UNIVERSITY OF TURKU

ABSTRACT

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Abstract

The aim of this research is to increase the knowledge about digital innovation hazards in public sector organizations.

Digital innovation is, just like for commercial sector organizations, very important for public sector organizations. Digital innovation can facilitate in improving the quality of products, services and service delivery, and it can decrease costs. Moreover, it can help to prevent public sector organizations' operational activities from being disrupted by innovations from the commercial sector organizations. However, innovation implies some degree of risk and various innovation barriers are repressing the will to innovate within public sector organizations. When the management pushes for a stricter management of these hazards, it is often at the expense of the organization's innovation program. By giving suggestions to public sector organizations about what an effective way of managing these digital innovation hazards can be, the complexity among the digital innovation hazards can be decreased. This can lead to a more efficient innovation program, with a better performance.

This research discusses how public sector organizations implement digital innovations, what kind of risks and barriers they face during the implementation process and what actions can mitigate or avoid these digital innovation hazards. It addresses research gaps of scientific research on digital innovation hazards within the public sector.

This research builds on existing literature about digital innovation, risk management, the public sector, chatbots and communication science. Based on the prior literature, a qualitative approach was chosen and a case study, using interviews as a source of primary data collection, was conducted. In addition, a focus group was conducted among domain specialists within PwC Nederland to generate professional perspectives on the studied subject.
Results show that implementing digital innovations in public sector organizations is indeed a risky business, since various types of risks arise during the implementation process. Besides that, eleven different innovation barriers are discovered, that are repressing the will to innovate within public sector organizations. Finally, there are nine actions suggested, that public sector organizations can perform to mitigate or avoid some of the discovered digital innovation hazards.

Key words	Digital innovation, innovation hazards, risk management, public sector, chatbot, communication science
Further information	A research conducted in the context of the Risk Assurance department of PwC Nederland

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DIGITAL INNOVATION HAZARDS IN PUBLIC SECTOR ORGANIZATIONS

A research conducted in the context of the Risk Assurance department of PwC Nederland

Master´s Thesis
in Information Management and
Global IT Management

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Turun kauppakorkeakoulu • Turku School of Economics

Tilburg School of Economics and Management

"*There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things.*"

Niccolo Machiavelli, 1532

"*The Americans have need of the telephone, but we do not. We have plenty of messenger boys*."
- Sir William Preece, chief engineer of the British Post Office, 1878.

"*Who the hell wants to hear actors talk?*"
- H. M. Warner, Warner Brothers, 1927.

"*I think there is a world market for maybe five computers*."
- Thomas Watson, chairman of IBM, 1943.

"*There is no reason anyone would want a computer in their home*."
- Ken Olson, president, chairman and founder of Digital Equipment Corp., 1977.

"*Television won't be able to hold on to any market it captures after the first six months. People will soon get tired of staring at a plywood box every night.*"
– Darryl Zanuck, 20th Century Fox, 1946.

Table of content

List of figures

List of tables

1 INTRODUCTION

1.1 Problem identification

Nowadays, innovation has an exceptional importance in organizations and this importance has still been increasing significantly during the last past years. New expectations, challenges and questions, coupled with great opportunities, emerge every day in all kinds of industries. To not fall behind, organizations are forced to come up with innovative approaches and solutions. The rapid changing world forces organizations to constantly think about their position in the future and to constantly anticipate in tomorrow's definition of value.

Innovations facilitate organizations in increasing their internal efficiency, external opportunities and disruptive changes (Parvianen; Tihinen; Kääriainen & Teppola, 2017). "*Yesterday's efficiency is today's inefficiency*" (Ståhle & Grönroos, 2000). Therefore, innovations are an extensive source of an organization's competitive advantage and profitability (Porter, 1985; Goswami & Mathew, 2005). Innovation became a key element to keep up with- or differentiate from the competition and the ever-changing environment, which is essential to survive as a profitable, modern organization. Innovation is no longer optional, but it has shifted to a priority position within organizations and within the society.

A considerable part of innovations these days can be classified as digital innovations. Digitalization is one of the major trends that is changing the current society. Researchers even speak of the golden age of digital innovations (Fichman; Dos Santos & Zheng, 2014). Connected clouds, block chain, machine learning, analytics, big data and augmented reality, to name some recent ones, are enabling transformations in the way organizations organize, work and live. It is crucial for organizations to have a strong and proper grounding in IT (Information Technologies) in general and in digital innovation in particular (Fichman; Dos Santos & Zheng, 2014).

Not all organizations identify profitability, market share and competitive positioning as their key drivers and motivation for innovation. Public sector organizations are fair examples of this. Public sector organizations do not experience such a 'market-pull' as commercial sector organizations do. However, this does not mean that innovation is irrelevant for them. Innovation can also facilitate in improving the quality of products, services and service delivery, and it can decrease costs. Moreover, it can help prevent their operational activities from being disrupted by innovations from the commercial sector organizations. Still the digital innovativeness of the public sector has quite a backlog if you compare it to the digital innovativeness of the commercial sector (Seddon, 2008; Fishenden & Thompson, 2012; Verma & Cutcher-Gershenfeld, 1996; Brown, 2001).

New products, services and processes have to be generated and public sector organizations should be able to adapt faster to the changing environment (Doz & Kosonen, 2014). Examples of innovation barriers in the public sector organization are a lack of urgency and the absence or inadequacy of resources (Cankar & Petkovsek, 2013). These can be identified as financial resources, but also as relevant skills/human resources and time resources. The public sector has to compete for financial resources, interest and a good reputation according to the same rules as commercial sector organizations, while recent research on innovation has mostly been focussing on innovation by commercial sector organizations (Windrum & Koch, 2008).

Perspectives on how to improve public sector programmes are needed and unfortunately, relatively rare. The decision-making processes and the culture in public sector organizations are also more obstructive, risk-averse and time consuming to change, compared to the processes of the commercial sector (Cankar & Petkovsek, 2013). Nowadays risk aversion is often identified with delays, failure to take action, loss of opportunities and stakeholder frustration (Walters & Ramiah, 2016). Besides that, the incentives for innovative behaviour are experienced differently within the two sectors.

Although a strong grounding in digital innovation has become increasingly important for organizations, it often implies the organization to take some degree of risk. Taking different types of risks is crucial to lead innovation and change well effectively. Yet risk taking is increasingly challenging with limited resources, a lack of urgency and the fear of reputational damage (Osborne & Brown, 2013). Especially in a strict risk management environment as most public organizations have. When the management pushes for stricter risk management, it is often at the expense of the organization's innovation program (Borgelt & Falk, 2007). This is creating a 'push-me-pull-you' struggle between digital innovation and risk management within public sector organizations. This struggle creates a lot of complexity among digital innovation barriers and increases the digital innovation risks, which represses the willingness to innovate and the trust that is allocated to digital innovations within public sector organizations. Since fewer innovations are generated and only implemented when they are multiply proven, the public sector's digital backlog is still enlarging and their performance is still lacking skills.

1.2 Research questions

The objective of this research is to increase the knowledge about digital innovation hazards in public sector organizations. This research will discuss how public sector organizations implement digital innovations, what kind of innovation risks and barriers they face during the implementation process and given suggestions about how they can manage these digital innovation hazards. It addresses research gaps of scientific research on digital innovation hazards within the public sector.

This leads to the following research questions:

I. Is implementing digital innovations in public sector organizations a risky business?
II. What is repressing digital innovation in public sector organizations?
III. How can public sector organizations manage the hazards among digital innovations?

More specifically, this research will focus on: incremental, technological, digital product and/or process innovations; and strategic, compliance, financial, operational and reputation innovation risks.

There are theoretical findings about how innovations are implemented, what risks are involved and how to these hazards are managed, but those are mostly focussed on the commercial sector instead of the public sector. Besides that, this research will particularly focus on digital innovations.

By analysing how a case organization from the public sector is currently implementing a digital innovation, a discovery of various risks and barriers that they meet during the various implementation stages is expected. By discussing how the organization has managed these hazards and, just as important; what they should change about their current actions. We expect to be able to give suggestions to other public sector organizations, about what an effective way of managing digital innovation hazards in public sector organizations can be. This will help to lower the earlier stated complexity of digital innovation hazards that public sector organizations experience and it will help to transform public sector organizations' mentality and culture to be less risk/change averse and thereby less innovation averse. This way they will be able to allocate more trust and budget into dedicated teams with capital, know-how and creatives, which will lead to a more efficient innovation program, with a better performance. This will support them making up the stated backlog, while benefiting from the upcoming digital innovations that are improving their organizational performance.

1.3 Research Setting

The research is conducted in the context of the risk assurance department of PwC Nederland. This department provides attestation and assessment services, to help organizations understand and manage business risks related to technology in the transformative age. The services that they provide include system & control reporting, IT audit, and extended assurance (PwC.nl, 2019). The team I have been working with was primarily focusing on middle size private companies and public sector organizations (PCPS).

> "We contribute to building public trust in public organizations by helping them maximise public value and to report in a transparent manner" (PwC.nl, 2019).

1.3.1 PricewaterhouseCoopers (PwC)

PricewaterhouseCoopers, mostly known as PwC, is a multinational, professional services organization, headquartered in London (UK). The organization was established in 1998 by a merger between Coopers & Lybrand and Price Waterhouse. In 2018 PwC ranked by ICAS as the largest professional services organization in the world. Along with Deloitte, KPMG and EY, PwC belongs to the Big Four auditors. PwC is a network of connected firms with more than 250.000 people, spread over 721 locations in 158 different countries. Over 5000 people work at PwC in the Netherlands. They are committed to delivering quality in tax, assurance and advisory services. They want to contribute to a greater level of trust in society and to solve problems. (PwC.nl, 2019)

1.4 Research Structure

The research consists of nine chapters. The second chapter introduces literature about the significant concepts and their theories. The third chapter focuses on the research design and clarifies the research approach and strategy. Besides that, it also discusses how the data is collected and analysed. In the fourth chapter, the used case is presented and extra relevant theories are presented. The fifth chapter elaborates on the gathered results, structured by the different data collection methods. In chapter six, conclusions are drawn from the afore mentioned results. The seventh chapter focusses on the limitations of this research and proposes directions for future research. In chapter eight, the reference list can be found and chapter nine consists of the appendices with supporting materials.

2 THEORETICAL BACKGROUND

In this chapter, existing literature about the key concepts: innovations, innovation hazards, risk management, and their theories are reviewed. To consider all relevant viewpoints and achieve a wide scope, a thorough analysis of related theories is conducted.

2.1 Innovation

The word 'innovation' is subtracted from the Latin word 'innovare', which means 'to renew' (Jenssen & Jorgensen, 2004). Innovation has been defined in many different ways by many different authors. The most widely accepted definitions of innovation focus on change, development, improvement and novelty with a commercial success (Schumpeter, 1939). Although novelty is an important element for innovation, other requirements like usefulness and market acceptance, should not be forgotten. Novelty does not always mean that the idea is completely novel to world, like an invention, but an innovation has to be novel to the context it is applied in (Hoecht & Trott, 2005). Besides novelty, an innovation should create value for the organization; weather from costs, performance or quality.

According to Joseph Engelberger (1982), Innovations need three essentials: a recognized need, people with knowledge and financial resources.

Innovations are a complex construct. They can influence the organization's growth in a positive and a negative manner. Figure 1 resamples the lifecycle S-curve of technologies. Organizations should be aware of the disruptions in technological innovations in their environment, as they can influence their operational activities and position in the market.

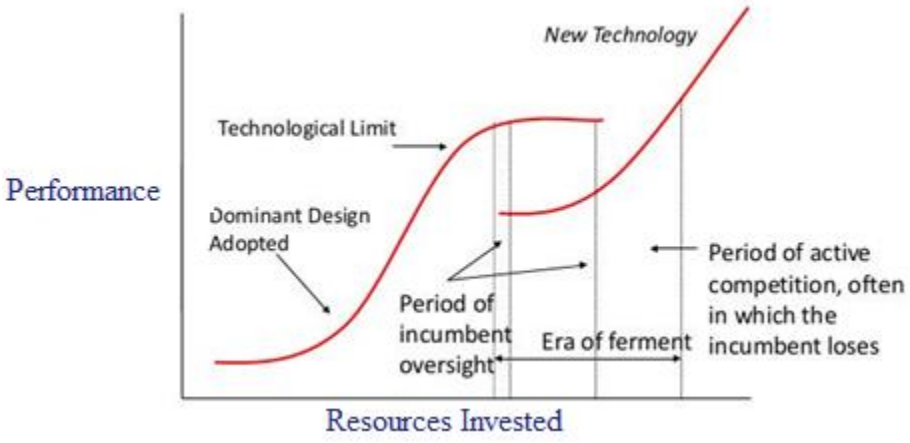


Figure 1 Technology S-curve and disruptive technology (Foster, 1986; Utterback, 1974).

The following definition of innovation will be used:

> "The implementation of a new or significantly improved product (good or service), process, marketing method, or organizational method which results in significant improvements in outcomes of efficiency, effectiveness or quality to business practices, workplace organization or external relations." (OECD, 2005).

2.1.1 Innovation implementation

Innovation implementation processes seem difficult to manage. Desouza et al. (2009) broke the innovation implementation process down into five discrete, cyclic stages. They claim that all ideas need to go through the full process to become a successfully implemented innovation.

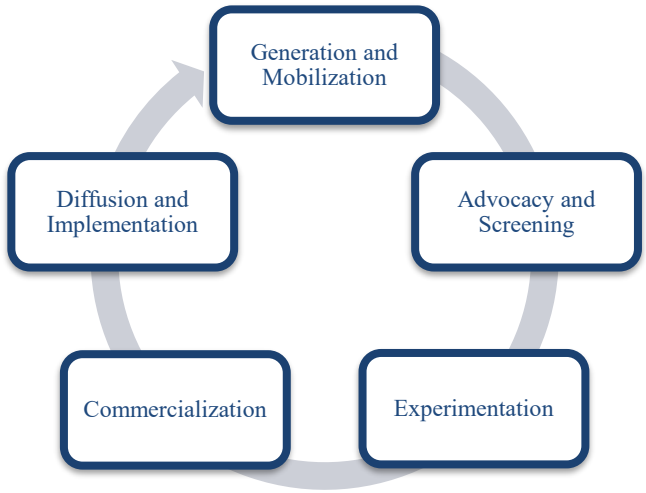


Figure 2 Innovation implementation process (Desouza et al., 2009)

1. *Generation and mobilization*
   In this stage, new ideas are generated whether through the development of new products (goods or services) or by the redefinition of earlier concepts, modification of processes or creation of new product elements (Von Krogh, Ichijo, & Nonaka, 2000). During the last past years, the traditional sources of ideation have been expanding to a wider set of potential sources. *"Idea generation is now a business function or activity, requiring the involvement of everyone in the organization and even those external to, but affiliated with, the organization"* (Cooper and Edgett, 2007). This includes inside sources like; employees, and outside sources like; customers, competitors, collaborators, partners and private inventors.

A SWOT (strengths, weaknesses, opportunities and threats) analysis or brain-storm session are good tools to help discover these opportunities (Cooper and Edgett, 2007). Ideas can be generated in a loose/playful environment, in a tightly controlled/problem-driven environment or in a hybrid environment that combines these two (Desouza et al., 2009). Not only existing knowledge is involved, but also new knowledge is generated, acquired and shared (Howells, 2002). Crawford (1987) classified two types of idea generation. The first and most general one, is about identifying unmet needs and problems, and finding solutions to these problems (problem find/solve approach). The second one is about modifying or improving existing products to create new products (fortuitous scan approach).

The ideas are also mobilized in this stage, since not all ideas have to be developed from the ground up. There are changes made to existing products, processes or frameworks that lead to the movement of ideas to another physical or logical location. Mobilization can also arise from traditional areas and shift them to more nurturing environments like spin-offs (Desouza et al., 2009). This can be very difficult since some individuals perceive knowledge as power and do not want to share their ideas. Besides that, ideas are very context-specific and therefor hard to implement in other contexts. Although this does not devalue or invalidate the ideas (Chua & Lam, 2005).

