Building an Agile Government: Its Possibilities, Challenges, and New Tasks

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Abstract

Although "agility" is a popular term today, an understanding of its meaning and key components is lacking. The term "agile government" has been increasingly used in various studies and reports but remains unclear. Therefore, the purpose of this paper is to review agile government studies, overcome the various new challenges against such trends, and identify possibilities of building an effective agile government. First, business agility studies and agile development methods are reviewed, followed by an overview of agile government studies and an evaluation of the present and future uses for agile governments. Finally, this paper identifies various challenges and suggests new tasks toward a more agile government based on the reviews.

Keywords: agility, business agility, government agility, agile government, agile management

Introduction

Much research has been done, and many arguments have been made, to implement an agile government or agile governance in recent years. For example, in the *Government Information Quarterly* (GIQ 2018), a special issue was published in 2018 with the theme "Agile Government and Adaptive Governance in the Public Sector." In early 2019, the World Economic Forum (WEF 2019) discussed the topic of agile governance as one of the global agendas. Although various discussions regarding an agile government or agile governance have occurred, a consensus has not been established on what the core attribute of agility in government is.

Generally speaking, agile management is a new method of managing the design and building of activities for engineering, information, and communication technology (ICT), as well as for new product or service development projects using a highly flexible approach. Its application in the public sector is a widely discussed topic around the world. The term "agile government" is emphasized by many countries' governments and is mainly relevant to Information System (IS) development methodology. Initially, "agile government" referred to the overall transformation of government organizations or practices in an agile manner. Although the term itself may have been mentioned before the 2000s, it is assumed that its use as a term to signify a systematic innovation in methodology began in the 2000s. One of the official documents that proposed an agile government as an important aspect of future governments was a provocative paper published by the State Government of Victoria, Australia (Australian State Services Authority

2007).

The ambiguity surrounding the term "agile government" stems from the multitude of studies on agility itself. Although "agility" is a popular term today, an understanding of its meaning and components is lacking (Wendler 2013). Mergel (2016) introduces a somewhat holistic concept that includes project management and software development processes; adjusted procurement procedures, combined with human resources policies; and organizational and managerial approaches to support innovative digital service delivery in government. This paper defines "agility" as the ability to fulfil the mission and to change the overall process of an organization in an efficient and effective manner utilizing a combination of coordination, strength, balance, and enhanced speed and capacity with the applications of advanced technologies. Many frameworks of agility have been developed, and research trends that are closely related to government agility can be summarized in two ways: business agility studies and agile development studies.

The purpose of this paper is to review agile government studies, overcome various new challenges against such trends, and identify the possibilities of building an agile government. However, this paper does not assert that all tasks in government should be subject to the agility principle as a top priority. There are other tasks that are more important in government work, such as deliberation based on democratic procedures rather than on agility. In fact, this paper emphasizes the need to apply agility in some task areas where the government's response to environmental change is reduced and high social costs are added, where the complexity of the environment is likely to put citizens at risk because of the government's slow response, and where the benefits of citizens can be increased through intelligent and rapid service applied to formal government works. Accordingly, this study primarily aims to derive a technological solution and/or method to substantialize government agility; thus, discussions of related key governance issues are beyond the scope of this study.[1] In the following sections, business agility studies and agile development methods are reviewed, followed by an overview of agile government studies and an evaluation of the present and future for an agile government. Finally, this paper suggests a new direction toward a more agile government.

Research Questions

This study focuses on the core attributes of agility in the government and public sectors that should be pursued, in accordance with private sector agile enterprise or agile management. This study also aims to identify the technical, administrative, and human factors that can implement these core agility attributes in government organizations using different operating principles from private companies.

1 Regarding the discussion of related key governance issues, OECD (2015), for example, emphasizes the following: (1) the ability to make collective commitments including aligning institutions and their behavior and engaging with the public and (2) aligning policies across public administration to share strategic objectives and public interest. Agility cannot be fully realized until governments are more open to, and engage meaningfully with, potential partners. Therefore, partnerships with key stakeholders are important because they increase investment options, double human capital capacity, diminish the risk profile for governments, contribute niche expertise, and can accelerate the execution of change. Moreover, partnerships with the private sector and civil society stakeholders can leverage innovation and response to citizen expectations, as well as delivering services in new ways (PwC 2015). However, such discussions are beyond the scope of this study as this paper focuses on technological solutions or procedural methods.

This study contains the following research questions: First, what are the levels and core attributes of agility within governments that require preparation for the present and foreseeable future? Second, why is it difficult to deploy and effectively operate an agile administration system at the business (organization) level within the government? Third, how can officials realize agile decision-making in order to implement agility at the business (organization) level within the government? Fourth, what policy and academic challenges should be addressed in order to realize agility in government. This study attempts to answer these research questions.

Agility in Business

What are the levels and core attributes of agility in government that require preparation for the present and foreseeable future? To answer this question, it is necessary to identify the level of agility that has already been implemented in the private sector and discover what its core agility is. In addition, when reviewing various previous studies and reports related to agility in government, it is necessary to clarify the level of agility that is being discussed.

