative and client-centered development process. The study referred a failure project (healthcare.gov) that demonstrated how waterfall processes may be dissatisfying. Furthermore, the initiated calls for more agile management approaches which are expected to help e-government organizations adapt faster to environmental changes and citizen requests. Agile methods share a number of principles that drive the development process of practitioners.

These 12 Agile Principles (AP) are described in the Agile manifesto (Beck et al., 2001) and are listed below for the sake of clarity:

- AP1*: Customer satisfaction by early and continuous delivery of valuable software (Valuable Delivery)*
- AP2*: Welcome changing requirements, even in late development (Welcome Changes)*
- AP3*: Working software is delivered frequently, weeks rather than months (Frequent Delivery)*
- AP4*: Close, daily cooperation between business people and developers (Close Cooperation)*
- AP5*: Projects are built around motivated individuals, who should be trusted (Motivation and Trust)*
- AP6*: Face-to-face conversation is the best form of communication (Face to face Communication)*
- AP7*: Working software is the primary measure of progress (Target Working Software)*
- AP8*: Sustainable development, able to maintain a constant pace (Constant Pace)*
- AP9*: Continuous attention to technical excellence and good design (Technical excellence)*
- AP10*: Simplicity—the art of maximizing the amount of work not done—is essential (Work Simplicity)*
- AP11*: Best architectures, requirements, and designs emerge from self-organizing teams(Self-organization)*
- AP12*: Regularly, the team reflects on how to become more effective, and adjusts accordingly (Continuous Improvement)*

A non-exhaustive list of Agile methods includes: Extreme Programming (XP), SCRUM, Feature Driven Development, Dynamic Systems Development Method (DSDM), Lean Development/Management (Cohen et al., 2003). However, a growing line of research has identified that practitioners also use tailored methods that fit the specificities of their organizations (Campanelli and Parreiras, 2015). This research tends to fall into two streams: situational adaptation of existing methods (contingency factor approach) and the composition of reusable fragments from different methods (method engineering approach). In this regard, several studies also investigated the impact of the context, i.e., the organizational and project constraints (business domain, organizational culture, compliance, etc.) on the implementation of agile methods. For example, (Ayed et al., 2017) studied the impact of the national culture on agile methods implementation and reported some culture-related *Agile Implementation Challenges*. Similarly to this study, the objective of this paper is to investigate the impact of the e-government services development context on the implementation of agile methods. In a previous study, we analyzed the context of e-government services development by organizing 35 in-depth interviews. We were able to identify challenges that governments face when implementing e-government strategies. These *Digital Transition Challenges* cover a wide range of the digital transition strategy: software development processes, organizational structures, services infrastructures and applications, internal competencies, organizational culture, policies and data exchange. The complete findings of this research activity can be found in (Chantillon et al., 2017). This latter study is considered as prelude to understand the e-government context.

In this paper, we will use these *Digital Transition Challenges* and *Agile Implementation Challenges* as theoretical background to find out the challenges (referred as Thematic Challenges in the "Results section) that are faced by practitioners when implementing agile methods in governments. More specifically, we will evaluate how these challenges impact the Agile Principles listed above in order to pave to way for the tailoring of agile methods to the context of governments.

Methodology

To the best of our knowledge, no previous work has tried to identify the underlying challenges to the implementation of agile methods in the e-government domain. As an overarching methodology to find out and validate the specific challenges that emerge when implementing agile methods in governments, we decided to follow the grounded theory approach. In this approach, the data is iteratively coded into theory at each step of the process (Strauss and Corbin, 1998). In order to gather this data, we chose to organize focus groups to understand which challenges practitioners face when implementing (agile) development methods in their organization. The data was then iteratively coded (after each focus groups) into theory (the e-government specific challenges).

We chose to organize focus groups in order to understand challenges as perceived by public sector representatives and to generate ideas about solutions for these challenges. Furthermore, we conducted the focus groups according to literature's best practices (Krueger and Casey, 2000; Morgan, 1996). To follow these practices, we chose to conduct discussions between 5 and 10

participants. We chose to follow a single category design to focus on a set of practitioners familiar with agile methods so that the validation of the constructs is empirically grounded. The list of people involved in the focus groups is detailed in the "Results" section. We decided to stop the research activity after three focus groups as each challenge had reached saturation and no more original findings were determined. We also made sure that the focus groups were homogeneous in terms of governmental levels (all participants were agile practitioners at a specific governmental level) but with enough variation between participants (in terms of organization, agile knowledge, position and responsibility) to stimulate discussion and contrasting opinions.