2. *Advocacy and screening*

   In this stage, the potential innovation benefits and costs are identified. Potential opportunities and threats are evaluated, since not all generated ideas are worth implementing. Some ideas are discarded because of low probabilities of success or high costs of implementing. This can be financial, but also structural of social. The idea is discussed within several organizational levels, since all ideas should be pitched to the upper management to get their support. This stage also allows a period of innovation refinement. Advocating the innovation helps to make the idea and its benefits more explicit and communicable. (Desouza et al., 2009)

3. *Experimentation*

   In this stage, the organization starts with experimentation and proto-type building. It often implies trials and pilots from practical, strategic, financial and technical perspectives (Fichman, 2001) (Damanpour & Schneider, 2006). The applicability of the innovation to a particular problem or context at a specific time are tested. Sometimes innovations can go beyond the current capabilities of the organization or they can be ahead of their time (Desouza et al., 2009).

This stage can result in a prototype, data, ideas for the future and studies about the innovation usefulness that can help the top-level management in evaluating other ideas. This stage can be really resource consuming since it is an unstructured process that is hard to manage or make routine. Especially since context is the key. (Desouza et al., 2009)

4. *Commercialization*

   In this stage, the focus shifts from the development of the innovation to the potential impact and the potential scope of the innovation. The audience needs to be defined; who will benefit from it? who will be using it? and how often? The user requirements are discovered and the scope is set. The innovation's specifications are established, so the actual benefits can be communicated. The innovation has to be made appealing/refined and has to be introduced to the intended audience. Often big data and/or prototypes from the stage before are used to show the tangible and intangible benefits. Commercialization creates the internal and the external market value of the new introduced innovation. The output of this stage is usually a defined product (good or service) and a developed business plan about how the innovation has to be diffused and implemented. (Desouza et al., 2009)

5. *Diffusion and implementation*

   In this stage the process of generating buy-in and acceptance of the innovation starts. "*Diffusion is the process through which an innovation is communicated through certain channels over time among the members of a social system*" (Rogers, 1995). The needed structures, maintenance and resources are allocated, developed or produced. In this stage, the innovations need to get accepted by their users, and they need to be able to change the behaviour/mindset of their users (Desouza et al., 2009). The innovation needs to be implemented and accepted at all levels of the defined context (Davis, 1989). This can be department-wide, organizations-wide or network-wide (Waarts & Van Everdingen, 2005). Support from upper management is seen as indispensable in this stage. The adoption of the innovation is a crucial and quite risky part of this stage. Many factors can affect the adoption of the innovation. Organizations should consider individual factors like; personality, organizational factors like; centralization or differentiation, and environmental factors like; industry characteristics (Lawrence & Lorsch, 1967). Riemenschneider, Harrison and Mykytyn (2002) defined three fundamental IT decision parameters: *"Anticipated positive and negative consequences, social approval or disapproval and perceived ease or difficulty in implementing or enacting the decision."*

2.1.2 Common innovation barriers

There are various researches conducted to find common reasons why some organizations do not innovate as much as other organizations do. This research will discuss the following five common innovation barriers that organizations can face, introduced by Albury (2005):

Figure 3 Common innovation barriers (Albury, 2005)

First, *short-termism*, which indicates short-term planning horizons and short-term budgets, forms a barrier for innovation (McCormick et al., 2003). Many organizations focus on the requirements for annual gains and try to break even every year. This is a more cautious way of working, that can lead to less innovation instead of looking for bigger gains over, for instance, five years. (Mulgan & Albury, 2003)

Secondly, a *lack of incentives* is an innovation barrier. If being innovative or adopting innovations is not rewarding, organizations and their workforce are less triggered to do so. Many professionals and executives spend their time dealing with day-to-day challenges and pressures of delivering. They often do not plan some extra time to think about changing the way of operating or delivering their value, because it is not appreciated by the rest of the organization. Besides that, the penalties for unsuccessful innovations can be higher that the rewards for successful ones. This also affects the mentality of employees to look for and recognize potential innovations. Especially, in a context without the urge to compete to survive. Some government policies like patens, trademark protections, corporate tax regime, etc. are created to strengthen incentives for innovation, but often it still forms a barrier being innovative. (Mulgan & Albury, 2003)

Thirdly, there is a *culture of risk aversion*. The unknown of the market and its customers and the unclearness of users' needs; creates risk (McCormick et al., 2003). Producing something that is new, can respond to existing needs, but it can also fulfil them in a completely different way than expected. This creates uncertainties about how large the potential market is and who exactly the intended customer group is. This is strengthen by the fact that there is no experience with the new knowledge yet. The more uncertainties, unclearness and unknown, the more risks are faced. In a risk and change averse culture, defensive behaviour will rise and innovation will be blocked or avoided. (Mulgan & Albury, 2003)

Then, *organizational arrangements* are forming a barrier for innovation. Innovation is only possible when organizations develop a proper alignment of systems management methods, culture and processes that embed innovation. When many systems, processes and infrastructures are intertwined with each other, it is very hard to make a change without messing them up. There can be an over-reliance on current high industry performers as sources of innovation instead of offering the right infrastructure to support internal innovative ideas (McCormick et al., 2003). The organization's strategy and infrastructure should be adjusted to this as well. (Mulgan & Albury, 2003)

Finally, there is a *lack of resources*. This can indicate financial resources, but also for instance human skill resources and time resources. This barrier can be cited as one of the most significant barriers to innovation. R&D (research and development) can have high costs where the payback time it often long and uncertain (McCormick et al., 2003). Often an organization cannot afford this or it can become a source of conflict with funders (Bergemann, 2005). Moreover, even if executives have the right opportunity and motivation to innovate, a lack of skills in risk or change management can be a significant barrier for the innovation process. Besides that, skilled and qualified employees are also more valuable and demand higher rewards, which is again a lack of financial resources. Finally, time should be allocated to innovation. Often workforce's focus is on the day-to-day operations and there is barely any time for more innovative tasks. (Mulgan & Albury, 2003)

2.1.3 Types of innovation

In 1939 Joseph Schumpeter defined five types of innovation:

1. Product innovation
2. Process innovation
3. Opening a new market
4. Development of new sources of supply for raw material or other inputs
5. Changes in the industrial organization.

This research will focus on the first two of Schumpter's categories: product and process innovation.

- *Product innovation* is defined as the development of new end products (goods or services) or changing a current product's design. (Utterback, 1994) (OECD, 2007). Therefore, product innovations are new, or significantly improved from previous products. This can include improvements in components, materials, software, technical specifications or other functional characteristics (OECD, 2007). Besides that, it can improve the product quality, which makes the product more competitive within the market (Reguia, 2014). Rammer et al. (2009) propose that the success of a product innovation depends on the degree of novelty. A high degree of novelty results in greater product differentiation compared to the competitors. It is more likely that the organization will get new customers, which can bring larger margins.

- *Process innovation* is defined as the adoption a new or significantly improved key process, including production and delivery methods. This improvement can include new techniques, equipment and software (OECD, 2007). It provides the envisioning of new strategies for the way of doing, designing and implementing new ideas (Davenport, 1993). Process innovation has a focus on efficiency and can contribute to reducing production time, costs and increasing the ability to differentiate from competition, especially in a service-oriented market. Automation of production processes is currently the big trend concerning process innovation. (Willcocks & Lacity, 2015)

There is also a significant difference between incremental and radical innovations. To narrow the search field, this research will focus on incremental product and process innovations:

- *Incremental innovation* is defined as an innovation that is significantly improved compared to currently existing products (Beck; Lopes-Bento; Schenker-Wicki, 2016). They can create incremental improvements in an organization's results or the performance of one or a few existing elements. However, the degree of novelty is less than then the degree of novelty from radical innovations. Examples are new functionalities in an existing product, improvements in the product line, etc. (Dewar & Dutton, 1986).

- *Radical innovation* is defined as an innovation that is radically new to the market or to the organization (Beck; Lopes-Bento; Schenker-Wicki, 2016). Radical innovations significantly change the organization's preferences, competences and way working (Schumpeter, 1934, 1943). They can be much more disruptive and discontinuous then incremental innovations are. Radical innovations have a higher degree of newness and differentness (Schilling 2008). They are often a solution to a problem that has not been solved yet, or has been solved in an inefficient manner (Dutton, 1986). These 'new-to-the-world' ideas are very rare and carry the highest level of risk (Cooper & Edgett, 1999).

Finally, we can divide innovation in technological versus administrative innovations. This research will focus on technological, incremental product and process innovations:

- *Technological innovation* is defined as an innovation that involves the adoption of an idea that has a direct effect/influence on the basic output processes (Daft, 1978). They are customer driven, have a market focus and are related to core work activities. It can be the implementation of a new service, process, program or product in the organizational context (Jaskyte, 2011).

- *Administrative innovation* is defined as an innovation that includes changes that have an effect/influence on the policies, allocation of resources and other elements that are associated with the social structure of the organization (Daft, 1978). It can be the implementation of a new process, procedure or structure in the administrative core of the organization in the organizational context. An example is creating new strategy teams composed of diverse employees (Jaskyte, 2011).

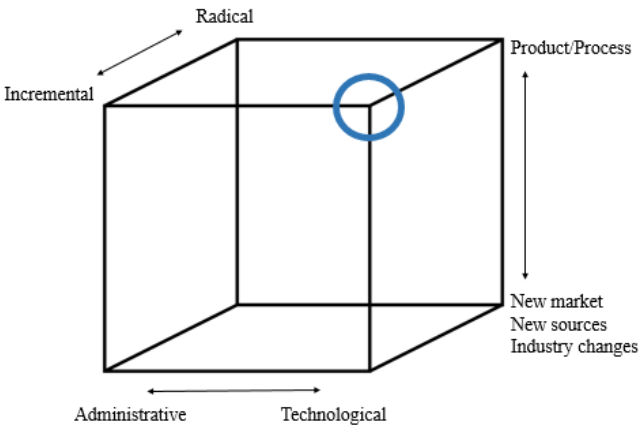


Figure 4 Multidimensional focus model of innovation

2.1.4 Digital innovation

A digital innovation is an innovation that is embodied in or enabled by information and/or communication technologies (IT/ICT) (Fichman; Dos Santos & Zheng, 2014). Digitalization explains the sociotechnical phenomenon, which covers the fact that society is adopting and using technologies in broader individual, societal and organizational contexts (Legner et al., 2017).

Digitalization can take place at several levels within an organization, such as: process level, organizational level, business domain level and society level (Parviainen, Tihinen, Kääriäinen & Teppola, 2017). The potential benefits of digital innovations are very high at the moment. Some examples that digital innovations can bring include: the capability to endless perfect copies, dramatic cost savings for content storage/duplication/transmission, improved ability to search/analyse/correct content (Negroponte, 1995) and it can uncouple the historically strict relationship between information types and their corresponding devices, storage media and transmission formats which creates digital convergence (Tilson et al., 2010). In addition, communication cost can be reduced and the speed and reach of resources can be increased. This creates digital connectivity, which enables coordination and collaboration among various participants (Lyytinen; Yoo & Boland). Besides that, one kind of digital innovation can enable an important part of another digital innovation, which creates an exponential growth of digital innovations. An example is how the digital detector technology of the mammography field for breast cancer detection, enabled radiologists to replace film-cassette based analogue mammography. This created the new product: digital mammography (Fichman; Dos Santos & Zheng, 2014).

As shown in figure 4, we shift our attention to the first two types of innovation that Schumpter defined, in combination with digitalization on a technological and incremental basis; technological, incremental digital product innovation and technological, incremental digital process innovation.

- *Digital product innovation* is defined as a significantly new product (good or service) that is embodied in or enabled by information and communication technologies (IT/ICT) (Fichman; Dos Santos & Zheng, 2014; Nambisan, 2013). Examples include new enterprise platforms (enterprise resource planning (ERP) platform and customer relationship management (CRM) platforms), new market products (smart devices) and existing products that are significantly improved by the addition of technologies (Lyytinen; Yoo & Boland, 2015). In contrast to the 'don't reinvent the wheel' wisdom, digital product innovations can reinvent even the most basic components of familiar products to capture the ultimate benefit from the transformative potential of digitalization (Mitchell, 2007).

- *Digital Process innovation* is defined as a significantly new method of doing things in an organizational setting that is embodied in or enabled by information and communication technologies (IT/ICT) (Fichman; Dos Santos & Zheng, 2014). In the last decades digital process innovations had an influence how transactions are processed, how decisions are made, how work is done, how firms handle their customers and suppliers, and how firms attract new customers. Examples include value chain automations, new governance structures and changes in the administrative core. It develops improved output productivity over time (Utterback & Abernathy, 1975).

2.1.5 Digital innovation in public sector organizations

The Public sector consists of the General government sector and the aggregation of all public corporations like hospitals, schools, housing corporations, etc. Digital innovation in public sector organizations is not necessarily less important than in commercial sector organizations. The lack of it can lead to a decrease of efficiency, legitimacy or inefficient approaches of social issues (Korteland & Bekkers, 2006). Besides that, it feeds the threat of becoming disrupted by innovations from the commercial sector. Sabbash et al. (2013) discussed how digital innovations offer incremental economic growth. Country governments that advance in digitalization derive 20 percent more in economic benefit than those that do not. Digital innovations have proven their effect on improving quality of life, boosting citizen access to public services and reducing unemployment. It can allow public sector organizations to operate more efficient and transparent (Sabbash et al., 2013).

2.2 Risk Management

Risk is an inherent part of practically all organization's internal and external operations. (Dionne, 2013). Risk management is associated with protecting individuals and organizations from losses associated with unknown accidents (Dionne, 2013). Protection and prevention activities are embodied in the risk management process. It is a rather recent corporate function and roles like chief risk officers arose during the last decades. Activities of self-protection became important to affect the probabilities of losses and costs, before they arise. A leader's behaviour towards risk, risk aversity or risk taking, also has a big effect on the decision-making among risk management activities in an organization.

This research will use the following definition of risk management:

> "Risk management is the identification, measurement and evaluation of risks followed by coordinated and economical application of resources to control and monitor the probability and impact of unfortunate events or to maximize the realization of opportunities." (Stulz, 1996, 2003).