In terms of agility in business, many businesses and organizations have experienced considerable volatile, uncertain, complex, and ambiguous (VUCA) environmental changes, marked with challenges, such as increased competition, globalized markets, and individualized customer requirements, along with numerous changes within every organizational field. For example, such scenarios were described in the 1990s by the Iacocca Institute's study (Nagel et al. 1991). This report covered a variety of perspectives on business agility from the concept of agile production to enterprise elements, infrastructure, and enabling subsystems. As strategic and operating conditions become increasingly turbulent due to factors such as hyper-competition, increasing demand from customers, regulatory changes, and technological advancements, the ability to sense relevant change and readily respond becomes an important determinant of success (Overby et al. 2006).

With an increase in the need of a business community for business agility, academic research on business agility elements, functions, and required capabilities has also increased. Practical methodology, supporting technology, and IS have been developed to realize agility in the business field: for example in agile manufacturing (Gunasekaran et al. 2019), agile organization (Ambrose and Morello 2004), strategic agility (Sambamurthy et al. 2003; Doz and Kosonen 2008), and enterprise agility (Overby et al. 2006; Dove 2005). The following business agility models and solutions are effective in the real business world:

- *Agile manufacturing*: This can be defined as the capability of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets and being driven by customer-designed products and services (Gunasekaran et al. 2019).
- *Real-time enterprise* (RTE): This is a concept in systems design that helps organizations automate processes across different systems, and the main goal of RTE is to provide real-time information to customers and stakeholders and implement processes to ensure that all related information is up-to-date and consistent throughout all systems.

- *Agile supply chain management*: This essentially is a practical approach to manage supply networks and develop flexible capabilities to satisfy rapidly changing customer demands. Agile supply chains have distinguishing characteristics: they are market-sensitive, virtual, process-integrated, and network-based (Christopher 2000).
- *Smart factory*: Industry 4.0 introduces the concept of a smart factory.[2] Industry 4.0 and smart factory applications include cyber-physical systems (CPS), Internet of Things (IoT), and cloud computing. Within the modular-structured smart factories, CPSs monitor physical processes, create virtual copies of the physical world, and make decentralized decisions.

In the real business world, beyond the agile response in a particular function, an agile response is realized at the level of the corporate management system, which includes several key functions of the company. In addition, when at the agile supply chain or smart factory stages, the collective agile responses of multiple companies operating in the industrial value chain beyond the individual company are promoted. This contrasts with the reality of the government sector, where even the agile responses of core businesses or central organizations within the government cannot be realized properly.

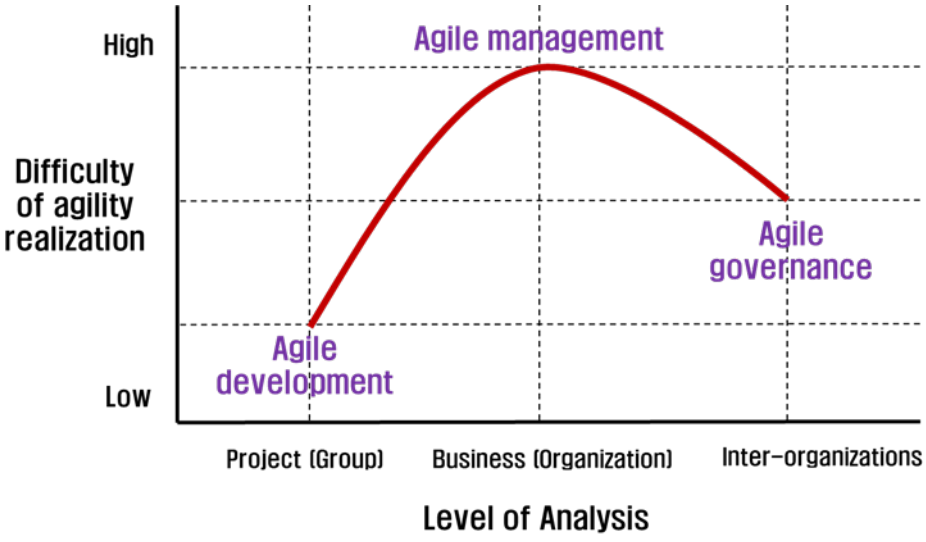
Agility in Government

Studies about agility in government have previously been centered as individual research or addressed as government innovation agendas in some countries; yet recently they have emerged as topics of comprehensive literature review research (Mergel et al. 2018) or collective research (WEF 2019; GIQ 2018). In particular, Mergel et al. (2018) found in the literature review of existing papers that there were flows of four areas of research: (1) software development approaches, (2) project management approaches, (3) application areas, and (4) potential outcomes.

Although quantitative literature classification methodologies are not used, qualitative literature reviews in this study show that different research flows exist. In summarizing the various previous studies related to agility in government, three different research flows can be classified according to the difficulty of agility realization and level of analysis, as shown in Figure 1: an agile project development at the group level; an agile management system at the organizational level; and an agile governance at the inter-organizational level. The difficulty of agility realization is a conceptual dimension based on various cases in the field. Many success stories have been reported in agile development at the project level, and agile governance at the inter-organizational level has been introduced recently (Schaake and Witter 2019). However, the issue reflects the fact that a successful case of agile management at a business level in government has yet to be reported.