In order to develop the questioning route of the focus groups, we followed the development process suggested by (Krueger and Casey, 2000). This approach will be complemented thanks to the use of graphical facilitation techniques to stimulate the discussion. We also adopted a funnel approach in order to stimulate free discussion at the beginning in order to further focus on specific challenges (Morgan, 1996). As a summary, the three focus groups generally followed this four-steps process: (1) The participants were asked to present themselves, their organization as well as their knowledge and experience with agile ; (2) They were asked to draw on post-it's the challenges that they face when trying to implement agile methods in their organization ; (3) Each practitioner discussed the challenges he/she identified and placed them on a board. At this stage, we helped the participants to group their challenges in general Thematic Challenges (TC) to design Affinity Diagrams. This visualization method was already tested in agile tailoring research such as (Ayed et al., 2014). In this step, we relied on the theoretical background (*Digital Transition Challenges* as well as the *Agile Implementation Challenges*) summarized in the "Background" section to help the participants to assign the post-it's to the general TC. However, this background was not provided to the participants in order to avoid the introduction of any bias in the study. Our assistance was reduced at the minimum to avoid bias from the researchers as we only intervene to facilitate consensus among participants about the assignment of the post-it ; (4) Fourth, starting from the most populated Thematic Challenges, a discussion emerged with the researchers playing a mediation role. As suggested by (Morgan, 1996), we used the theoretical background to generate discussion for this step.

After a complete transcription of the three focus groups, we performed a classic analysis technique and analyzed the findings of the focus groups (Rabiee, 2004). The visualization allowed us to have both a quantitative and qualitative analysis of the practitioners' statements. For the quantitative analysis, we looked at the frequency of Challenges. For the qualitative analysis, we focused on the discussion that emerged from stating these challenges to check if other challenges than the ones reported on the post-its emerged. Furthermore, we formulated hypothesis about how the challenges impacted the Agile Principles described in the "Background" Section

Results

In this section, we present the challenges impact Agile Principles in an e-government context, identified thanks to the findings from the three focus groups. These challenges were iteratively theorized thanks to the organization of three focus groups following the Grounded Theory approach. The participants were selected based on convenience sampling. However, we ensured diversity in terms of organizations as participants came from different governmental levels (local and regional) and from different governmental sectors (IT, employment, simplification, etc.). Furthermore, the focus groups were also diverse in terms of roles as the first focus group consisted mainly of developers, the second one of middle level management team leaders, and the third one of strategic leaders. Table 1 details the profiles of the different focus groups participants. This table details the current roles, expertise and organization of the participants. It is worth to note that some participants relied on their previous agile experience in other public organizations to identify the challenges.

N°	Organization	Role	Level	Agile Experience
1	Intercommunal Cooperative	Project Leader	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method

1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
1	Intercommunal Cooperative	Developer	Local	Customized Agile Method
2	Simplification Body	Project Leader	Regional	Agile Project Management
2	Employment body	IT Advisor	Regional	Customized Agile Method
2	Employment body	IT Director	Regional	Customized Agile Method
2	Public Consulting organization	IT Advisor	Regional	Agile Project Management
2	Public Consulting organization	IT Manager	Regional	SCRUM/CANBAN Practices
3	Regional Government	Product Owner	Regional	Agile Project Management
3	Regional Government	General Director	Regional	Agile Project Management
3	Regional Government	General Inspector	Regional	Agile Project Management
3	Regional Government	IT Project Leader	Regional	Agile Project Management
3	Regional Government	General Inspector	Regional	Agile Project Management
3	Regional Government	General Director	Regional	Agile Project Management
3	Regional Government	General Director	Regional	Agile Project Management

Table 1. Focus Groups Participants

In the next sub-sections, we will detail the identified thematic challenges as well as the insights gained from the focus groups. Table 2 provides a summary of the different identified Thematic Challenges (TC), their occurrence in the three focus groups, the number of challenges (as reported on post-its). We will also detail how the identified challenges impact the Agile Principles (AP) detailed in the Background section.