2.2.1 Elements of risk management

Tummala and Burchett (1999) note that a risk management process should include the following five main elements:

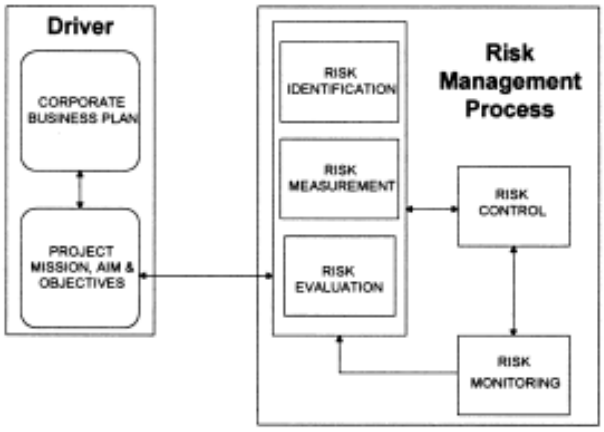


Figure 5 Risk management process (Tummala & Burchett, 1999)

1. *Risk identification*

   First, existing risks that can influence the project need to be recognized, identified and understood. Besides that, the organizations should also be aware of potential risks that do not exist yet, but can arise in the future. Risks can be found in the internal and in the external environment of an organization. Therefore, all employees, organization-wide, should be involved in this process. Identifying risks should be an ongoing process within the organization's projects. A work breakdown structure is a tool that is often used in this process. To make sure that the process of risk identification is effective, a risk manager is appointed to take responsibility of this task. It can also be a part of an individual's job. Used tools like flow charts, checklists, fault/event tree analysis, system hazard analysis, etc. should be available to this individual. (Tummala & Burchett. 1999)

2. *Risk measurement*

   To proceed effective risk management, the identified risks should be measured since each potential risk has potential consequences. Various instruments are used to measure the complexity, probability, frequency, severity and impact of a risk. This also includes assessing uncertainties that are associated with the impact. Often statistic data is used to represent the scope of possible values. This data is based on various engineering and management factors such as; environment, market conditions, etc. However, some projects are unique, and the data may not be available or not apply to them. In that case, experience and knowledge from professionals is most reliable. (Tummala & Burchett. 1999)

3. *Risk evaluation*

   This element involves identifying alternatives for the decision makers and evaluating them based on the measurements from the element before. The various alternatives are prioritized and compared, to determine which alternative is most applicable for the context. The risk aversion of the project manager or the organizations is an important indicator of the results of this element. Once the evaluation is finished, a strategy (risk response) to mitigate the undesirable risks is developed. The main goal is to not necessarily eliminate the risks, but to minimize the negative impacts. (Tummala & Burchett. 1999)

4. *Risk control*

   The organization should take actions and make new decisions, rules, standards or procedures. New control regulations with effective management tools to carry out the choses risk strategy, are set up. First, a planning is made based on the defined strategy from the element before. This planning consist of the activities that are necessary to bring the risk elements under control. Then a plan is made for each individual risk element and in the end, all individual plans are integrated with each other. Once the plans are established, the techniques are implemented. (Tummala & Burchett. 1999)

5. *Risk monitoring*

   Monitoring risks is enduring a timely tracking of the levels of risk, the risk actions and the new regulations. Progress reports with milestones, are developed and distributed periodically. This should happen on a regular and accurate basis, determined by the impact and probability of the risk. It can provide information about new risks that are arising and about possible issues that the implemented solutions are facing. If the implemented solutions are facing issues, corrective actions are devised and, again, evaluated. (Tummala & Burchett. 1999)

2.2.2 Risk response

Risk responses are possible approaches to deal with risks that are identified and measured. this research will discuss four risk response strategies (PMI, 2004).

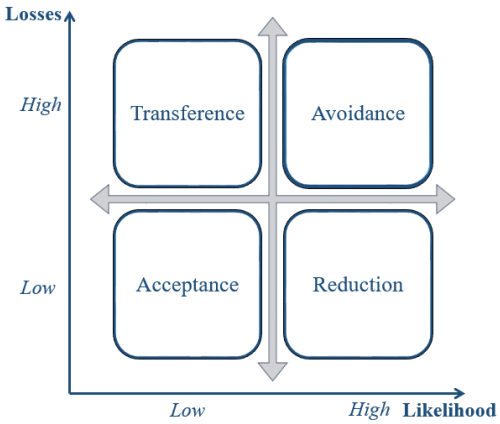


Figure 6 Risk responses (PMI, 2004)

1. *Avoidance*
   With this strategy, the possibility of the risk is completely terminated. This strategy is chosen when the potential losses and the likelihood of the risk are high. The easiest way to this is to remove the risk element or condition from the project deliverables (Zhang & Fan, 2014).Organizations change the project plan to protect the objectives from the risk's impact. After that, alternatives are identified, evaluated and realized (PMI, 2004).

2. *Transference*
   This strategy does not eliminate the risk, but transfers it to another party, outside the project (PMI, 2004). Buying an insurance is a good example of this strategy, since you transfer the risks to the insurance organization. This strategy is chosen when the potential losses are high but the likelihood is low. The potential loss is then covered by transferring fixed costs to the other party, that is taking over the risk (Zhang & Fan, 2014).

3. *Reduction*
   This is a strategy where the risk element is shaped differently to reduce either the likelihood of the risk or the potential impact to an acceptable threshold (PMI, 2004). Objectives, planning or specifications are adjusted to the situation. Often external experts are contacted and simulations/prototypes are made. Since the impact and/or probability is reduced, the expected value of the risk is also reduced. It can also affect the expected losses of other risk events, but there is a high change that the project costs will increase because of the adjustments (Zhang & Fan, 2014).

4. *Acceptance*
   Acceptance of the risk is accepting the fact that the potential losses and the likelihood are low enough to handle. This strategy is chosen when the risk cannot be or is not sever enough to be avoided, transferred or mitigated. Many (insignificant) risks will be handled by this strategy (Zhang & Fan, 2014). The possible damage should be taken into budget and covered by the resistance capacity.

2.2.3 Types of risk

According to Chance (2004) there are five types of risks: strategic, compliance, operational, financial and reputational risk.

- *Strategic risks* are defined as risks that arise from wrong, high-level managerial decisions among the strategy of an organization or improper implementation of these decisions. Every organization needs a well thought out business plan, based on strategic decisions. If the organization's strategy becomes less effective, KPI's are affected and the organization starts to struggle to reach its goals; a strategic risk occurs. This can be caused by several happenings like for instance; new technological developments, new competitors, shifts in customer demands, shifts in material costs, or other large-scale changes. A radical innovation like digital music is a good example that had to be successfully adapted in the organization's strategy to stay alive (Chance, 2004).

- *Compliance risks* are defined as risks that are caused by potential violations of regulations, rules, laws or ethical standards. Laws change a lot, all the time. There is always a risk that your business will face regulations in the future that differs from your way of working. The GDPR (General Data Protection Regulation) or new employee safety regulations are fair examples of this. The organization can change, which will force the organization to comply with regulations that did not apply for them before (Chance, 2004).

- *Operational risks* are defined as risks that occur from fraud, errors, being unable to deliver certain products or services, fail to maintain a competitive position and bad information management. It is about failure in an organization's internal day-to-day operations. This failure can be caused by people or by internal technological processes. More secure regulations and processes can often prevent these risks. Occasionally it can also be caused by an external factor like natural disasters or a power cut (Chance, 2004).

- *Financial risks* are defined as risks that refer to the money that is flowing out and in the organization. These risks can increase costs or decrease revenues and profit. Examples are customers that are unable to pay for your delivered products, fluctuating exchange rates, but also having a debt is a financial risk (Chance, 2004).

- *Reputational risks* are defined as risks that arise when the organization is affected by negative public opinions. These can be caused by for instance a scandal. If an organization's reputation is damaged, this can have a lot of influence on its daily operations and daily performance. Customers stop appreciating and trusting the organization itself or the way the organization does business, and will go to a competitor. Besides that, this can also apply for the workforce. They can leave the organization or it can become very hard to attract new employees. (Chance, 2004).

2.2.4 Innovation risks

It is proven that innovations do not automatically guarantee success. Only one out of thousands ideas becomes a project and on average, one out of three projects still fails (Schilling, 2008). A distinctive feature of an innovative project is that the chance of failure is often greater than the chance of success. It is a risky activity with a lot uncertainties and unknown outcomes (Dionne, 2013). The innovation may fail, non-adoption by the producers or users can occur, or the innovation is unable to be sustainable for the long term. This can cost many expensive resources. The created risks are sometimes never faced before and context specific. Innovation risks increase when there are uncertainties; whether a suitable solution is available or not; whether a solution can be found within the set budget, resources and time planning; whether finding a suitable solution is crucial for the success of the project (Halman, 2018).

2.2.5 Risk management in the public sector

Public sector organizations face, just like commercial sector organizations, quite some risks, but with different sources. Most of these risks arise from political or other stakeholder interests, public perceptions of science and technology, climate, social safety and health issues, management of a trustworthy workforce, and unknown markets for new research areas, just to name a few (Leung & Isaacs, 2008). The experienced risks can belong to all five above discussed risks types. Risks are often in conflict with the stewardship role of public sector organizations. This very save approach, that involves high-risk aversity and only funds projects with an exceptional high chance of success, is sometimes a risk itself (Hood, 2008).

This is also caused by the fact that a risk can often create more damage in public sector organizations than in commercial sector organizations. The consequences are often long lasting, widespread and deeply penetrated into activities that extend even beyond the current project. It can also cause damage to other projects of the organization, to general operations of the organization and the activities of other stakeholders. (Baldry, 1998). Besides that, public sector organizations have to deal with increasing pressure from society to be accountable. Making a mistake is often a taboo and the media are constantly on top of it. This reinforces the risk averse behaviour. Ozinga (2013) speaks of a negative error culture instead of a positive one, where mistakes are negotiable and an active attempt is made to learn from them to prevent repetition. The reasons for innovations, and therefore taking risks, are rarely based on financial rewards. The intended benefits are of non-financial nature, which makes it more difficult to calculate the return on investment for risk full intentions (Baldry, 1998).

3 RESEARCH DESIGN

To explain how the empirical part of the research was approached, strategized and conducted, a research design was set up with the methods and approaches that are applied and the reason why these were chosen. "*A research design is the logic that links the data to be collected (and the conclusions to be drawn) to the initial questions of study*" (Yin, 2003). In this research, there was a focus on digital innovation hazards in public sector organizations. A qualitative approach was chosen to expand on the current literature and to reveal unexpected matters about the studied subject through an inductive analysis using primary and secondary research data. A case study, a focus group and a literature research were conducted to collect data. This data was coded and analysed to draw conclusions and that answer the research questions and increase the knowledge about the stated research subjects.

3.1 Qualitative approach

According to Creswell (2009), there are three types of research approaches: qualitative, quantitative and a mixed approach. For this research, a qualitative approach was chosen. This systematic scientific examination builds a largely narrative, holistic description of a phenomenon to expand the researcher's understanding. Schumacher and McMillan (1993) defined a qualitative research as "a *primarily and inductive process of organizing data into categories and identifying patterns (relationships) among categories*." Qualitative research includes ethnographies, literature research, grounded theories, history studies and case studies conducted by (participatory) observations, focus groups, surveys, interviews, document reviews or a combination of those. This will cover viewpoints of the subject's background, purpose and meaning (Puusa & Juuti, 2011). By adopting an inductive and qualitative approach, more in-depth information and understanding of the research subject and its natural context was gained. (Saunders et al., 2003).

3.2 Case study

To answer the research questions, this research conducted a exploratory, single, embedded case study on a Dutch public sector organization to explore, describe and explain their relationship with digital innovation and its hazards. Yin (1994) describes a case study as "*An empirical inquiry that investigates a contemporary phenomenon within its real-life context.*"

Like surveys, case study research approaches can be treated as a quantitative or a qualitative approach, but as stated before this research used a qualitative approach. A case study can be exploratory, testing theories, explanatory and descriptive. The studied case subject can be an individual, an organization, a relationship, a project, an event or an action, that exists in a real life context with a specific place and time (Yin, 1994).

This method was chosen because case studies allow more detail, richness and profoundness of data, which is not easily to obtain by other research designs. It can help to revise existing ideas from previous research and produce new hypotheses that can be tested with follow-up research. Yin (2003) defines four types of case study designs:

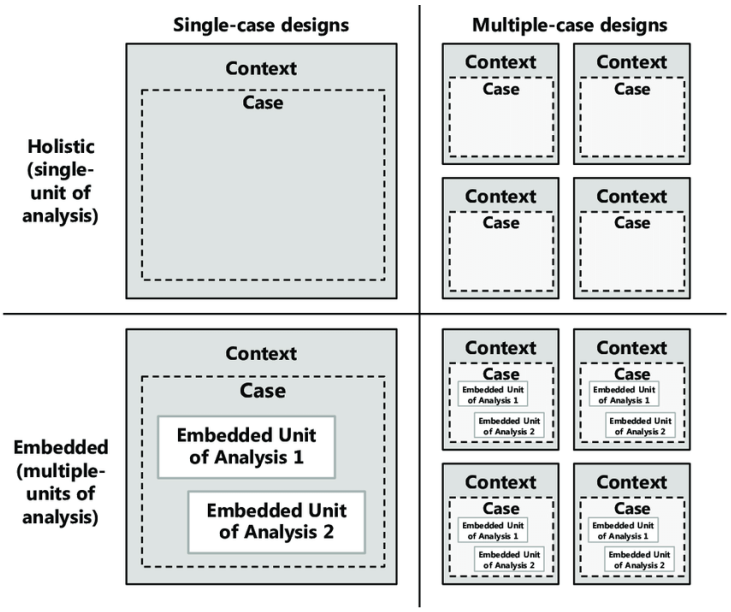


Figure 7 Case study types (Yin, 2003)

In this research, a single embedded case study design was chosen. One representative, critical case was chosen to provide data for answering the research questions. Within this case organization there was a collaboration with a multiple sub units: IT, client contact, engineering and risk. The research incorporated the results from multiple sources within these units, that provided various points of view. Not the whole organization was involved; therefore, this case study is classified as embedded.

3.2.1 Case selection

Case selection is based on the following main prospective: the representativeness of the studied subject. The selection can be based on a prospective approach; when the criteria are formed first and cases fitting the criteria are chosen if they are available, or retrospective; when criteria are formed based on historical records for selecting cases.

In this research, a prospective manner was used for selecting the case. The case can therefore be classified as a 'critical case', according the five rationales of Yin (2003). The target group this research wants to provide knowledge about digital innovation hazards consists of public sector organizations. Therefore, a case organization that belongs to the public sector and is currently implementing a digital innovation was selected. In collaboration with PwC's network, an organization that has a great variety of characteristics and encompasses the range of extremes was chosen. However the case organization is labelled as 'advanced' in terms of digital innovation, so it will be possible for public sector organizations that are classified as 'average' or 'below average' can receive some suggestion from this research. In addition, a personal interest for communication science was included in the choice of case organization. The digital innovation that is being implemented in the case organization includes communication science theories. The case study is conducted confidentially and the name of the organization will not be mentioned in this research. Neither will there be any information mentioned that could lead back to the case organization or its workforce.

3.2.2 Data collection

Most of the primary data was collected by confidential, semi-structured, in-depth interviews with employees from various departments within the chosen case organization. Besides interviews, also some documentation about the analysed innovation was shared. This included a video with a demonstration of how the innovation works.

The semi-structured interviews had an open-ended nature and were chosen because they are very useful to obtain detailed information about a person's opinions, perceptions and experiences. Besides that, there were supporting questions that arose during the interviews themselves. As according to Yin (2010): "*The researcher will have a mental framework of study questions, but the specifically verbalized questions as posed to any given participant will differ according to the context and setting of the interview*". These questions made it possible to branch out on the predefined questions if for instance more clarification was needed. The interview questions were tested on Janne Lahtiranta, a Finnish domain specialist on eHealth. After some adjustments the final interview questions were formed. The interviewees were selected based on their relation to the digital innovation process. Either they influence this process or this process influences them. Since this creates quite a large group, I decided to divide the group into the following subgroups: IT, client contact, risk and engineering. In collaboration with the innovation manager, we chose a representative for each subgroup as an interviewee. The interviews are conducted confidentially and the names of the interviewees will not be mentioned in this research.

The following interviews were conducted:

Table 1 Interviews case organization

Name	Role	Date	Duration
Interviewee 1 (I1)	Product and information manager	03/06/2019	52:27 min
Interviewee 2 (I2)	Team manager social rental and client contact	03/06/2019	1:03:23 min
Interviewee 3 (I3)	Collaborator client contact	11/06/2019	29:21 min
Interviewee 4 (I4)	Data engineer	11/06/2019	1:06:11 min
Interviewee 5 (I5)	Risk manager	11/06/2019	44:46 min

All the interviews were held in Dutch and took place in person. Based on mutual agreement, the interviews were recorded and thereafter manually transcribed. These records were destroyed after transcription to ensure the confidentiality. Since semi-structured interviews were conducted, there were a few pre-set questions, which were supported by questions that arose during the interviews themselves and are more context and setting bound. The following pre-set interview-questions were used within the case organization to collect the data for answering the research questions:

Table 2 Interview Questions

Research question	Pre-set interview question
RQ1: Is implementing digital innovations in public sector organizations a risky business?	What does the implementation process of a digital innovation look like within the organization? • How does the idea generation work? Who are involved? What role do they play? • How does the screening of ideas work? Who are involved? What role do they play? • How are you experimenting with the idea? Who are involved? What role do they play? o Do users also have a role? • How is the idea commercialized? Who are involved? What role do they play? • How is the idea implemented? Who are involved? What role do they play?
	What risk does the organization encounter during the implementation of a digital innovation? • What strategic risks is the organization facing?