2 The term "*Industrie 4.0*" was introduced by the German government. More details are available at http://www.plattform-i40.de/I40/Navigation/DE/Home/home.html (last accessed 5 August 2019).

Figure 1. Trends of Agility in Government



Source: drawn by the authors.

Many studies argue that an agile government should be realized. However, a few studies question why agile management is not realized in a government organization, unlike in a private business organization. Figure 1 shows that agile government is possible, as a result of a comprehensive review of various previous studies that included actual implementation cases related to agile management in the private and public sectors. Agile software development is mainly applied to a group-level project, while agile management is mainly applied to the business or factory (organization) level.

Agile Development at the Project (Group) Level

In the e-government or ICT sector, the implementation methodology of an agile government began in IS development or in software development fields. In 2012, the US Government Accountability Office (GAO 2012) identified 10 practices for applying agile software development methods to IT projects. The practices generally align with five key software development project management activities: strategic planning; organizational commitment and collaboration; preparation; execution; and evaluation. Officials that used agile methods in federal projects generally agreed that these practices were effective (GAO 2012).

The agile approach has been implemented within the private sector software industry since the early 1990s. Currently, it is the standard for software development and management in the private sector (Measey 2013). The agile approach is compared to the traditional waterfall approach that captures all requirements and specifications beforehand, distinguishing design and analysis from development. Therefore, the waterfall approach fails to adequately respond to change. Agile development adopts an iterative and incremental approach to software development and is performed in a highly collaborative manner (Lapham et al. 2010). It recognizes that a future system owner may be unable to gather all requirements beforehand.

Thus, the project is broken down into several smaller components, and plans are continuously inspected and adapted using rapid prototyping (Balter 2011).

The agile approach in IS development provides some important methodological implications for establishing an agile government. The GAO (2012) highlighted agility characteristics in the timing and scope of project planning, project evaluation, and collaboration. The US Office of Management and Budget (OMB) has recognized the value of a modular development methodology (Kundra 2010) as not a one-size-fits-all strategy. However, although a modular approach addresses many risks, it also creates certain predictable challenges that should be considered when evaluating its applicability in a given investment (OMB 2012).

Agile Management at the Organizational Level

AT Kearney (2013) refers to agile government as a methodology for enhancing government performance. They suggested four government agility features: (1) short-term frontline responsiveness, (2) strategic adaptation, (3) outcome focus, and (4) preventing or reducing issues before they arise. However, the first official document that presented agile government as being an important aspect of future governments was a paper published by the State Government of Victoria, Australia, as mentioned earlier (Australian State Services Authority 2007). Moreover, a 2008 report by the same authority proposed a more advanced agile government model (Australian State Services Authority 2008). To become more agile, governments must develop four types of capacity and management cycles: (1) scanning emerging trends and issues, (2) sensing opportunities to translate information into actionable solutions, (3) responding to opportunities and risks, and (4) shaping future environments. Mergel et al. (2018) insisted that governments must create systems that allow them to scan trends, identify developments, predict the potential impact on the organization, and quickly learn how to implement changes to their standard operating procedures.

Agile Governance at the Inter-Organizational Level

In recent years, there has been a growing number of research studies on agile governance. In January 2019, the World Economic Forum (WEF 2019) discussed the topic of agile governance as one of the global agendas. In a WEF presentation, Bason and Broekaert (2019) stated that "The Fourth Industrial Revolution and its advances in technology are transforming the ways in which individuals and groups live, work, and interact. Governments, companies, and civil society organizations that have traditionally had the responsibility of governing the societal impacts of these technologies are struggling to respond to the rapid change and exponential impact, and are trying to become more agile" (Bason and Broekaert 2019, 17-19). They stress that agile governance cannot be realized through discussion alone, but there are some political risks, and these should be put into action (i.e., talk less, act more).

The implementation of agile governance has been reported in many successful instances. Schaake and Witter (2019) pointed out that there are more than 100 places worldwide where governments are using technology to crowdsource policy. The authors considered government-

private partnerships (PPPs) to be a key and viewed them at an inter-organizational level. For example, in Iceland and South Africa, the constitutions were crowdsourced by citizens. In Europe, open data and open budgets give citizens access to information and empower their decisions on the spending of public resources. Studies are being trialed to identify the nature of agile governance through such successful cases; yet they have not developed a general theory.

Focusing on the Agile Management in Government Organizations

This paper argues that among the three research flows (agile development at the project or group level, agile management at the business or organization level, and agile governance at the inter-organizational level), implementing agile management in government organizations should be the core of agile government. It is in line with a study by PricewaterhouseCoopers (PwC 2011, 2015), which highlighted agility in government, and studies by Doz and Kosonen (2008) and OECD (2015), which presented the strategic agility model.