ID	Thematic Challenges	Occurrence in focus groups	Number of Challenges reported by Practitioners
TC1	Internal Competences	3	16
TC2	User Participation	3	12
TC3	Internal Stakeholders Alignment	3	11
TC4	Drivers to Adopt Agile	3	11
TC5	Impact of Regulations	3	10
TC6	Hierarchical Structure	3	10
TC7	Resources Management	2	6
TC8	Domain Complexity	1	9

Table 2. Summary of Focus Group Results

TC1: Internal Competences

The most often reported challenge is the lack of internal competences, also reported as the unavailability of specific IT profiles in e-government teams. For example, several participants pointed out that team members are over-specialized, that they lack time and resources to continuously improve own competences and that their soft-skills and knowledge of agile methods may be limited. This lack of "Competences" is most likely not purely specific to the e-government domain but can be a result of the low attractiveness of the public sector as reported by some practitioners. Indeed, participants reported that governments have difficulties to attract specific profiles to facilitate the digital transition. However, it can also be the result of the low investment by leaders in the implementation of methods such as agile with no immediate pay-off. This challenge has a number of consequences. Firstly, it is hard to find a common lexica and understanding with other public agents to discuss the advancement of projects and thus makes communication difficult (AP6, *Face to face Communication*). Secondly, there is a lack of transdisciplinarity within development teams although it is one of the main practice in agile methods. Indeed, self-organization is made difficult if the team can't support all necessary development tasks (AP11, *Self-organization*). Most developers in e-government projects are specialized in clear-cut tasks, which can lead to a decrease in technical excellence (AP9, *Technical excellence*)

Hypothesis: TC1 impacts AP6, AP9, AP11

TC2: User Participation

The second most reported thematic challenge resides in the difficulty to stimulate user participation. Indeed, close collaboration between users and developers is an essential Agile Principle. In the case of governments, users can be the citizens, businesses or even other public servants. When these users are the citizens, participants reported that their number and the diversity of their profiles make it difficult to identify a fitting participation methodology. The use of representatives was discussed in the focus groups but several questions remain unanswered: Can the representatives fully understand the needs of the whole user population? How to ensure their availability? Regarding availability, the specific case of public servants being users has been discussed. Indeed, if development teams work in agile, there is a need for other internal public servants users (sometimes from other departments) to adopt agile principles to be more available and reactive to communicate their requirements and feed-back. Thus, the diversity of e-government users makes their participation in the development process difficult (AP4, *Close Cooperation*). Furthermore, the lack of user participation may make the integration of late requirements difficult (AP2, *Welcome Changes*) and thus decrease the delivery of valuable systems aligned with the requirements of users (AP1, *Valuable Delivery*).

Hypothesis: TC2 impacts AP1, AP2, AP4

TC3: Internal Stakeholder Alignment

Governments constitute a diverse ecosystem with multiple internal stakeholders, each of which has his/her own objectives. Among these stakeholders, there are different business teams that don't always communicate with each other, leading to a certain level of silo structure. This silo structure may hamper the alignment of development projects in the organization. Furthermore, different IT teams may have different maturity levels regarding agile methods. This bimodality leads to a more difficult alignment internally. The silo structure is particularly pregnant in large governmental organizations. Thus, the alignment between the different stakeholders and teams makes it difficult to implement agile methods in the governments at scale. The participants reported that this silo structure leads to a lack of communication between units (AP4 *Close Cooperation*, and AP6 *Face to face Communication*) and makes the improvement of the overall development process difficult (AP12, *Continuous Improvement*).

Hypothesis: TC3 impact AP4, AP6, AP12

TC4: Drivers to Adopt Agile

Another crucial challenge resides in the need for influential drivers (or sponsors) able to impulse the implementation of agility. There exist two main methods to transition to agile: bottom-up and top-down. In the bottom-up approach, the willingness to change the development practices emerges from the operational development teams themselves. In this case, the main challenge is to convince the leaders of the organization to invest in a sustainable change towards an agile way of working. Indeed, if projects are not built around motivated individuals, they contradict an essential Agile Principle (AP5, *Motivation and Trust*). In the top-down approach, the strategic leaders of governments impose the adoption of agile practices to the development teams. However, this sponsoring does not always lead to concrete actions (hiring of agile specialists, support of pilot projects, etc.) as participants stated that short-term objectives often drive the IT strategy in governments. More generally, these difficulties to find drivers for Agile methods raise the question of the innovation in the public sector : who has the capacity and the responsibility to drive innovation in the products and services of the governments ? This challenge does not impact a specific agile principle but is an essential pre-condition to the implementation of agile methods.