	• What compliance risks is the organization facing? • What operational risks is the organization facing? • What financial risks is the organization facing? What reputational risks is the organization facing?
	In which phase of the implementation process does the organization encounter these risks?
RQ2: What is repressing digital innovation in public sector organizations?	What are your barriers to innovate? • Is there room for innovative thinking? • What kind of rewards are given to people that think innovatively? • What are the consequences of introducing an unsuccessful innovation for the organization? And for the individual? • Does the organization experience competition from other organizations? • How is innovation matching the organization's culture? • What does the organization to stimulate innovation? • Does the organization have the right resources to be innovative? o If yes, what are the most important resources the organization uses? o If no, what resources are missing?
RQ3: How can public sector organizations manage the hazards among digital innovations?	How are these risks managed? • How are risks identified? Who are involved in this process? What role do they play? • How are risks measured? Who are involved in this? What role do they play? • How are risks assessed/evaluated? Who are involved in this? What role do they play? • How are the risk controls drawn up for dealing with the risks? Who are involved in this? What role do they play? • How were the risks monitored? Who are involved in this? What role do they play?
	Are there parts of this process that you think should be different/changed?
Remaining questions	What is your relation to the innovation 'the chatbot'?
	How does the chatbot work?

	• What does the communication process look like? • Of what components does the chatbot exist?
	What influence will the chatbot have on your role?
	What are the benefits and difficulties of the chatbot?

3.2.3 Data analysis

To gain a better understanding of the collected data, the data was coded, tabulated, combined and analysed. First, the data was familiarized by transcribing it and reading it critically. Then, the raw data was thematised and characterized to create the categories of interest that are relevant to the research questions. Afterwards the data was analysed, to understand the data and find relations between the key characteristics. Reoccurring topics and their compression formed the following codes:

Table 3 Thematisation in-depth interviews

Research question	Codes	Sub codes
RQ1: Is implementing digital innovations in public sector organizations a risky business?	Implementation of digital innovation	- Generation and mobilization - Advocacy and screening - Experimentation - Commercialization - Diffusion and implementation
	Digital innovation risks Innovation barriers in public sector organizations	- Strategic risks - Compliance risks - Operational risks - Financial risks - Reputational risks
RQ2: What repressing digital innovation in public sector organizations?	Innovation barriers in public sector organizations	- Lack of urgency - Poor business - IT affiliation - Lack of resources - Conflict of interests - Organizational arrangements

		- Culture of risk and change aversion - Lack of incentives - Social responsibility
RQ3: How can public sector organizations manage the hazards among digital innovations?	Innovation risk management process	
	Digital innovation risk management outcomes	- Urgency creation - Business - IT alignment - Collaborations with other corporations - Organizational wide involvement - Culture change - Resource balance

After that, the empiric results are combined and tied with the earlier found theoretical material and the interpretation phase started. The results were debated and conclusions were generated to answer the research questions.

3.3 Focus group

Besides in-depth interviews, a focus group within PwC was conducted to collect primary data from domain specialists in the public sector field. A focus group is a focussed discussion on a set of questions with a certain amount of participants, in this case seven, to get some in-depth understanding of the research subjects in a fast and efficient manner. This method shares some elements with the interview methods such as: a set procedure, prewritten questions and human subjects, but they can provide a broader range of information and offer more opportunity to seek for clarification. They give a real-world response, but also observe commonalities and differences between the participants. They are less convenient for sensitive topics, but since there is no question of that in this case, it is very suitable.

3.3.1 Data collection

The researcher personally facilitated the discussion as a discussion leader and moderator. The individuals that conducted the discussion are referred to as participants. The participants discussed their perceptions, experiences, ideas and opinions about the pre-set questions. There was also room for the participants to question each other, contradict and provide various arguments. This helped to get deeper insights and it worked as an extra quality check on the pre-set questions. The interaction encouraged the participants to express opinions and to comment collectively on the various views. According to Selm and Wester (2006), this is also the biggest advantage focus groups over personal interviews. The focus group was conducted within a homogeneous group, consisting of participants with similar background and expertise, but from different positions within PwC. They were not randomly selected, but based on their expertise, knowledge and willingness to collaborate.

Table 4 Participants focus group

Name	Role
Participant 1 (P1)	Associate Audit
Participant 2 (P2)	Manager Technology
Participant 3 (P3)	Manager Risk Assurance
Participant 4 (P4)	Senior Manager Risk Assurance
Participant 5 (P5)	Senior Associate Public Sector
Participant 6 (P6)	Senior Manager Risk Assurance
Participant 7 (P7)	Associate Digital Transformation

The focus group took place in person on the 8th of July 2019, at a meeting room that was located within the PwC office. The focus group was also held in Dutch. Based on mutual agreement, the group discussion was recorded and analysed. To structure the focus group, brainstorming guidelines from Alex Osborn (1938, 1963) were followed. Osborn codified four basic guidelines:

1. *"The best way to get a good idea is to get a lot of ideas"* – Linus Pauling (1928). Go for quantity instead of quality. This will enhance divergent production, and a greater number of ideas creates a greater chance of producing an effective and radical solution. (Osborn, 1938 & 1963)
2. Reduce social inhibitions among group members. Defer judgement of participants on each other's ideas and withhold criticism. Participants should focus on adding or extending ideas and reserve criticism for a later stage. This also creates more freedom for generated unusual ideas. (Osborn, 1938 & 1963)

3. Improve and combine different ideas from different participants: *"1+1=3"*. Hitch-hiking, building on ideas of others to create new idea, is very welcomed. (Osborn, 1938 & 1963)
4. Welcome wild and exaggerated ideas, also called freewheeling. This is encouraged since they can generate different perspectives and suspend assumptions that result in better solutions. Besides that, it is easier to tame a wild idea, then to make a make a calm idea more exciting. (Osborn, 1938 & 1963)

The process of the focus group was guided by Osborn's principles and procedures for creative problem solving (1963). Since it was an experienced group, the session started with a welcome and an explanation of the problem. After the above rules were communicated to the participants, the call for ideas started. Every participant wrote down his ideas for the stated questions on a piece of paper. Thereafter everybody presented their ideas and the discussion and selection of most associated ideas began. After all questions were handled, the session ended with a wrap-up.

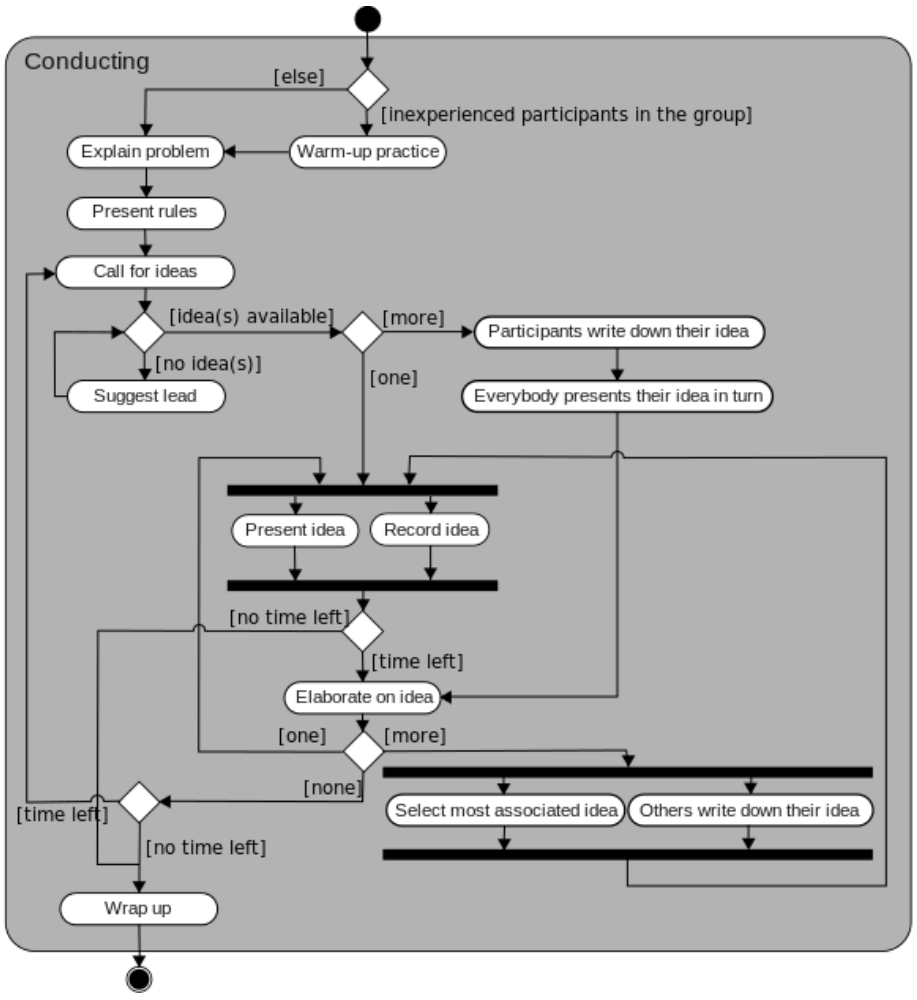


Figure 8 Applied Imagination (Osborn, 1963)

The following questions were presented:

Table 5 Focus group questions

Focus group questions
What does the implementation process of a digital innovation look like within the organization? • How do the different stages look like? • Who are involved in each stage? • What is important to take into account? • How does this stage differ from the same stage in the commercial sector?
What are innovation barriers within public sector organizations? What is the best way to deal with these barriers?
What risks may arise when implementing the chatbot? What is the best way of managing the found risks?

3.3.2 Data analysis

The collected data was coded and analysed, to create the ability to draw conclusions from it. The data was first familiarized, by transcribing it and reading it carefully. The raw data was then thematised into codes that were reoccurring in the discussion and are relevant in answering the research question. Then the data was analysed to find relations between the key characteristics of the findings. Recurring topics and their compression formed the following codes:

Table 6 Thematization focus group

Research question	Codes	Sub codes
RQ1: Is implementing digital innovations in public sector organizations a risky business?	Implementation of digital innovation	- Generation and mobilization - Advocacy and screening - Experimentation - Commercialization & Diffusion and implementation
	Digital innovation risks	- Strategic risks - Compliance risks - Operational risks

	Innovation barriers in public sector organizations	- Financial risks - Reputational risks
RQ2: What repressing digital innovation in public sector organizations?	Innovation barriers in public sector organizations	- Lack of urgency - Poor business - IT affiliation - Lack of resources - Conflict of interests - Organizational arrangements - Culture of risk and change aversion - Social responsibility - Supplier dominance - Lack of inspiration sources
RQ3: How can public sector organizations manage the hazards among digital innovations?	Digital innovation risk management outcomes	- Business – IT alignment - Collaborations with other organizations - Organizational wide involvement - Resource balance - Getting inspired - Better screening and commercializing of ideas - Standardization of processes

After coding, the empiric results are combined and tied with the earlier found theoretical material and the interpretation of the findings started. The results were debated and conclusions were generated to answer the research questions.

3.4 Literature research

To support the primary collected data and to develop more triangulation, secondary data was collected through deduced approaches to answer the research questions. The secondary data is collected by a theoretical literature research. This method collects existing data about a specific subject and was used to create theoretical frameworks that answers research questions in a descriptive manner. This data is also used as a backbone for the research and its interview questions. "*A review of prior, relevant literature is an essential feature of any academic project. An effective review creates a firm foundation for advancing knowledge."* (Webster & Watson, 2002)

3.4.1 Literature collection and analysis

Scientific literature can be selected from various sources such as scientific journals, books, papers, theses and archive material. It is not just a simple summary of all available sources, but also a critical discussion of the most relevant information. The literature was selected based its relevance, quality, recency and the author's reputation. Elaborated definitions and key variables were analysed and research boundaries were set. Based on the amount of search words matched with the research's title and text, articles were selected for relevance. The amount of citations was used as an indication of the quality of the research and the author's reputation. This was also checked in the Web Of Science – Science Citation Index. Most literature was found in an electronic manner. Sources were found on the search engine Google Scholar, the digital library JSTOR, reference lists from other publications and domain specialists' recommendations. All used literature is captured as references in the attached reference list.

3.5 Quality of research design

The quality of a research design can be measured by the validity and the reliability of the research, using systematic analysis to evaluate the choices and principles that guided the research.

3.5.1 Validity

Validity can be divided into construct validity, internal validity and external validity (Yin, 2003).

- *Construct validity* refers to establishing the right operational measures of the subjects that are studied. The triangulation in this research, the use of multiple sources of evidence investigators, methods or theories, to provide corroborating evidence, contributed to this. Yin (2003) recognizes construct validity as a possible problematic test for case study researches, since they are affected by the subjective perception of the researcher. For this reason, this research used multiple sources for data collection. Besides multiple interviews, also a focus group and a literature research was conducted, to establish a valid chain of evidence.
- *Internal validity* refers to how well a research is compassed and if there is no question of confounding. It focusses on identifying causal relationships as distinguished from spurious relationships. This is harder to achieve using a qualitative approach. Explanation building during the data analysis is therefore very important to show that it follows the steps of the scientific method.
- *External validity validity* refers to the ability to establish the domain to which findings can be generalized, past the specific context. Since this research conducted a single case study, this is often a problematic test since multiple case studies provide more ability to generalize. However, an organization that has a great variety of characteristics and encompasses the range of extremes was chosen.
  This way we tried to partly overcome the before stated limitation. Besides that, King, Keohane and Verba (1994) discussed that even when case studies only consist of one or a few cases, the amount of observations within the case study matter as well. Therefore, the case organization and its innovation was fully observed, from multiple perspectives. This makes it possible that other organizations from the target group also are able to benefit from the results of this research. (Yin, 2003)

3.5.2 Reliability

The reliability of a research refers to measuring and demonstrating the fact, that the operations of the research can be replicated and repeated, receiving the same results. Another researcher should be able to replicate the exact same research and get the same results and conclusions. Therefore, the research design is clear, complete and accurate. All the taken steps and guidelines are documented. This way another researcher is able to carefully repeat each step. (Yin, 2003)

4 CASE STUDY

A case study strategy was chosen to increase the knowledge about the research subjects. In collaboration with PwC, a case organization was selected and data was collected by conducting interviews with various employees within the case organization. They shared very interesting, insight information about how the innovation and risk management processes work. Besides that, a specific innovation that the case organization is currently implementing: 'the chatbot', was analysed. In this chapter, the background of the case organization, the innovation itself and the relevant theories that apply to this innovation are discussed. As stated before all information that could lead back to the case organization or its workforce will be anonymized to ensure confidentiality.

4.1 Organization background

The chosen case organization is a Dutch housing corporation; a social enterprise that focusses on serving tenants and future tenants that depend on social housing rental. The organization rents out, manages, sells and develops various types of housings in different price ranges and neighbourhoods. Thereby, the organization has to follow government policies and the municipal housing visions. They strive to be a contemporary corporation that is active on a high and professional service level. The organization temps to invest constantly in improving its performance and it wants to allocate resources as efficiently and effectively as possible. (company website, 2019)

One of the organization's most important key performance indicators (KPI) is customer satisfaction (interviewee 2, 2019), but also financial continuity and the right balance between the availability of good-quality houses and the affordability of these houses (company website, 2019).

Success factors are therefore: a good customer service, an efficient operational process, a balanced housing offer and an internal organization that is decisive and flexible. Besides that, it requires that all company information can be processed, presented and shared in an easy, clear and transparent manner. To arrange this, the organization invests in various optimization methods (company website, 2019).

Digitalization has an important role in this optimization process, especially digitalization within the communication channels like the client portal, the website and social media, but also the more traditional channels like letters, phone calls and flyers (company website, 2019). It is important for employees to be able to stay in contact with each other, but also with the tenants for requests or emergency contact. (Interviewee 1, 2019)

4.2 Chatbot

The eager to use digitalization as an optimization tool for achieving more efficient communication between the organization and its tenants, and subsequently creating a higher customer satisfaction rate, was the main motivation for the case organization to start the implementation of the following digital innovation: a chatbot.