One of the leading global consulting firms, PwC (2011, 2015), has identified the following key elements that define agility in government: (1) adaptability (the ability to adjust and meet changing requirements); (2) innovation (the ability to generate and use new ideas, methodologies, and technologies); (3) collaboration (the ability to leverage internal and external knowledge and resources to enhance the mission); (4) visibility (the ability to create and maintain transparency to enhance fact-based decision-making); and (5) velocity (the ability to recognize and respond with the requisite speed to new circumstances and events).

According to a recently published report on public sector agility by the Organization for Economic Co-operation and Development (OECD 2015), these three dimensions of strategic agility (Doz and Kosonen 2008) can be applied to the public sector: (1) strategic sensitivity, or the ability to understand and balance government values, societal preferences, current and future costs and benefits, and expert knowledge and analysis, using this understanding to plan, set objectives, make decisions, and prioritize; (2) collective commitment, or the adherence and commitment to a common vision and set of overall objectives that can be used to guide public actors' individual work, co-ordination, and collaboration with other actors (both within and outside of government) to achieve goals collectively; and (3) resource flexibility, or the ability to mobilize resources (both personnel and financial) in response to changing priorities in order to identify and promote innovative ways to maximize the results of resources used, and to increase efficiency and productivity for both fiscal consolidation and re-investment within more effective public policies and services. Both the OECD (2015) and Doz and Kosonen's (2008) studies fall under the theme of strategic agility and ask for an agility within the government that is at the level of private companies. However, the conceptual level may be assessed as having proposed an appropriate agility model for the government; yet the practicability of this model through actual application has not been high.

Building an Agile Government: Rhetoric or Reality?

Since the mid-2000s, an increasing number of innovative trials have focused on government agility. After 2010, the Fourth Industrial Revolution became more visible, and policy uncertainty became even more evident. Thus, innovation attempts that incorporate the business agility model into the public sector are expected to increase. For example, Mergel (2016) extends the conceptual model from an agile approach as a software development methodology to the level of agile management, or, as she called it, "agile innovation management", which applies to government innovation based on the US federal experience. Despite these attempts to build an agile government, it is not practically feasible to achieve adequate government agility, unlike business agility.

This paper questions the feasibility of government agility as follows: Is the agile government concept a rhetoric or reality? Although many researchers have recognized the importance of an agile government, its implementation plan remains rhetorical because they have not proposed solutions for several fundamental issues in government agility. Moreover, strategic agility requires increasing integration without deceleration (Doz and Kosonen 2008). If the speed of the government decision-making is increased, there is a risk that the decision quality will deteriorate. Therefore, to increase government agility, the dilemmas of decision-making speed and quality in the government and public sectors must be resolved. In the private sector, businesses and organizations have various methods and solutions for business agility, such as RTE, agile supply chain management, and more recently, CPS-based smart logistics and factories.[3] However, governmental and public organizations do not have feasible and effective methods and solutions for government agility. This phenomenon is a result of the intrinsic differences between the public and private sectors. The reasons that the previously implemented business agility models are difficult to apply to the government and public sectors are as follows:

First, the scope of coverage differs. Private companies target markets with many customers and competitors; governments target a smaller scope, such as civil society or the national economy. Both are very indeterminate; thus, their scope determinability level cannot be compared. Second, there are many differences in the complexity of the issues that decisions target. The complexity of the issues causes uncertain causalities and degrades the decision quality. In the private sector, businesses have clear problem-solving targets, such as customer dissatisfaction and delivery time, and can discover the causality model through marketing or consumer behavior studies. However, due to the complexity of the government sector, it is difficult to elucidate causality. Moreover, it is relatively easy to enter into a state of forecast and result uncertainty in which governments are unaware of the effects of the intervention. Third, the process of taking an action and monitoring its response outcome differs. This is distinguished