Hypothesis: TC4 impacts AP5

TC5: Impact of Regulations

Governments have to take into account the new regulations in their processes and in their development projects. Several participants of the focus group pointed out that regulations impact significantly their development practices and may be in tension with their willingness to implement

agile methods. They stated that they were in the expectative of regulations (e.g., regarding data security) that often lead to delays impacting the team's ability to deliver valuable software frequently (AP1, *Valuable Delivery*). Since these regulations contain critical information that may have significant impacts on the system to be developed, the project team is not able to work on the system at a constant pace (AP8, *Constant Pace*). Furthermore, the impact of regulations on the e-government services are sometimes not budgeted but have to be integrated in the development anyway. The specific regulation regarding government procurement was cited as the main regulatory barrier. As, in government procurement, the planning and outputs of the development projects have to be fixed upfront, it makes it difficult to change scope of the project afterwards. The lack of scope flexibility is in tension with the agile principle (AP2, *Welcome Changes*) which directs to welcome changes, even late in the project. However, agile methods could also constitute a lead for solution as it provides support for changes in priority during the development process due to new regulations.

Hypothesis: TC5 impacts AP1, AP2, AP8

TC6: Hierarchical Structure

Governments tends to function hierarchically. This top-down way of working is present within governments as all major decision validations regarding the project or resource requests have to pass through several official decision-making bodies ("Steering Committee", "Working Group", etc.) which slows the development process as a whole (AP8, *Constant Pace*). The pyramidal structure is in tension with the transversality advocated by agile methods (AP4, *Close Cooperation*) since each department has to follow its own hierarchy. Furthermore, participants reported that leaders in governments are reluctant towards the concept of scope flexibility (AP2, *Welcome Changes*) as it is perceived as a loss of control on projects. Furthermore, the top-down culture is also a consequence of the influence of political representatives on the functioning of governments. Developments teams see their work heavily influenced as politicians require the projects to be modified to fit their own needs and agenda, often linked to the agenda of the elections. This reduces the self-organization margin of teams (AP11, *Self-organization*) and increases the complexity of the development process (AP10, *Work Simplicity*).

Hypothesis: TC6 impacts AP2, AP4, AP8, AP10, AP11

TC7: Resources Management

Despite their limited budgets, Belgian governments are required to innovate and develop their online strategy. Among other consequences, strategic leaders from the third focus group reported that this lack of resources in governments led to the lack of internal competences as described in the first challenge. When asked to "do more with less", governments are reluctant to engage in agile methods as these are perceived as experiments with no clear pay-offs and cost-reduction. There is indeed no awareness that agile methods can deliver value, also on the short-term. Furthermore, the up-front resource management, based on legally binding software requirements specification, makes it difficult to review the scope of the project (AP2, *Welcome Changes*). This reluctance to invest in agile methods is also a consequence of the "Hierarchical Structure" and the political representatives agenda that prefer to invest in short-term projects to deliver value before the end of their mandate.

Hypothesis: TC1 impacts AP2

TC8: Domain Complexity

The last e-government specific challenge relates to the complexity of governmental domain with its regulations, diverse user base, security requirements, size of the projects, etc. Some participants reported that this complexity is in tension with the notion of short "Time-boxed iteration" advocated by Agile as most important requirements require time to be integrated in the software. Indeed, they consider that some requirements can't be delivered as a "working piece of software" as agile methods usually recommend (AP3, *Frequent Delivery* and AP7, *Target Working Software*). Therefore, the initial planning of the iteration delivery is made difficult.

Hypothesis: TC1 impacts AP3 and AP7

Discussion, Limitations and Future Directions

In this section, we open the discussion for a possible tailoring of agile methods to the e-government challenges identified in the previous section. Table 3 summarizes the impact of each challenge to the Agile Principles described in the Agile Manifesto (summarized in the "Background" Section).

	AP1	AP2	AP3	AP4	AP5	AP6	AP7	AP8	AP9	AP10	AP11	AP12
TC1						X			X		X	
TC2	X	X		X								
TC3				X		X						X
TC4					X							
TC5	X	X						X				
TC6		X		X				X		X	X	
TC7		X										
TC8			X				X					

Table 3. Summary of Impact of Challenges on Agile Principles

Table 3 allows identifying which challenge is impacted the most by the identified challenges, i.e. "*Welcome changing requirements, even in late development*" (AP2). A particular attention needs thus to be set on the tailoring of practices to implement this principle. Furthermore, Table 3 also shows that TC6 (Hierarchical Structure) is the challenge that impacts the most the Agile Principles. This challenge, although not reported as the most important by practitioners, seems to be the barrier with the highest impact on agile methods implementation .