Nowadays, there is more interaction between humans and computers than ever before. Humans want to communicate with computers in the same manner as they communicate with each other (Dix, 2009). This trend stimulates the implementation and use of chatbots. In this research, the following definition for a chatbot will be used:

> "A chatbot is a computer program or conversational agent that is able to communicate with humans by providing answers to their input and holding the conversation, using natural language processing (NLP) through auditory or textual methods." (Sansonnet, Leray & Martin, 2006)

Chatbots are developed and used for many different purposes in various domains. They can be used for fun, education, psychological assistance or for instance in customer service systems as in our case (Shawar & Atwell, 2007). This is changing the customer experience in businesses rapidly by; enhancing customer satisfaction, cut costs and improve productivity (interviewee 4, 2019). To fit current customer expectations, organizations are reshaping the interaction experience from a human-to-human interaction to an advanced self-service experience. Using chatbots can therefore become a crucial element for improving a business' customer service and staying competitive in the future (Oracle, 2016).

4.2.1 History

The origin of interaction between humans and computers is as old as the computer science field itself. In 1950, Alan Turing already asked the question 'Can machines think?'. Sixteen years later, the first computer program that simulated and rephrased user input using NLP-techniques was made: ELIZA. This relative simple program managed to give the illusion of understanding and it fooled many humans (Weizenbaum, 1966). During the decades after ELIZA, many chatbots followed her approach with various additions like emotion management and speech fusions (Kholod, 2018).

In 2001, a new milestone was set: SmarterChild. This was a chatbot that was inspired by instant messaging platforms such as: SMS, MSN Messenger and AOL Instant Messenger. It provided access to news, sport results, weather forecasts etc. This was the first chatbot that was connected to a knowledge centre and detained asked information for its users (Wei, Yu & Fong; 2018).

IBM initiated the next upgrade of the chatbot worth mentioning, by inventing the Watson AI in 2006. The chatbot was designed for- and tested by winning 'Jeopardy!', an American TV show, which it did in 2011 (Chandrasekar, 2014). This was also a breakthrough from the NLP point of view, since the questions involved many plays on words. Unfortunately, it had a big shortcoming; it was only able to answer one-liner questions, not to have a proper conversation (Kholod, 2018).

Starting from 2010, more chatbots arose in the form of virtual assistants such as Siri (Apple), Cortana (Microsoft), Alexa (Amazon), Google assistant (Google) and others. They brought the conception of conversation as well as target-oriented communication (Yu et al., 2016).

4.2.2 Communication process

A conversation with a chatbot can be initiated by either the chatbot or the user. The process starts when one of the two parties inputs a question, request or notification in the form of text or speech. Thereafter, the users input is decomposed and analysed (Ortec, 2019). A process, classified as 'speech recognition science', is used to convert spoken language into text (queries), using speech recognition algorithms and machine learnings (Ortec, 2019).

The query is measured along a number of dimensions such as: vocabulary size, speaker independence, co-articulation and noise handling (Gruhn, Minker & Nakamura; 2013). Text analysis begins with a normalization process in which text is broken up into its component parts; chunks of text are broken into sentences, sentences into words and punctuations, and words into their respective phonemes (Rashad, El-bakry & Ismail, 2010). Then the language and the function of the dialog is identified and the text is scanned by machine learnings for patterns of keywords or phrases. Machine learning is a well-known AI (artificial intelligence) field that can be seen as a statistical computer model, that is able to recognize evidence for patterns in raw data (Ortec, 2019) (McTear, Callejas & Griol, 2010). Based on the found evidence, the chatbot filters the knowledge centre for the most suitable conversation tree. From this conversation tree, it receives the most applicable, pre-scripted answer. In order to communicate, the chosen answer is merged into a phrase and presented to the user as a reply to his input (Abdul-Kader & Woods, 2015).

This reply should be consistent with the conversation's context. To tackle this issue, two different modules work in pair. One generates a list of possible answers and the other ranks them based on a certain algorithm and selects the most suitable one. NLP is one of the main tools for analysing speech and giving human- like reactions (Demner-Fushman & Chapman, 2009). The chatbot produces a structured representation of a text that contains spoken language understanding (SLU) (Jeong & Lee, 2006). This process is repeated during the entire conversation.

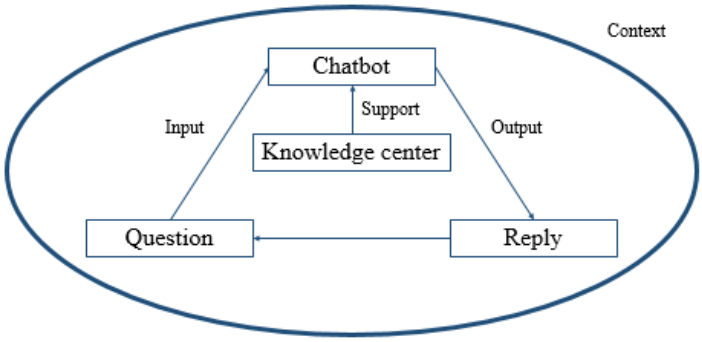


Figure 9 Question-answering system framework

4.2.3 Case chatbot

On a yearly base, the case organization receives about 120.000 phone calls from tenants with questions, requests or notifications. To answer all these phone calls, the organization offers work to 12 full time employees, answering phone calls five days a week, from 9.00-17.00 (interviewee 2, 2019). The chatbot, that the case organization is currently implementing, is a voice-driven, virtual customer contact assistant (interviewee 4, 2019). Users (mainly tenants) can use the chatbot as a helpdesk employee for repair requests - 24 hours a day, seven days a week. However, there is no human employee involved in this process and all interaction takes place with a computer.

The organization is working on this innovation and various employees, from different teams, are involved in the process. However, the innovation is not nearly there yet. The proof of concept of this innovation has been presented to different teams and the next step is to produce and review a minimum viable product (MVP) (interviewee 1, 2019). An MVP is a product with just enough features to satisfy early users and provide feedback for future product development. This means that the innovation is not very mature yet within this organization, but the people involved are fully engaged in it. Besides that, the innovation has proven itself in other, but similar environments.

According to interviewee 4 (2019), the process of the chatbot's proof of concept works as follows:

1. User initiates conversation by calling the helpdesk.
2. Chatbot answers call and receives input from the user. This input consists of a repair request, repair question or other type of notification.
3. Chatbot stores input. The chatbot is coupled to Google cloud, where all conversations are saved, stored and used for training.
4. Chatbot recognizes speech. The words and phrases from the input are recognized and translated to text, which is then transformed into a query.
5. Chatbot analyses text. By using machine learning, patterns of words and phrases are discovered and a match is made with the right topics within the knowledge centre. This leads to a selection of the most suitable conversation tree within the knowledge centre.
6. Chatbot chooses most suitable reply. This reply is based on the selected path within the selected conversation tree. There are two possible type of replies.
    a. Chatbot replies with a follow-up question. This creates more clarification or provides additional information. If this type of reply is chosen, the process goes back to step 2.
    b. Chatbot replies with a settlement. There are three types of settlements.
        i. Chatbot sends instruction video or guidelines, so the user can fix the problem himself.
        ii. Chatbot plans an appointment with a mechanic, so the mechanic can fix the problem.
        iii. In case the phone call contains a request that goes above the chatbot's capacities, the chatbot connects the user with a real life helpdesk employee, provided that the user calls within office hours.
7. End of conversation

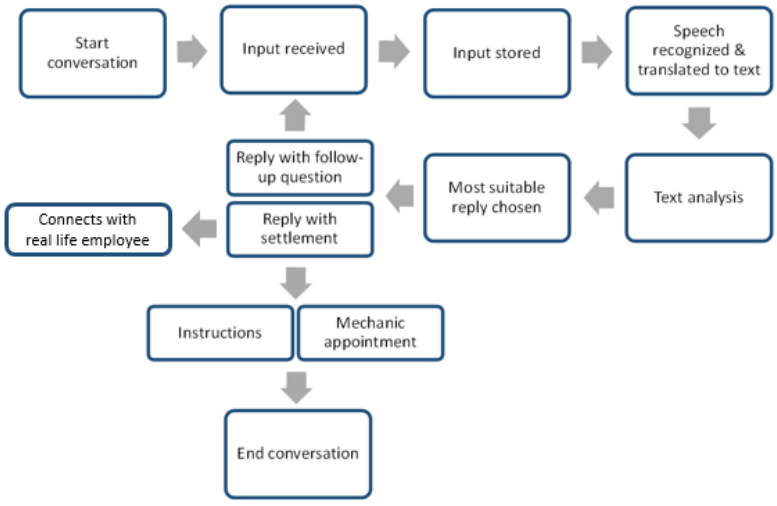


Figure 10 Case chatbot repair request process

According to interviewee 4 (2019) the chatbot will take over various tasks from current employees within the case organization.

- The conversations with calling users will be handled with a minimum interaction with real-life human employees. This has a huge impact on the productivity and is the main source of saving resources for the case organization, without declining the customer service. (interviewee 4, 2019)
- Determining the right solutions for the users such as planning a mechanic appointments or sending an instruction video for reparations is also taken from the helpdesk employees. (interviewee 4, 2019)

On the other hand, the chatbot creates some new tasks that need to be addressed (interviewee 4, 2019).

- A knowledge centre needs to be established. "*Chatbots are only as intelligent as the knowledge they have access to."* (Cahn, 2017). This is something that the case organization has not obtained yet. This knowledge centre should consists of context-specific information, possible input translations, conversation trees and prescripted replies. The machine-learning algorithm of the chatbot can then find patterns and relations between these fields. This all has to be written out by humans first, including a wide range of input variations to lead to the desired output. (interviewee 4, 2019)
- The chatbot needs to go through a detailed training that also considers quite some human input. To optimize the algorithm; problems should be defined and correct/incorrect answers need to be lined out and evaluated by human efforts. This way the chatbot can 'learn' not to make the same mistake again. These tasks sound like self-learnings, but require constant human feedback.
- A link between the knowledge centre, the chatbot and the enterprise resource planning system (ERP) needs to be established. This way the chatbot can for instance check mechanic capacities and plan mechanic appointments if required by the conversation tree from the knowledge centre. (interviewee 4, 2019)

However, the efforts for these three tasks are very high during the first periods of use, but will decrease in the long term. (interviewee 4, 2019)

- The chatbot needs to be controlled and monitored continuously by employees, to maintain high service quality. The chatbot also has to keep learning, since environments are still changing and new possibilities or demands arise. (interviewee 4, 2019)

4.2.4 Chatbot benefits

As stated before, the chatbot can provide various benefits for the case organization such as taking various tasks out of hands from employees. Besides that, there are other benefits as well:

- The chatbot makes it easier for users to contact the organization. The service is not bound to specific working hours, which is much more suitable for emergencies. The chatbot is available 24/7 and replies immediately. Besides that, the users do not have to wait until a help desk employee is released from an earlier phone call and they can be helped immediately. (interviewee 2, 2019)
- The chatbot is easily accessible for digibets or low literate people, which are represented by 1.9 million people in the Netherlands. There is no need for them to send an email when they want contact outside working hours, but they can just call like they are used to do. (interviewee 3, 2019)
- The organization is forced to establish a knowledge centre, which consists of dynamic and real-time data. This is of great value and can be useful for other processes as well. (interviewee 4, 2019)
- The automation of the customer helpdesk generates a higher quality of service for its users. By following the right conversation tree, it always gives the most suitable solution for the given problem. Machine learning algorithms can give a percentage of certainty in what extent they think the reply is suitable for a certain question. It is possible to program the chatbot in such a way, that it only gives a reply if this certainty level is high. The system will never forget something or accidently make a mistake, like humans can. Besides that, the chatbot has no emotional attachments, so it does not matter if the user is for instance angry or sad. (interviewee 4, 2019)
- The algorithm can also recognize deeper patterns like frequently askes request that are linked to specific locations. If multiple tenants from the same neighbourhood complain about a roof leakage, then maybe the whole street needs to be checked out.
- Once the chatbot is implemented, it is very scalable. Besides that, it can be expanded by installing other features such as other languages, to serve an even broader range of users. (interviewee 4, 2019)

4.2.5 Chatbot difficulties

As stated before, the chatbot created quite some extra tasks for the case organization, but it can also bring some other types of difficulties:

- Chatbots are getting 'smarter' as they are used more often. A chatbot can fail when the analysed query has not been saved before in the knowledge centre. This means that there can be quite some difficulties in the first periods of use, which can demotivate users to use the chatbot, since their first experience with it was bad. (interviewee 4, 2019)
- The current roll out of the chatbot does not serve international and multi-cultural users. It does only process Dutch conversations and irregularities like accents, ambiguities and mistakes can create language barriers that affect the outcomes (interviewee 2, interviewee 3; 2019).
- The automation that chatbots provide for non-skilled/talent based tasks can kill various jobs in a business. Therefore, employees can perceive the innovation as a threat (interviewee 2, interviewee 3, interviewee 4; 2019).
- The chatbot can bring some new security considerations. The knowledge centre full of data can for instance arise some serious privacy implications that clash with laws and regulations (interviewee 4, interviewee 5; 2019).

4.3 Theoretical background

Since this research will focus on the specific digital innovation 'the chatbot', some extra theories will be discussed to enhance the required knowledge background for better understanding of the findings.

4.3.1 Link to the aforementioned theories

The chatbot creates a new service for the organization's customers, since they can contact the helpdesk 24 hours a day and seven days a week for repair services, instead of only during working hours (nine hours a day, five days a week). This service is new from the previous service that they gave to customers. Besides that, the chatbot also improves the current key process of handling tenant's repair requests for the organization. This process is faster, more efficient and uses fewer resources. Therefore, the chatbot is classified as both a product and a process innovation. The chatbot is classified as an incremental innovation.

The chatbot is a significant improvement compared to the current manner of handling repair requests, but degree of novelty and differentness is not high enough to be a radical innovation. The chatbot does not change the organization's preferences or competences. Thereafter, the chatbot can be classified as a technological innovation, since the chatbot has an effect on an important process that is related to one of the key performance indicators. Finally, the chatbot is enabled by information and communication technologies - therefore, the chatbot is classified as a digital innovation.

4.3.2 Communication

Communication is an important concept in our society. The word 'communication' is subtracted from the Latin word 'communicare' which means 'to share'. Every entity is connected to one another through all kind of communication channels. By using mutually understood signs, symbols and semiotic rules, information can be conveyed from one entity or group to another. This can happen for different purposes such as: inform, persuade, educate, train, motive, integrate, relate or entertain. Shannon and Weaver (1948) described the definition of communication as follows:

"All of the procedures by which one mind may affect another".