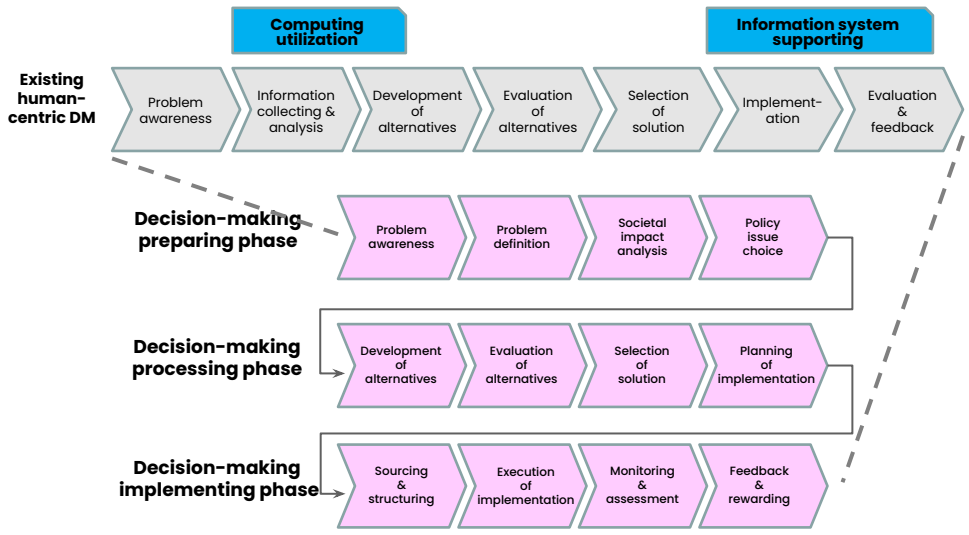
3 Industry 4.0, Real-Time Enterprise (RTE) and Cyber-Physical System (CPS) are addressed in the paper because the level of agile management in the private sector increases with the actual adoption of these new innovative concepts or techniques. For example, with Industry 4.0 spreading, innovative techniques, such as smart factory and digital twin city, are evolving together. If they are actually implemented, real-time sensing and response speeds are increased, which in turn increases the level of agility. Real-Time Enterprise (RTE) is a private enterprise innovation technique that implements agile management. CPS is a mechanism controlled by computer-based algorithms and, for example, smartphone platforms make possible mobile CPSs. This paper does not argue that the government should apply private sector innovation techniques as they are. This study is intended to confirm that these innovative concepts or techniques are methodologies with empirical evidence that is already realized in the private sector. If these techniques are modified and applied to the government sector, it is expected to contribute to the improvement of government agility.

from the situation of the private sector, which has clear and measurable performance and performance indicators, such as profits. In the private sector, the differentiation strategy as based on agility has a clear primary performance goal linked to market performance, and businesses utilize their immediate feedback as related to response and performance through the activation of the sense and respond function. By contrast, the government and public sectors lack clear and measurable performance indicators. In addition, they are unaware of how an agile government action affects a primary outcome goal, and at the same time, they do not have the effective means and methods to obtain immediate feedback information. It is one of the systematic weaknesses that increases the bureaucratic risks due to government agility. Fourth, the motivation of decision-making participants and actors differs. In the private sector, the differentiation strategy as based on agility is apt to appear as a result of market performance, which is linked to various rewards for those who have led business agility. In contrast, the government sector focuses on negative rather than positive results and emphasizes punishment by its failures or negative effects rather than rewards for its agility-based performance.

Agile Decision-Making

The government's comparative issues result in a lack of agile decision-making capabilities within it. Figure 2 presents an existing human-centric decision-making process in the government and public agencies. The first difference in the scope of coverage is mainly applied to the preparation phase. The second set of differences in the complexity of the issues are mainly applied to the preparation and processing phase. The third difference in the process of taking action and monitoring its response outcome is mainly applied to the implementation phase. Finally, the fourth difference in motivation is applied to the implementation phase, but it affects the entire decision-making process.

Figure 2. Basic Decision-Making Processes and Real Decision-Making Activities



Source: drawn by the authors.

As the Fourth Industrial Revolution has recently become more visible, newly developed technologies and solutions are emerging that are expected to enhance the agile decision-making capabilities of the government. For example, Chatfield and Reddick (2018), limited to Houston 311 services in the USA, show that agile customer response services that use big data and analytics can be implemented in practice. Such development will increase the possibility of business agility models and solutions being modified for the government and public sectors.

With the development of IoT, big data, and cloud computing technology, the sensing ability of government and public bodies is likely to expand greatly. With the expansion of government cloud adoption, information exchange and sharing among government departments are expanding. With the proliferation of CPS, information exchange and sharing between the private and public sectors have greatly increased. The expansion of IoT and cloud computing will greatly increase the possibility of collecting and utilizing measurable goal-related data in the public sector. Improving the sensing and monitoring capabilities of government and public bodies can contribute greatly toward reducing the gap between the private and public sectors.

The enhancement of big-data-analyzing capabilities and the use of artificial intelligence (AI) can be a breakthrough solution for the complexities of the government and public sectors. Zuazua and Lohmeyer (2019) pointed out the importance of the ability to use new technologies to secure necessary data in a timely manner, in order to create an agile governmental system, and to utilize them through artificial intelligence-based analysis. In particular, AI combined with deep learning, or machine learning, can greatly enhance problem-solving abilities, thus overcoming the complexities that humans cannot understand as evinced by the success of AlphaGo.[4] By strengthening the capabilities of scenario planning and complex event processing (CEP) as developed in the private sector, it is possible to enhance the ability to predict the occurrence of social issues, strengthen the initial response capacities in the event of issues, and improve problem-solving capacities based on scenarios. Improving the government's and public bodies' utilization of big data and their forecasting capabilities can contribute greatly to reducing the gap between the private and public sectors, particularly the second set of differences in the complexity of the issues.