However, this paper is only the start of an interesting sub-domain of the e-government research area and has limitations that suggest ways for further research. First, we chose to study the impact of the Thematic Challenges on the Agile Principles as stated in the Agile Manifesto. Further studies should use other constructs as basis for the impact analysis. For instance, the impact of the Thematic Challenges on the operational agile practices could constitute an interesting lead for further research. Secondly, our findings reflect the situation in Belgium and should be validated in other countries with different state structures, cultures and maturities in e-government. Furthermore, the findings could also be further validated through focus groups with a different composition in terms of participants. In this paper, the aspects of federal level and hierarchy positions were controlled but other factors could influence the discussions: agile knowledge, digital literacy, size of the organization etc... To illustrate this limitation, some *Digital Transition Challenges* identified in previous work (Chantillon et al., 2017) were not discussed in the focus groups. For instance, the digital divide of the population was not addressed. This divide impacts the development of e-government service as it increases the need for user-friendliness and for multi-channel service delivery. We may argue that this digital divide of citizens may impact the user involvement principle of agile methods (AP4) as a diverse range of users should participate in the development to ensure representativeness. Furthermore, the participation of users with a lower digital literacy might make the collection of requirements difficult.

Finally, these challenges should also be validated in a concrete setting through case studies in governments. In that regard, all the identified challenges could lead to action research in concrete settings in order to design innovative solutions to tailor agile methods. At this stage, we have already reflected on leads for solutions that could constitute a solution to the adaptation of agile methods to the e-government domain. Concerning the stimulation of user participation (TC2), leads for solutions could be found in the user participation in information system field of research. In previous studies, we have established an inventory of participatory methods to stimulate this participation (Simonofski, Serral Asensio, et al., 2017; Simonofski, Vanderose, et al., 2017). Among these methods, one particular method particularly fits to stimulate user participation: Crowd-centric Requirements Engineering (CCRE) that applies the crowdsourcing paradigm to the requirements engineering process (Snijders et al., 2015). With such methods, the large user group of e-government services could more easily be targeted. The regulatory challenges (TC5) may be handled by keeping a waterfall process at the beginning of the project or around the release time while implementing an agile process throughout the system development phases. For example, government organizations are usually required to prepare plans for security emergencies on critical infrastructures. The preparation of such

documents may require the intervention of several specialists and is often a precondition for the approval of the software. In such case, a waterfall process could precede the iterative development phase. Similarly, when several operations, including the verification of regulations (e.g., citizens privacy rights), are required to take software to production, a waterfall process can be implemented afterwards. Challenges such as the lack of alignment between e-government stakeholders (TC3) and the lack of drivers (TC4), can be addressed through the implementation of a change management initiative at strategic levels of organization. Various change management models could be considered, e.g., the Satir process model and the Kotter's eight steps model (Cameron and Green, 2015). In summary, by examining all the identified challenges in-depth, we should be able to provide a concrete agile methodology that fits the specificities of e-government.

Conclusion

In this paper, we have identified, refined and validated the challenges that practitioners face when implementing agile methods in an e-government setting in Belgium. Therefore, this paper contributes in several ways to the existing body of knowledge on agile methods for the development of e-government services. First, it contributes to research by providing an empirical validation of the constructs identified in (Ayed et al., 2017) for *Agile Implementation Challenges* and (Chantillon et al., 2017) for *Digital Transition Challenges*. Second, it suggests and validates the challenges that could hamper the implementation of agile methods in an e-government context. This contribution is helpful for research as it allows researchers to build on these challenges to further examine agile methods in e-government. However, this contribution is also helpful for practitioners as it can be used as a check-list for points to consider before investing in an agile strategy and before tailoring a method. Third, this paper also opens the discussion for the tailoring of agile methods to the specificities of governments. This tailoring will take the form of specific guidelines reusing practices from several agile methods (e.g. SCRUM). The design research paradigm will help to consider these guidelines as artefacts to be refined thanks to several research activities. The first research activity that we intend to perform next is to conduct in-depth interviews with agile practitioners that have successfully implemented agile methods in their governmental organization. Then, we will extract best practices and test them in concrete settings thanks to the action research paradigm. After several iterations, we expect to formulate valid guidelines that will adapt the software development processes of government to the challenges identified in this paper.

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