Communication is a social, dynamic process, which always has a sender, a message and a receiver. The sender is the information source and the originator of the message. This message consists of information based on the sender's knowledge, experiences, standards etc. The message is encoded by converting the information into signals and then adapted for transmission by a communication channel, towards the receiver. This can happen verbal, non-verbal, consciously or unconsciously. The receiver receives the message by hearing, seeing, feeling or using another sense. He decodes the sent information by converting the signals into a message that is understandable and comfortable for him. Then the receiver adds the converted information to his own knowledge, experiences, standards etc. Based on the decoded message, the receiver gives their feedback to the sender. (Shannon & Weaver, 1948)

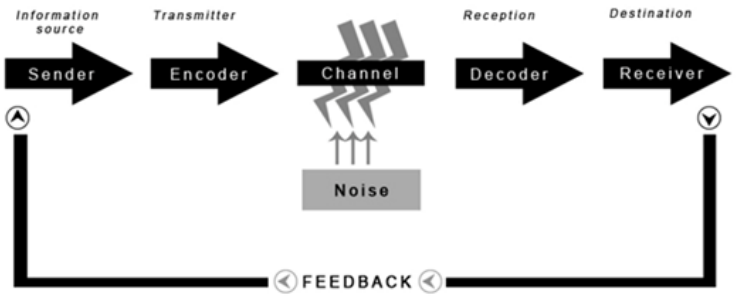


Figure 11 Model of communication (Shannon & Weaver, 1948)

This communication process can be influenced by external noises while it propagates through the channel. These noises work as barriers for effective communication. Shannon and Weaver defined seven types of noise:

- *Environmental noise* is defined as a noise that is caused by environmental factors, such as standing next to a loud speaker or sounds from a construction site.
- *Physiological-impairment noise* is defined as a noise that develops by physical conditions such as blindness or deafness.
- *Semantic noise* is defined as a noise that is caused by different interpretations of the meanings that are assigned to certain messages.
- *Syntactic noise* is defined as a noise that is caused my grammar mistakes that disrupt the communication and make it less understandable.
- *Organizational noise* is defined as a noise that is caused by physical distance between entities based on their functional specialization of tasks, authority, power or status.
- *Cultural noise* is defined as a noise that develops when the message is affected by cross-cultural factors. Culture is a shared set of values and attributes of a group that can differ from another group. In addition, stereotypical assumptions can cause this noise as well.
- *Psychologic noise* is defined as a noise is caused by certain human attitudes, feelings, desires, fears, opinions etc. such as anger or sadness.

There are four classifications for communication based on the receiver(s) to whom the message is addressed. First, there is intrapersonal communication, when the sender is communicating with himself. Secondly, there is interpersonal communication, where the message exchange takes place between two entities. This includes dialogues, interviews and conversations. Then group communication stand for communication with large or small groups, like an organizations, club or classroom in which individual entities retain their individual identity. Finally, there is mass communication, which occurs when a message is sent to a large group where each entity becomes a faceless individual with almost no possibility for personal response or feedback. Examples are communication by newspaper, radio or television.

To enhance understandable, valuable and effective communication Baird and Stull (1992) came up with the seven c's of communication. These include:

1. *Courtesy*, which means that the sender considers the receivers desires, circumstances, emotions and requests. It involves being aware of the others perspectives and feelings. Besides that, is improves relationships. (Baird & Stull, 1992)

2. *Clarity,* which contains of getting the meaning that, is in your mind, into the mind of the receiver regardless the unique interpretations, ideas and experiences that are associated with the words. A balance of precise language and familiar language needs to be found to increase comprehension. (Baird & Stull, 1992)
3. *Correctness,* which means that the transmitted message should not contain any wrong information. This builds confidence. (Baird & Stull, 1992)
4. *Concreteness,* which defines being specific, definite and vivid instead of vague and general. (Baird & Stull, 1992)
5. *Credibility,* which is about the receiver accepting the statement from the sender. Trust and honesty play a big role in this process. (Baird & Stull, 1992)
6. *Completeness/consistency,* which makes sure the send message contains all the facts the receiver needs for reaction. (Baird & Stull, 1992)
7. *Conciseness,* which helps to say something in fewest possible words. It is complete without being wordy. (Baird & Stull, 1992)

In this research, there is a focus on interpersonal, conscious, verbal communication. Consciousness refers to the entity's awareness of its own thoughts, feelings, attitudes, beliefs, behaviour and bodily sensations. Verbal communication covers the spoken or written conveyance of a message. The most important tool for this is human language. The human language can be defined as a system of symbols and grammars/linguistic structures by which the symbols are manipulated. This is mainly build on the common properties of languages using patterns of sound or gesture. (Cancho & Solé, 2001)

4.3.3 Communication with a chatbot

Modern communication introduces new manners of communication, which differ from how entities used to communicate. Communication with technology is getting faster, easier and for that reason, more and more popular in personal and business life. This also applies to the public sector, where the case organization belongs to. This evolution started by using technology as a communication tool like a mobile phone, but nowadays technology can take over the role of the sender and/or the receiver completely, like in the case of a chatbot.

Shannon and Weaver's communication theories also apply for communication between a human entity and a computer. However, this can affect the amount of noise within the communication model of communication between a human entity and a computer (Antheunis, Valkenburg & Peter; 2007).

Communication with a chatbot instead of a human entity has no influence on *environmental, physiological-impairment, organizational* or *cultural noise*. However, it can affect *semantic, syntactic* and *psychologic noise*. The chatbot is programmed to recognize certain words and word combinations, and link this combination to a certain meaning. If the sender codes a message that can be interpreted in different ways, the chatbot can assign the wrong meaning to the message. Therefore, communication between a human entity and a computer can increase the amount of *semantic noise*, compared to communication between two human entities. Furthermore, the wrong link between a word combination and a meaning can also be caused by grammar mistakes or accents. This can create an increase in the amount of *syntactic noise*. Finally, a computer has no human emotions and is only able to recognize them up to a certain degree. When the expressions go beyond that degree, the computer will not be able to decode the message correctly, which creates a *psychologic noise*. However, it can also mitigate psychologic noise, for the same reason. Since the chatbot has no emotions, it does not matter how angry or sad the user is, it will not affect the friendliness or accuracy of the chatbot up to a certain degree.

However, the above-mentioned noise enlargements do not count for all computers or chatbots. A lot of training, extensions and updates can increase the abilities of the computer or chatbot that prevent the noise enlargements.

The communication between a human entity and a computer, instead of another human entity, also has an effect on some aspects of Baird and Stull's 7 c's of communication (1992). As stated before, a computer has no emotions or emotional awareness. Therefore, the computer is not able to fully take someone else's perspectives into account. This lowers the *courtesy* of the communication. A computer is able to find the best balance between precise language and familiar languages, based on its software. This will create a communication *clarity*. A computer is also programmed in a way, that it always gives the right information and without mistakes or shortcomings. This increases the *correctness* of the communication. The computer will also follow the selected conversation tree, which eliminates vague or general answers. The communication gets more *concrete* because of this. It is possible that humans distrust the receiver, when they hear a computer talking instead of a human entity. This can be perceived as impersonal and they can feel misunderstood. Although, this can also work the other way around, that human entities have more trust in technology than they have in human entities. Therefore, the *credibility* of the communication can be affected in both a positive and a negative way. As stated before, the computer is trained to give information without mistakes or shortcomings in the fewest possible words. This makes sure that the message is *complete, consistent and concise*, since it always follows the same selected path of the conversation tree it was trained to do.

5 RESULTS

In this chapter, the gained results from the different data collection approaches are presented with reference to the aim of the research, which is to increase the knowledge about digital innovation hazards in public sector organizations. First, the findings from the aforementioned theories will be discussed, followed by the findings from the case study and the focus group.

5.1 Results from aforementioned theories

As stated before, innovation in public sector organizations is very important. The lack of it can lead a decrease of efficiency, legitimacy or an increase of inefficient approaches of social issues. Moreover, public sector organizations can become disrupted by innovations from commercial sector organizations.

Earlier we discussed the innovation implementation process that is introduced by Desouza et al. (2009). They present five cyclic implementation stages that ideas have to go through to become a successfully implemented innovation. This cyclic process consist of the following stages: generation and mobilization, advocacy and screening, experimentation, commercialization, diffusion and implementation.

According to Chance (2004), five different types of risk can occur and affect an organization. These also apply for digital innovations. Digital innovations can form risks for public sector organizations from the following categories: strategic, compliance, operational, financial and reputational risks.

Organizations can face different types of innovation barriers, which are repressing the will to innovate. These barriers can even contribute to an organizations' innovation backlog, if compared to other organizations. According to Albury (2005) the five most common innovation barriers are: short-termism, lack of incentives, culture of risk aversion, organizational arrangements and lack of resources.

Hazards within the environment of an organization should be managed effectively, to mitigate or eliminate their negative impacts. Tummala & Burchett (1999) present the following five key elements of a risk management model: risk identification, risk measurement, risk evaluation, risk control and risk monitoring. According to PMI (2004), there are four risk response strategies to choose from during the risk control stage: avoidance, transference, reduction and acceptance.

5.2 Results from case study

Table 7 Interviews case organization

Name	Role	Date	Duration
Interviewee 1 (I1)	Product and information manager	03/06/2019	52:27 min
Interviewee 2 (I2)	Team manager social rental and client contact	03/06/2019	1:03:23 min
Interviewee 3 (I3)	Collaborator client contact	11/06/2019	29:21 min
Interviewee 4 (I4)	Data engineer	11/06/2019	1:06:11 min
Interviewee 5 (I5)	Risk manager	11/06/2019	44:46 min

5.2.1 Implementation of digital innovations

Based on the five interviews within the case organization we can state that the five stages of the digital innovation implementation process of public sector organizations look as follows:

1. *Generation and mobilization*

   Ideas are generated from various sources. The organization works with a sounding board that consists of six individuals with a management- or other key position within the organization. Each of them represents a data domain like: client contacts, real estate, IT, external relations etc. The sounding board is provided with ideas from the workforce, suppliers or external parties. (I1, I2 & I4)

   The workforce is a key source for ideas, especially employees that work with external relations and visit external parties or other housing corporations (I1 & I2).

   > "We notice that many employees, especially employees who are outside a lot, see things and wonder 'why don't we have that?' Then ideas arise" (I1, 2019)

   Besides that, opinions from new employees with fresh perspectives on the current operations are appreciated. If employees come up with ideas, they share these with their manager. The case organization holds a few business analysts that do desk research on relevant developments and visit seminars to stay up-to-date and to get inspired. Once a year the management team sits around the table with various suppliers to discuss possibilities among technological innovations. (I1& I2)

> "Another point of view is that we organize a 'round the table' with our existing suppliers, over the entire width of the value chain. We discuss ideas that we see as potential technical innovations. These results are also shared with the sound board group." (I1, 2019)

The innovation manager has a yearly 'look-forward' meeting with each domain executive separately, to discuss possibilities for the upcoming year. Besides that, the housing corporation is part of an association for housing corporations in the Netherlands. They go their meetings to share ideas, trends, developments and other important industry related events. The idea for implementing the chatbot came from these housing corporation association meetings. (I1 & I4)

> "We go to meetings with other housing corporations and we hear things that others are doing. This is how we see what exists." (I1, 2019)

All the findings from the above stated events are shared with the sounding board. Besides that, the organization tries to follow developments that arise in the environment of their tenants and the overall society. Tenants are offered more and more digital services from other parties. If the organization stays behind, it can influence the tenants' satisfaction with them negatively, which should be prevented. (I1 & I2)

> "We are all offered more and more digital services, from banks, insurers, etc., then the ideas arise like 'hey, can we also use this within our organization?'" (I2, 2019)

2. *Advocacy and screening*

First, the managers shortly screen the provided ideas. They decide whether they provide it to the sounding board or not. (I1, I2, I3 & I4)

> "Managers perform the first screening. Then the ideas are further elaborated to the sounding board. One idea continues and the other does not." (I2, 2019)

Then the ideas are discussed within the sounding board. They prioritize the ideas and determine the agenda from the innovation team to prove the concepts. (I1)

> "So if there are more ideas than budget and/or time, priority must be given. The sounding board group does that as well. If they give the green light, the idea will be further investigated" (I1, 2019)

With approval of the financial director, the budget is split among the different initiatives. (I1 & I3)

Time and budget allocation is a difficult process, since they are both quite rare within the organization. When an idea is on the agenda of the innovation team, a proof of concept is made up to discover the demand, quality, effort, costs and most important; the potential customer value of the idea. The innovation is also compared to the current processes, systems and the organization as a whole. It provides an advisory report with information about these elements and possible adjustments if needed. If the advisory report indicates that the proof of concept was a success, it gets a 'go' for the next stage. (I1, I2, I3 & I4)

> "The proof of concept provides a good image of the possibilities and an advisory report with information that answers the question: 'What does it bring?' This can be nothing, insufficient, or something we did not expect initially."(I1, 2019)

3. *Experimentation*

When the proof of concept was successful, an MVP (minimum viable product) is introduced. This is the first version of the product that only has the core features that make sure the product works. The organization describes it as an advanced prototype that allows them to collect the maximum amount of learning about the users, with the least amount of effort. Real suppliers and users are engaged in a real-life test environment, without any long-term agreements. The innovation is not implemented and not part of the production process yet. (I1, I2, I3 & I4)

> "In accordance with a supplier or several suppliers, a kind of advanced prototype is made, which tests the concept with real users. We do this without having long-term contracts with the supplier, and the innovation is not a real part of the production process yet." (I1, 2019)

Based on the outcomes of the MVP, the management team decides if there is budget to purchase the needed resources to implement the innovation. If not, then the innovation can be pushed forward to next year's budget planning. (I1 & I4)

> "After MVP, we first determine whether we are going to do it or not and whether a budget is allocated to it or not." (I4, 2019)

4. *Commercialization*

   If the budget is settled, the plan of implementing is made up. The innovation team contacts various suppliers to find out what is available on the market. In addition, other housing corporations or comparable organizations are asked for their opinions. Then the available products are compared to each other, to find out what the most suitable one is for the organization's context. Besides quality, costs and potential benefits, also the implementation approach of the supplier is taken into account. (I1)

   > "In the end we heard a number of suppliers who have already made these kinds of products. And in the end, we chose for '*omitted*' because they offered the most structured implementation approach." (I1, 2019)

5. *Diffusion and Implementation*

   In collaboration with the supplier, the innovation team and, if needed, other external parties, the innovation is implemented into the organization. Since the management tries to take the employees with them, along the whole implementation process, employees are already aware of what is coming and they know why it is important. The outcomes of the proof of concept and the MVP are provided to them and they can prepare themselves for the change. (I1)

   > "The objective is to really show people what we have experimented with and what it could possibly offer our tenants." (I1, 2019)

   If the tenants are also involved with the innovation, like in the case of the chatbot, they also need to be aware of the change and clear information should be provided to them as well. Then the needed trainings are provided to a certain amount of employees, so a successful pilot can be launched. After this pilot, the last adjustments can be made to the innovation before it is diffused across the organization as a whole (I1).