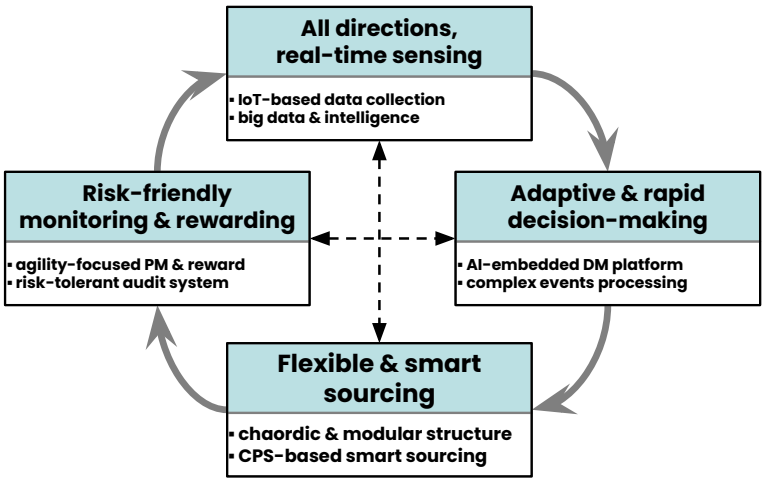
On the other hand, the proliferation of social networking services (SNSs) and smart mobile devices is increasing the possibilities of the early detection of social issues and the identification of new solutions by collective intelligence. The development of the public sector platform, along with the expansion of the shared economy, has increased the possibilities of co-creation by combining various resources owned by the private sector, individuals, and the state (Hong and Lee 2016). If governmental innovations, such as systematic risk management and tolerance for failure due to innovation, are achieved, the gap between the private and public sectors can be reduced.

4 AlphaGo is an AI computer program that played the board game Go and was developed by Alphabet Inc.'s Google DeepMind in 2015.

New Challenges and Tasks for Building an Agile Government

To achieve an agile government, it is necessary to enhance the feasibility of agile decision-making. Agile decision-making is at the core of an agile government. For a more effective government agility response to the Fourth Industrial Revolution, it is necessary to develop the following functions: (1) real-time sensing in all directions; (2) adaptive and rapid decision-making; (3) flexible and smart sourcing; and (4) risk-friendly monitoring and rewarding, as seen in Figure 3.

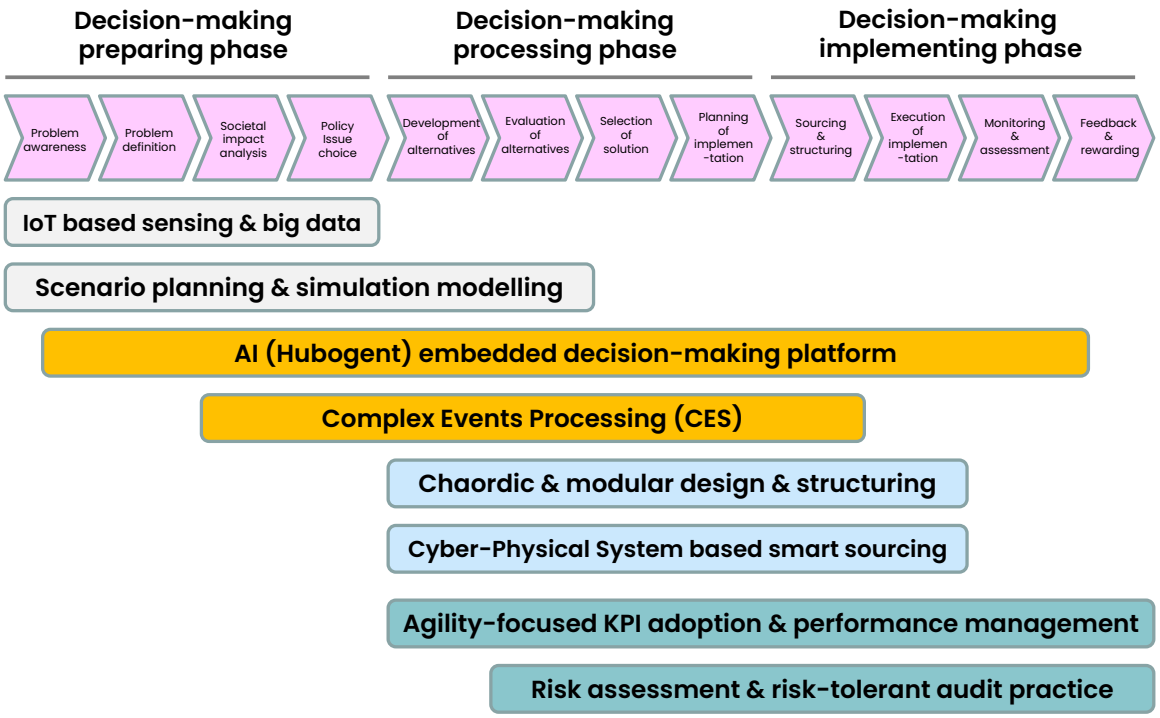
Figure 3. New Challenges for a More Effective Government Agility Response to the Fourth Industrial Revolution



Source: drawn by the authors.