   > "As soon as we start integrating the innovation into the daily work, so with the real users, we call it a pilot." (I1, 2019)

5.2.2 Digital innovation risks

We found out that the case organization faces the following risks within the earlier stated five risk categories, while implementing digital innovations:

1. *Strategic risks*
   It is harder to find the right strategic direction for Public sector organizations. This is a risk. Public sector organizations have to keep up with their environment, since many other industries are ahead of them. When citizens get used to certain services from other industries, they will miss it in the housing corporation industry, which will affect their satisfaction with the organizations (I2 & I5). Besides that, public sector organizations have to meet certain government rules and agreements, which require efficient work methods. On the other hand, the organization's strategy has to focus on the needs of the tenants instead of the needs of the organization itself; especially since they are subsidized by- and feature public money. (I1, I2 & I4)

   > "Can we spend public money on innovation, while some rental houses still have mold on their walls?" (I2, 2019)

   This can create a split between vision of the employees that are directly in contact with the tenants and the vision of the executives above them. Besides that, it is hard to discover if there is any demand for a particular digital innovation, even by hosting proof of concepts and pilots. This creates a strategic risk since it is harder to prioritize initiatives. (I1)

   > "They only know that they want it, when it is there". (I1, 2019)

   Digital innovation is also forming a strategic risk, when it is influencing one or more of the organization's KPIs. Like stated above, the chatbot can influence customer satisfaction, which is a KPI for the case organization. (I2 & I5)

   > "If the chatbot does not work, we have a problem. Customer satisfaction is one of our KPI's and if the quality of the service decreases, it will have a negative impact on the strategy we implement." (I5, 2019)

2. *Compliance risks*
   Public sector organizations have to fulfil regulations and performance agreements from the municipality and the government, since they are subsidized by them. To fulfil these requirements, they need to have things in order. If not, they can receive penalties or be cut on their subsidies. This is a compliance risk. (I1 & I3)

> "Yes, for example, we have performance agreements with the municipality. In order to comply with these, we must have everything in order. That is an important objective." (I1, 2019)

Besides that, regulations can change fast and organizations have to be flexible. Digital innovation can support this. For instance, public organizations work a lot with personal data. Therefore, they are bound to certain regulations, like the current implemented GDPR (general data protection regulation). Especially with a digital innovation like the chatbot, it is important to have an overview of this. (I1, I2, I3, I4 & I5)

> "At the moment, privacy is very important. Data leaks must be prevented. Therefore, many options also have to be redesigned within all processes." (I2, 2019)

3. *Operational risks*

There is a risk that the digital innovation fails or will not fulfil the set expectations. This creates an unsolved problem, but can also damage the trust of the users (both, the workforce and the citizens). (I2, I4 & I5)

> "I think it can get very risky, when the innovation's efficiency expectations are not met. That is very annoying. This is something we will only find out, when the innovation is already fully implemented. This affects our confidence and we will continue playing 'catch-up'." (I2, 2019)

As stated before, the culture of public sector organizations is more risk and change averse. Digital innovation can therefore create a grimmer and uncertain atmosphere among the workforce, since employees are not open for change. As for the chatbot, employees can get afraid of losing their job to automation. This affects the atmosphere, but also the relation between the manager and his team. The manager will continue to strive to achieve his targets, which digital innovation can help with, when his team members are afraid to lose their jobs to digital innovation. This is a risk since this grim atmosphere and the conflict of interests can affect the team's day-to-day work performances. (I1, I2, I3 & I4)

> "It is a risk, that employees will get a sense of superfluity. They may think that fewer FTEs will be needed, after the innovation is implemented. That though is not healthy and creates an uncertain situation. What you also see, is that the relationship between the manager and the employee becomes increasingly grim." (I1, 2019)

In addition, employees that do not accept the change the digital innovation brings, and do not use the digital innovation for this reason are a risk, since it can affect the daily operations. Finally, systems within public sector organizations are all connected and attuned to each other. This also creates higher risk when a digital innovation fails, or does not fit in properly. (I1 & I5)

> "It is very difficult to implement something into the current processes. Current processes, which are closely connected, must be changed and people must come along. That is very difficult. We also have an organization that is a bit older, and in my experience, that makes it even more difficult to get employees along with such ideas." (I5, 2019)

4. *Financial risks*

As stated before, if public sector organizations do not meet the performance agreements set by the government and the municipality, they could be cut on subsidies. This is a risk. Public sector organizations work with strict, yearly budgets for innovation. These budgets are set by the sounding board, based on the government's subsidies. Because of these financial restrictions, they cannot just decide to do or implement something that was not budgeted in advance. Especially since, they have to be completely transparent and are constantly supervised. By their caution, they can miss out on important developments or have to shut down innovation processes when they go over budget. (I1, I4 & I5)

> "We cannot just say 'oh, we have a new innovation project idea, we are going to do something new', when that project is not budgeted." (I1, 2019)

Since most public sector organizations are service oriented, costs can be hidden and/or hard to allocate. This makes budgeting and staying on budget hard, which is a risk. Just like the chatbot from the case organization, many digital innovations must continue to develop in the future, but it is very hard to budget these costs since they are unsure. (I4)

> "I also think that the costs should not be underestimated, especially since there are many hidden costs in the extra and future tasks." (I4, 2019)

If a digital innovation turns out to be unsuccessful, resources are lost, which is a risk. Since the resources are so strictly budgeted and rare, this can oppose innovation. (I5)

5. *Reputational risks*

   Public sector organizations are very transparent and constantly supervised by the government, but by the media and the citizens as well. If a digital innovation fails or turns out differently than expected and communicated, this can be captured and turned against the organization, which can create reputational damage (I1, I2, I3, I4 & I5).

   As stated before, tenants are also served by other industries. If the service of public sector organizations lags behind on other industries, this can damage their reputation. (I1 &I2)

   > "We are not obliged to offer good service to our tenants, but if you want to have efficient business operations with optimal activities, you have to take into account that the world is getting faster and time to market is getting shorter. When you look at how people are served nowadays, as a housing corporation you can no longer be left behind without bothering yourself." (I1, 2019)

   If the chatbot for instance does not comply with the GDPR and a data leak, which makes saved phone calls publicly available, is found, it can have tremendous consequences for the organization and its reputation. Besides that, a digital innovation like the chatbot represents the whole organization when it is directly in contact with a tenant. If a chatbot unintentionally starts discriminating a certain group, by not recognizing their dialect for instance, a big reputational risk is created. (I1, I2, I3, I4 & I5)

   > "If the chatbot starts training, you also have to ensure that there is a great diversity of data, so nobody gets disadvantaged, discriminated or racist." (I4, 2019)

   Caused reputational damage does not only exists among tenants, but also among the workforce. It can become a lot more difficult to keep the current employees and/or attract new employees. (I3)

5.2.3 Innovation barriers in public sector organizations

Based on the five interviews within the case organization, we can state that public sector organizations face the following eight innovation barriers:

1. *Lack of urgency*
   Public sector organizations experience no or barely any competition in their daily operations. Because of this, public sector organizations barely feel the urge to improve, since it does not affect their direct cash flows. The tenants' efforts and costs for switching from housing corporation are very high, making them stay with their current corporation. The lack of urgency/need for improvements creates a barrier for digital innovation. (I1, I2, I3, I4 & I5)

   > "Currently there is a housing shortage in our environment. All our houses are rented out and if somethings comes free, a new tenant is found easily." (I4, 2019)

2. *Poor business – IT affiliation*
   The relation between the business side and the IT department is not very affiliated. There is not a lot of direct or spontaneous communication between the entities, which is needed to get expectations in line. (I1 &I2)

   > "They do not come to the IT department with 'Hey, I have this idea'. No, it always goes through a manager who contributes it through the sounding board, while we need that stuff spontaneously." (I1, 2019)

   Business is supposed to work with the implementations from the IT department, but without clear communication, the expectations can pass each other, which creates a miss fit. The business side communicates their ideas to their managers, which again communicate it through the sounding board, to the IT department. This creates a big delay in the communication. Besides that, when expectations from the two entities do not line up, it creates frustrations. This poor affiliation between the business and the IT department creates a barrier for innovation. (I1)

   > "One thinks, 'I have an assignment here, that I have to work more efficiently, but IT has not yet delivered anything so I don't have to do anything.' That is not working out well for innovation" (I1, 2019)

3. *Lack of resources*

Public sector organizations have a lack of resources like financial resources, human resources and time resources.

- Financial resources

  Public sector organizations are bond to a specific innovation budget, which is many eyes; excessively low (I1, I2 & I3). Because of these restrictions, the innovation program has to be decided at the beginning of the year, and changes are barely possible later on. This creates an innovation barrier and pushes the organization into a digital innovation follower's position instead of being a digital innovation leader. (I1 & I2)

  > "Once a year the management determines where the budget is allocated to. This means that we cannot come up with all kinds of ideas halfway through the year. We are out of budget by then, and only next year it will possible again." (I2, 2019)

- Human resources

  Skilled employees, that lead digital innovation, are often rare and therefore expensive. (I1)

  > "Those people are expensive and rare. And they only get more expensive because they are so rare." (I1, 2019)

  Public sector organizations have an aging population and this makes it hard to be appealing for young talents. Besides that, public sector organizations cannot afford high compensations or bonuses like some other organizations can, since they are bond to public money. There is also a low degree of diversity among the employees within the corporation, which does not help to get a diversity of perspectives and opinions. (I1, I2, I4 & I5)

  > "I think skilled people are still missing, but we also miss diversity within the teams." (I5, 2019)

- Time resources

  Public sector organizations have their main focus on the operational activities, not on digital innovation. Managers barely allocate any time to innovation. Employees that want to be innovative are expected to be so during their own time, in addition to the day-to-day operational activities. It is not a fixed part of the work activities and therefore often skipped. (I1, I4 & I5)

  > "The organization is arranged operationally, not innovative. Everyone must stay with his regular tasks. If there is an innovation project, then you have to add it to your normal tasks."(I1, 2019)

4. *Conflict of interests*

   There is a split vision between the executives of public sector organizations and the teams that are directly in contact with the citizens. The management has a focus on the organization's strategic objectives for an overall continuous progress, while front-end employees focus on what they see at the business' front-end. The misfit of these visions for the organization can cause frustrations and incomprehension from both sides, even though they have the same long-term goal: the best housing service for the tenants. (I1, I2 & I5)

   > "We should think less about the money. It is about the tenant. We are not a company that revolves around money, but around the customer."(I2, 2019)

   If employees have an idea which is not aligned with both visions, they have to prove it to the management, which can even feel like a penalty for being innovative. This also forms an innovation barrier for public sector organizations. (I2)

5. *Organizational arrangements*

   Processes within public sector organizations are strictly aligned and widely shared. To make a small change in one system, all aligned systems need to change as well. This creates a lot of effort and therefore costs. Besides that, the right resources need to be placed in the right positions. As stated before, these resources are rare, which creates a challenge and therefore an innovation barrier. (I1 & I5)

   > "Starting something is fun, in terms of attention, but finishing it is difficult. It is difficult to focus on all the changes that need to be made, and it is often over-addressed here. It is very difficult to implement the innovation in the whole process, while taken steps that are too big." (I5, 2019)

6. *Culture of risk and change aversion*

   The culture within public sector organizations is more risk and change avers, and therefore not very innovative. Organizations are often aging and employees are doing their job for a long time, in the same manner, which makes is almost a routine job. Routines are hard to change, especially if the organization feels no urgency to do so and has no active, stimulating innovation program. (I2, I3, I4 & I5)

   > "Older people are often more difficult to get involved in innovation, certainly older people who have been here for a long time and have performed their work in the same way for a long time. They live in a certain routine that they need to break out of, without the urgency to do so." (I4, 2019)

In addition, the management of public sector organizations do not experience the urge to innovate either and prefer to be a smart follower, instead of a digital innovation leader. The organizations also know that unsuccessful digital innovations can damage them financially and reputational. The ambition to prevent this, is also an innovation barrier in public sector organizations.

> "I prefer to wait until an innovation is completely perfect, so that the risks are lower and right now you have to adjust many setting yourself, which is difficult. This makes us a smart follower." (I1, 2019)

7. *Lack of incentives*

   There are barely any incentives for being innovative in public sector organizations. There are no compensations or rewards given for coming up with ideas, working on ideas or being innovative in another manner. Incentives can encourage extrinsic motivation for certain behaviours, like being innovative or spend time on innovations. Employees are less triggered and inspired to be innovative. This is a barrier for innovation in public sector organizations. (I1, I2, I3 & I5)

> "Innovation is not very actively promoted and there is no active innovation policy. There are also no direct rewards for thinking innovative." (I5, 2019)

8. *Social responsibility*

   Public sector organizations have a big sense of social responsibility. They are funded by public money, to improve social needs from citizens. This provides them a lot of trust, but they also have to apply to social regulations imposed by the government and its institutions. Besides that, public sector organizations have to be very conscious and transparent about their operations, decisions and expenses to the government, the media and the citizens. (I1, I2, I4 & I5)

> "Every euro we spend can only be spent once. We have a very large social responsibility. All people who use our services, but also the quality of our property, should be managed fairly and responsibly. We are very transparent and I like that very much." (I2, 2019)

This requires a well thought out decision-making process that takes a lot of factors and stakeholder's interests into account. People that apply for a job at public sector organizations often have a social need to contribute to the society, through their work. Money spend on organization innovations is sometimes harder to link with society satisfaction then money spend on for instance improving the houses. (I4 & I5)

> "We cannot just sponsor money and time. We are not allowed to sponsor at all, but we can actively participate. It is sometimes difficult to describe where the boundaries are. All activities must have a direct relationship with our core business." (I5, 2019)

The right balance between consciously dealing with funding and have a good innovation program to improve the organization needs to be find. This can be a barrier for innovation within the public sector.

5.2.4 Innovation risk management process

According the five interviews, the risk management of digital innovation implementation risks within public sector organizations, is as follows:

Risk management is the main task of the risk and compliance department, led by the risk and audit manager. Yearly this department sums up the top ten enterprise risks within the internal control systems (ICS), based on the innovation project agenda for the particular year. (I1, I2, I4 & I5)

> "There is a special department for risk management: the risk and compliance department. This department determines the top ten enterprise risks and looks at: where these risks come from, how big the chance is that they will occur, what the impact could be and what the mitigating measures should be."(I1, 2019)

The risk manager is involved in each project's start, proof of concept, MVP and final pilot. Domain executives and employees are responsible for identifying risks within the project as well, and they should be reporting them to the risk manager. This is done with the support of a risk matrix. Sometimes an external specialist is involved in finalizing this risk matrix. The risk's impact and likelihood are measured and these elements form the axes for the risk matrix. The matrix helps evaluating and prioritizing the found risks. The risk and compliance department makes up a plan to control the identified risks. This plan can include a risk avoiding, transferring, reducing or accepting strategy. To proceed the control plan, an approval from the upper board is needed. The risk manager also monitors whether all measures are met during the successive innovation implementation stages. Therefore, the project team provides a progress report after each stage. After a project is finished, risks are still being monitored. This is done by taking samples from the operational process outcomes, to check if everything still goes as expected. Based on the risk matrix, the amount of needed samples to check is decided. (I2, I4 & I5)

> "As a risk manager, I have to be included in the process from the beginning and I want to see all measures that are taken to mitigate the risks. I expect something like a progress report from the project team about these mitigations after each stage. Every time a stage is closed, I would like to know what the state of the risks is. I was already involved in the proof of concept of the chatbot, to identify some risks. For example, the GDPR and the way we will be handling customer data, was very important for me." (I5, 2019)

5.2.5 ***Digital innovation risk management suggestions***

Based on the five interviews within the case organization, we can form the following six suggestions for public sector organizations that are implementing a digital innovation.