To activate these four agility functions and this cycle, it is necessary to develop various supporting tools and solutions and apply them to the public sector. For example, Hugos and Hulitzky (2010) suggested Business Process Management (BPM), Complex Event Processing (CEP), Business Intelligence (BI), and Simulation Modeling (SM) as technologies to support the agile business process, as seen in Figure 4. This paper argues that the agile management system at a business or organization level should be applied to government organizations beyond agile development at the project level. To this end, the authors present an agile decision-making and practical solutions model for government that reflects the characteristics of government organizations as a comprehensive framework. To implement agile decision-making, big-data analytics and AI technologies are proposed. Moreover, to implement an agile management system, various ICTs, such as the Complex Event Processing (CEP), and new management techniques, such as risk management, will also be required to apply for further development of agile government.

Figure 4. Emergent Tools and Solutions for More Effective Agile Decision-Making



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This study suggests the following agile decision-making support tools and solutions according to decision-making processes and phases:

· *IoT-based sensing and big data analytics*: IoT is the inter-networking of physical devices, vehicles, buildings, electronics, and other network connectivity that enables these objects to collect and exchange data.[5] IoT is achieved through seamless large-scale sensing, data analytics, and information representation, using cutting-edge ubiquitous sensing and cloud computing (Gubbi et al. 2013).

- *Scenario planning and simulation modeling*: The scenario planning methodology is suggested to systematically incorporate future uncertainties into the planning stage, and simulation modeling is required to predict the impact of uncertain future variables. A more effective application of simulation requires both big data and AI support.
- *The AI-embedded decision-making platform ("Hubogent"[6])*: AI can help overcome the limitations of human-driven decision-making. The Zuazua and Lohmeyer (2019) study highlights the human and AI collaborative decisions.[7] By increasing the agility of

5 For example, the US Air Force takes an agile approach to its newest management system aimed at giving troops real-time awareness through multiple interconnected systems (Maucione 2020).

6 "Hubogent" is a newly created term by the authors Hong and Kim (2016; Kim and Hong 2017) and is a compound of the words "Hubo" and "Agent." It refers to an intelligent program or robotic agent that has been endowed with an intelligence system to performs administrative work for human beings.

7 They pointed out that "The solution is to distribute decision making further from the traditional centers of control, while rapidly building requisite new skills and behaviors and guiding and augmenting human decision making with new technologies, processes, rules, and analytics."

decision-making, AI can particularly contribute to improving accuracy and speed as well as analytical abilities (Hong and Kim 2016).

- *Complex Event Processing (CEP)*: Event processing is a method of analyzing streams of information about events and deriving a conclusion from them (Luckham 2012). Complex event processing (CEP) is event processing that combines data from multiple sources to infer patterns that suggest more complicated circumstances, consisting of a set of techniques for processing real-time events and extracting information from event streams as they arrive.
- *Chaordic and modular design and structuring*: Agile organization and personnel should be mobilized using the chaordic[8] and modular principles. Chaordic and modular design and structuring can increase system agility (Dove 2005).
- *Cyber-Physical System (CPS) based smart sourcing*: Smart sourcing implies intelligent outsourcing. It increases innovation across a range of processes from core to non-core, allowing organizations to focus on their most critical areas of differentiation and customer value (Bajec 2009). Currently, CPS can enhance smart-sourcing capabilities.
- *Agility-focused key performance indicator (KPI) adoption and performance management*: To measure governmental and public performances, various KPIs have already been developed and utilized. However, the development of detailed KPIs that are directly linked to agility is insufficient, and the performance management that takes advantage of its characteristics is ineffective. Rdiouat et al. (2015) suggest various performance indicators for an agile government and agile decision-making.
- *Risk assessment and risk-tolerant auditing practices*: Risk management is a critical part of any change process and will be necessary to make the public service more agile (PwC 2015). Governmental auditing systems, both internal and external, have the potential to enhance strategic agility and public administrative reform (OECD 2015). To enhance agile decision-making and action, governmental auditing institutions should vitalize a risk assessment service function and develop risk-tolerant auditing practices.

Concluding Remarks

This paper reviewed more diverse previous studies, including Mergel and her associates' (2018) paper, as well as cases and studies on the agile management in the private business sector (Christopher 2000; Sambamurthy et al. 2003; Overby et al. 2006; Luckham 2012; Gunasekaran et al. 2019). This paper intends to present an agile decision-making and practical solutions model for government as a key basis for transitioning beyond the research phase and into the execution phase.

There are various new challenges and tasks for building an effective agile government. First, it is effective to implement an agile decision-making or agile administration system at the core of the agile government, together with a digital transformation of the work of the government. To become more agile, the government needs to constantly transform itself into an effective

8 Dove (2005) suggested three types of organizing principles: Ordered, chaotic, and chaordic. The term "chaordic" means governed by, or combining elements of, both chaos and order, such as Lego combination blocks.

digital government. Coleman and Forman (2016) suggested seven pillars for becoming a digital government organization: hybrid IT environments, security, advanced data analytics, IT service management, application services, mobility services, and user-centered designs. For digital government transformation, governmental process automation can be a particularly critical success factor. Therefore, agile governments require the following: (1) fast decision-making, (2) flexible resource allocation, (3) access and analysis of a constant stream of high-quality data to understand the changing environment, (4) appropriate risk-taking, (5) flexible policy-making approaches that allow for rapid changes to plans and decision reversal when needed, (6) balancing of short-term responsiveness with long-term management of uncertainty, (7) active shaping of the operating environment, and (8) a shared values base (Australian State Services Authority 2007; PwC 2011, 2015; Doz and Kosonen 2008; OECD 2015).[9]

While governmental innovation has so far been driven by a physical environment, future government innovation or transformation should make use of the cyber-physical environment as its new administrative space. In this respect, it will be necessary to create a mid- to long-term roadmap for establishing relationships and prioritizing between future digital transformation tasks and agile government tasks.

Second, the government should make an effort to balance the basic initiatives presented in this study in order to implement an agility model within the government. In this study, the authors sought possible solutions with an emphasis on sensing and decision-making, which is likely to be the most difficult of the functions when realizing an agile government. However, since resource sourcing, risk-monitoring, performance evaluation, and reporting measures are also important for implementing government agility, they require in-depth research, alongside specific solutions. This is in line with the three principles as laid out by the OECD (2015) and Doz and Kosonen (2008), namely, the balanced implementation of the three principles of strategic sensitivities, collectivity, and resource flexibility.

Third, further research on how AI-embedded decision-making can be implemented is required in order to execute agile decision-making. It is necessary to utilize the concepts and principles of the Hubogent (Kim and Hong 2017). "Hubogent" is used to refer to an intelligent program or robotic agent that has been endowed with an intelligence system that performs administrative work for human beings (Hong and Kim 2016; Kim and Hong 2017). Agile decision-making, which is at the core of an agile government, must be transformed into Hubogent-embedded decision-making (Hong and Kim 2016). Henceforth, it is necessary to study the effective ways by which to realize Hubogent-embedded decision-making in the government.

Fourth, it is necessary to coordinate various institutional, administrative, and human arrangements for the actual operation of the agile government, and further research on the technical implementation methods of applying the requested new technology is required.

9 A local public health center plays an important role in providing public health care for local citizens, but it does not provide speedy and high-quality medical services due to the lack of specialized medical personnel. For example, one of its problems was missing the golden time for early detection of lung diseases. In order to solve this problem, one of the district governments in Seoul, Eunpyeong, assisted by the Korea Information Society Agency and an IT company (LG-CNS), established an AI and Cloud-based Health Center in 2019 for the first time in the nation's public health center. Prior to the introduction of such a system, a public health doctor's reading of a tuberculosis-oriented X-ray images was slow. It usually takes over a day for a health center to request a medical specialist outside a district health center to read X-ray images and receive results. After applying this service, a local health center can get the result in 20 seconds. Moreover, its accuracy level exceeded the average accuracy rate of university hospital specialists. At present, the AI-assisted analysis system analyzes all four major lung diseases (lung cancer, tuberculosis, pneumonia, and pneumothorax) within 20 seconds, and collaboration between a doctor and AI really improves the accuracy rate of medical diagnosis (Kim 2019).

For example, a technical solution for Hubogent-embedded decision-making, agile decision-making platforms, and so on should be presented (Hong and Kim 2016; Kim and Hong 2017). In addition, the agile management system architecture as a complete blueprint that encompasses institutional, administrative, and human elements, in addition to technical elements, should also be designed in detail. Another interesting suggestion would be that an agile development approach, rather than a conventional waterfall development approach, would be more effective as a development methodology for this purpose.

Finally, there is a need to establish a relationship with an adaptive governance, which is discussed in conjunction with the study of an agile governance or agile government. For example, Soe and Drechsler (2018) view adaptive governance as encompassing an agile governance, on the basis of previous studies (Wang et al. 2018; Janssen and van der Voort 2016). However, the core concept of agile governance is limited to the agile development approach that is applied to software development. If we extend the concept of an agile governance that includes inter-organizational relationships, or technical solutions such as the agile management system as discussed in this study, it is not easy to interpret bilateral relationships as one side encompassing the other. With regard to the most comprehensive digital governance, agile governance can provide a sustainable governance framework that keeps innovative digital service delivery within the government, while adaptive governance can be a type of comprehensive innovative governance. Therefore, it is necessary to remember that the agile management system within the private sector did not occur overnight; it has evolved over a period of more than a decade through trial and error processes. It should also be considered that the environmental factors of competition among private companies have contributed to enhancing the completeness of the agile management system. It is also necessary to consider the other external pressures that could replace the external pressure of competition, such as the vision and leadership of political leaders, the level of technological development of private companies, the level of academic development within academia, the attempts to innovate an agile government in advanced or neighboring countries, and the discipline of adaptive governance.

As a matter of fact, the content of the new challenges in this paper is based on various private sector experiences because of limited systematic studies on agile government at this point. Accordingly, it is unavoidable for this paper to utilize corporate experiences that could provide practical lessons for the development of agile government. Having such limitations and difficulties, this paper aims to propose new possibilities of agile government. If experimental challenges and empirical applications in this field are accumulated in the future, they should be developed into more rigorous research papers based on systematic research methods.

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