1. *Urgency creation*
   Since there is no urgency created from the organization's market, urgency to innovate needs to be created from another source. As stated before; public sector organizations attract employees with a social need to contribute to society, through their work. If the user-benefits of a digital innovation are more clearly communicated to these employees, it can stir up their feel of urgency towards the innovation. Which is needed, since the tenant's expectations are getting higher, caused by the developments within the other service organizations from their environments. (I1 & I4)

   > "We are not obliged to offer good services to our customers, but if we do want to have an efficient business operation, with optimal organization, we have to take into account that the world is getting faster and time to market is getting shorter." (I1, 2019)

   Digital innovations can improve, flexibilize and optimize organizations' internal processes. This can also facilitate in satisfying the government's performance agreements, which can also be a source of urgency for innovation. When there is a higher urgency, the organization is more stimulated to give attention to their innovation program, improving its performance. (I1)

2. *Business - IT alignment*

   The current relation between the business side and the IT department, also seen as the front-end and back-end of the organization, is stiff, without a lot of communication. The expectations of each other differ and the threshold to approach each other is big. This blocks a successful collaboration between the two entities, which blocks a successful alignment between the business needs and the IT offers. This collaboration should be organization wide positioned and promoted. (I1, I2 & I4)

   > "We are very concerned with how do we get the innovation team on the map and how can we promote it. A very important part of this is how we position ourselves as the management, the domain managers and the innovation team."(I1, 2019)

   Sharing knowledge, tools, infrastructure and successes can help to accomplish this alignment. In addition, external communication professionals could help. It will create a joint responsibility for innovation and a better-streamlined information sharing process, so opportunities and risks can be identified and anticipated, in a faster and more efficient way. This will create more trust, a lower failure rate, better customer responsiveness and a more efficient innovation program. (I1)

3. *Collaborations with other corporations*

   Various housing corporation share the same overarching activities, needs and complications. Some digital innovations can therefore be handled in collaboration with each other. This created the association for housing corporations in the Netherlands, where housing corporations become partners in some areas, including innovation generation. Continuing to use this association for co-creations, can prevent the reinvention of the wheel, which creates more time and money for other projects from the innovation program. (I1, I4 & I5)

   > "We are part of an association founded by the government and housing corporations themselves. This association should ensure that housing corporations collectively pick up new things. This way, resources can be saved, since housing corporations share many activities." (I1, 2019)

4. *Organizational wide involvement*

   An organization wide shared vision contributes to becoming inspired and committed to a shared goal. A vision can inspire actions, create energy and create will from executives and their teams, to make a change. Employee acceptance of change is very important. Without this, a change will not be absorbed into the daily operations and the workforce can even sabotage the change. (I1, I2, I3 & I4)

> "We have to ensure that the innovation is accepted among employees and that seems very simple, but it takes a lot of time within this organization. If that does not happen, we notice that certain undercurrents arise that, subsequently, can influence the success of innovation negatively, and potentially even to sabotage it." (I1, 2019)

Understanding the change is the key element of making sure employees will accept and socially approve the change. Therefore, the workforce should be involved from the beginning of the implementation process and the corresponding decision-making processes. (I2, I4 & I5)

> "If there is no urgency, it does not matter what you do, but the innovation will not be adopted. Employees must therefore be included early in the process."(I4, 2019)

This will also create the possibility to have more social control among employees. If the top management shares the same vision as the innovation team and the front-end of the organization, it will also be easier to budget the processes. Therefore, it is important that all parties are involved. This will make the innovation program more efficient. (I3)

5. *Culture change*

   The current culture is focused on the past and the current situation, instead of the improved future situation. This creates routines that must be broken first, before applying change. Manager support, trainings or external professionals can help with this. It is important to listen to all parties, create awareness, communicate directions transparently, create the right motivations to change and reward/recognize preferred behaviours. This will make it easier to make a change in the organization's culture and implement a digital innovation. (I1, I2, &I4)

6. *Resource balance*

   The right balance between budget, human skills and time is important to stimulate the innovation program. Without enough budget, innovation cannot be realized. Especially the last three stages of the implementation process have high expenses. If steps or stages are skipped to save budget, there is a higher chance of failure. When there is too much budget, there is a chance that it will be spend irresponsibly. Without the right human skills, digital innovations are harder to identify and implement. Especially new employees and a higher diversity among employees can provide new, critical and original 'out of the box' ideas. The right human skills are expensive, which can be at the expense of the strict budget. (I1, I2 & I5)

> "Not only young people are innovative, but I would like to see more diversity within our workforce. The organization will then become 'more sexy' and we will have a greater chance for 'out of the box' ideas." (I5, 2019)

Finally, there needs to be time allocated for the innovation program. Innovation is not something that can easily be done, next to normal tasks. This is something that should be arranged from the management team down and employees should feel comfortable to take this time. (I1)

5.3 Results from focus group

Name	Role
Participant 1 (P1)	Associate Audit
Participant 2 (P2)	Manager Technology
Participant 3 (P3)	Manager Risk Assurance
Participant 4 (P4)	Senior Manager Risk Assurance
Participant 5 (P5)	Senior Associate Public Sector
Participant 6 (P6)	Senior Manager Risk Assurance
Participant 7 (P7)	Associate Digital Transformation

5.3.1 Implementation of digital innovations

According to the held focus group, we can state that the five stages of the digital innovation implementation process of public sector organizations looks as follows:

1. *Generation and mobilization*
   Many public sector organizations are focussing on the digitalization of their processes these days. Public sector organizations focus on ideas that are coming from inside of the organization or industry, like from employees or other industry members. This is possible since industry members are no competitors, but potential cooperation partners. (P2 & P6)

   > "Currently, there is a focus on what comes from within the organization. So from employees, or in some cases from other public sector organizations. The corporation market is of course different from the normal commercial market. The other corporations are not your competitor, but more potential collaboration partners." (P2, 2019)

Some public sector organizations organize special teams that focus on digital innovation, but this concerns just a few. Most of the time, the IT department covers the task of idea generation. They visit seminars and read things online. The business side gets involved later in the process. (P3, P4 & P6)

> "I often see that ideas come from the IT department, more than from the management or the other teams. IT has often seen or read something that triggered their interest. The business side only get involved during the implementation, which is a pitfall." (P3, 2019)

2. *Advocacy and screening*

   Many public sector organizations do not have a clear screening procedure. There is no list with requirements that the idea has to meet, before going to the next stage. The most important requirement is that it has to fit in the budget. This budget is mostly set in a collaboration between the executive team and the IT department. (P2, P3 & P6)

> "Screening does not happen enough in my opinion. Usually it is just 'hey this sounds like a cool idea, let's do it.' There are no further checklists with requirements." (P3, 2019)

3. *Experimentation*

   None of the domain specialist had specific knowledge about how public sector organizations experiment with their digital innovations.

4. *Commercialization & 5. Diffusion and Implementation*

   The last two stages are the hardest ones during the implementation process, but also have the most potentials. (P2, P3 & P4)

> "When public organizations start working on digitization, the focus is usually on the first three stages. I usually compare it with a scale from 0 to 100. After the first three stages, organization are only at 1. It will only become difficult to get from 1 to 100, during the last two stages. Even though this is where the value is added the most and the organization can deploy the innovation broadly." (P2, 2019)

The various innovation barriers that public sector organizations are facing are causing this difficulty, which makes it hard to find organization wide support for the commercialization and diffusion of the innovation. (P2, P3, P4 & P6)

5.3.2 Digital innovation risks

During the focus group, it emerged that public sector organizations face the following risks within the earlier stated five risk categories, while implementing digital innovations:

1. *Strategic risks*
   There are various strategic risks that public sector organizations face while innovating. First, there are many stakeholders with many different interests and exceptions. This creates an unclear demand and therefore there is a risk that the wrong strategy is chosen and followed. There is a chance that individuals, whose interests are not satisfied, will not support the digital innovation and therefore will not follow the chosen strategy. (P1, P2, P3, P4, P5 & P6)

   > "Getting an idea is not that hard, but realizing it is very difficult. A reason for this is the big amount of stakeholders public sector organizations have, who all have different interests. It makes it difficult to find broad support for the innovation." (P2, 2019)

   Secondly, when the digital innovation can influence one or multiple KPI's of the organization, it forms a risk for the followed strategy. Therefore, it is very important that the digital innovation does what it is supposed and expected to do. (P1, P2 P4, & P7)

   > "You have to be sure that the user feels helped by the new service. They must feel heard, otherwise it can affect the organization's KPI's and thereby the organization's strategy." (P7, 2019)

   Finally, digital innovations do not always give results that can be measured in money or other tangible measurements. This makes it difficult to decide how it affects the strategy and if it is worth implementing. (P4 & P7)

   > "The proceeds are often not in euros, but in, for example, better service quality. There must be budget for that, but the results are a lot harder to measure and therefore it is a lot harder to allocate the budget to it." (P4, 2019)

2. *Compliance risks*
   There are various regulations and performance agreements that public sector organizations have to meet. Especially since they work with a lot of confidential data, which needs to be handled with care and an eye on for instance the current GDPR. There can be nasty consequences if these regulations are violated by the public sector organizations. (P4, P5 & P7)

> "In addition, the case is often about confidential information. So, information that must be handled with care. For example with the GDPR, organizations need to think carefully about what data they can save and what not, and how to handle this data." (P7, 2019)

3. *Operational risks*

   A big operational risk is that the digital innovation is not doing what it is expected to do. This affects the daily operations, especially if there is a possibility for individuals to even abuse it. Digital innovations often deal with automating human work. Employees need to accept the innovation and start use the innovation correctly, so the performance can be optimal. This also creates the fact that less human employees are required. If employees react negatively on the digital innovation for this reason, they are a risk for the day-to-day operations. Finally, public sector organizations' systems and processes are widely aligned. A digital innovation in another part of the organization can therefore affect the daily operations in this part of the organization, which is an operational risk as well. (P2, P3 & P5)

   > "The organization needs to pay attention, to be sure that the innovation is not going to be abused. If someone can request something, can he also request it endlessly? I do not think that every innovation can recognize that." (P2, 2019)

4. *Financial risks*

   Public sector organizations do not have endless financial resources. This also creates the risk of not having a good financial buffer to cope with consequences of unsuccessful digital innovations. (P6)

   > "The financial buffers within public sectors organizations are small. If something goes wrong, there may be consequences that the organization cannot absorb." (P6, 2019)

5. *Reputational risks*

   The government, citizens and media are constantly supervising the operations of public sector organizations. Public sector organizations are very transparent and therefore, every made mistake can be seen and magnified by everyone. This can have a tremendous effect on the organization's reputation. (P2, P4, P5, P6 & P7)

   > "Public sector organizations should always be careful, because they work with public money. Issues can easily come out and if something comes out that sketches the image of 'They just throw the money over the bar, they are just playing around and produce nothing', their reputation will sure be damaged." (P6, 2019)

5.3.3 Innovation barriers in public sector organizations

Based on the held focus group, we discovered that public sector organizations face the following nine innovation barriers.

1. *Lack of urgency*
   Public sector organizations barely experience any competition; this creates less urgency to innovate. Digital innovation is therefore given a lower priority, especially since the needed resources are rare. (P1, P6 & P7)

   > "Innovation has no priority; the focus is on the user – the citizen. The citizen will come knock on the door to satisfy his needs anyway. There is not really a need to innovate, so the innovativeness of the organization very much depends on the attitude of the workforce and the management. They choose to take steps or not." (P1, 2019)

2. *Poor business – IT affiliation*
   Most of the digital innovation ideas are currently coming from the IT department and the business side only gets involved later in the process. This means that the final users are not always involved in creating a solution for their problem, which can create a mismatch in expectations. (P2, P5 & P6)

   > "I see that innovation is usually done by the IT department. This group often loses connection with the rest of the organization. The rest of the organization will only get involved later in the process." (P6, 2019)

   There is not a lot of appreciation for time that is spend on innovations. Therefore asking around for ideas done by the IT department is often seen as 'bothering your colleagues'. Because of this, it is done only once in while instead of making it a continuous process of information sharing. (P2)

   > "Sometimes multiple contact with the business side is seen as a weakness. Occasionally, IT does a round around the business side to collect ideas, but usually only once a year or once every six months, instead of continuously. They do not want to come across as being 'difficult'. Interpreting needs is not seen as benefiting, but as bothering. The business side is not coming to the IT department either, if they have an idea." (P2, 2019)

3. *Lack of resources*

Public sector organizations have a lack of resources like financial resources, human resources and time resources.

- Financial resources

  Since there is no urgency to innovate within public sector organizations, it has low priority and therefore not a lot of budget is allocated to it. Especially in some public sector industries, like in the healthcare industry, digital innovation is very expensive. This ensures that the possibility of scaling up is missing. In addition, the financial buffer, to compensate for failed innovations is missing (P1, P3, P5, P6 & P7)

  > "The budget is low, and innovation has no priority. Certainly without financial buffers to cope with failures." (P7, 2019)

- Human resources

  Public sector organizations do not have enough employees with the right skills to support the digital innovations. They do not fully understand how the technologies work and what they can do. The organizations often want to work with the existing workforce, but these people lack knowledge.
  It is also difficult to attract new employees, since those are often attracted to organizations that are more modern. Besides that, public sector organizations are budget bound, which makes attractive bonuses impossible. (P1, P2, P6 & P7)

  > "The right knowledge is simply not there. They often want to do things with the existing staff, but these people do not have an IT background. They simply grew into their tasks, but have not studied for them. You can also see that the workforce is often older than an average workforce, and many will soon retire. Therefore, a new batch should be established or the organization has to outsource tasks. But the necessary knowledge for implementing new things is just not there yet." (P6, 2019)

- Time resources

  There is a main focus on the daily activities within public sector organizations, which does not create a lot of time for innovating. Time spend on innovating is not very appreciated. The 'ordinary' work comes first, that must continue. If employees want to work on digital innovations, they have to do this besides the regular work, which is not very attractive. Moreover, the organization is often not efficient enough to allow that. (P2 & P6)

> "Ordinary work often gets the upper hand. Projects, not necessarily innovation projects but every project, does not get enough attention due to the regular work activities. Those must always go on. Therefore, if someone works on a project for a client, it is always extra work. There is no space and capacity for innovation, plus the organization is most of the time, not efficient enough for it." (P2, 2019)

4. *Conflict of interests*

   There are many different interests and objectives among the stakeholders of public sector organizations. These interests do not line up with each other, which is confusing and creates friction. This makes it also hard to determine the demand for certain products or services, which leads to overestimation and/or underestimation. A multi-track policy can be the answer to that, but that is very expensive and makes the organization more inefficient. In addition, the expected results of digital innovation projects are harder to determine, especially since many results are not measured is money or other tangible measurements. (P2, P3 & P4)

   > "Public sector organizations deal with many different interests and objectives of stakeholders. This can be very confusing. An innovation can be good for the objectives of one, but bad for the other one." (P4, 2019)

5. *Organizational arrangements*

   Systems and processes of public sector organizations are widely intertwined. If the organization wants to change something in one place, it can have an unexpected effect on something in many other places. In addition, there is a lot of historical data, that is still relevant. This creates a complex IT landscape. Historical data needs to be transformed to the right format, to ensure the usability for the new programs. Every new system must be tailor-made and must fit precisely with the current systems and processes. (P1, P3, P4 & P5)

   > "There is a lot of intertwining with other systems. If organizations change something in one place, it will often have to continue to other places as well. That makes it very difficult to make any adjustments." (P5, 2019)

6. *Culture of risk and change aversion*

   The culture within public sector organizations is more risk and change avers than the culture of commercial sector organizations. This affects their innovation program, which is thereby less up to date. Public sector organizations are also harder to change, since many tasks became routine work. Employees have been doing the same tasks for a long time, in the same way. Therefore, it is hard to implement

a digital innovation that changes the daily way of operating. Employees will reject it. The fact that the workforce consists of employees with an above-average age, contributes to this as well. Moreover, employees that spend time on innovating are seen as employees that 'row against the stream', which is not appreciated. (P1, P2, P3, P5, P6 & P7)

> "Where there is little innovation, there is a culture of not wanting to move. People who have been in the same place and role for years and a manager who thinks it is fine like this, causes bad motivation. Whoever wants to change the status quo is looked at strangely." (P6, 0219)

7. *Social responsibility*

Public sector organizations have a big social responsibility to the citizens, since they are subsidized by the citizen's money. For this reason there are a lot of regulations and agreements they must act upon. This makes public sector organizations very accountable, but also dependable. Innovations have to add up to all these regulations, agreements and expectations, which is difficult and makes it easier to deprioritize the projects. (P2, P4, P6, P6 & P7)

> "They must be constantly accountable to society. That is a barrier to innovation." P7, 2019)

8. *Supplier dominance*

There are only a few suppliers that can deliver certain products that public sector organizations need. Some systems they work with are very specific and not needed by other companies. This holds potential supplier competitors back. This creates a lot of power for the suppliers and they will not feel the need to innovate their systems. This represses the will to innovate and contributes to the backlog in the public sector organizations' systems. Besides that, those systems can be very expensive; investing in something new not attractive. (P2, P4 & P6)

> "These suppliers also have a very specific number of customers. For example a benefit administration system, only 350 of them are needed throughout the Netherlands. Who will invests in creating the next innovative steps within this system? No one! Those 350 customers remain dependent on that system and thereby the supplier. Same applies to sewerage software or building permits software" (P4, 2019)

9. *Lack of inspiration sources*

To innovate, organizations need to get inspired. Idea generation is focussed on internal sources, in particular; employees. Those employees work with the same systems, processes and people every day. This creates a bubble, without any looks

into the external environment of the organization. This makes it hard to come up with the right solutions for certain inefficiencies. Public sector organizations also have a slight aversion to ideas from commercial sector organizations. There rules a 'not invented here' culture, which concludes that something that is not invented within the organization will not work. This limits the amount sources for new ideas and therefore for digital innovations.

> "I have an example. They ask their employees: 'if you have ideas about something in your processes that can be replaced by digitization, let us know.' Of course that will not work. They actually ask: 'how can we make you unnecessary?' And of course, nobody will give ideas for that." (P2, 2019)

5.3.4 Digital innovation risk management suggestions

According the held focus group, we can form the following seven suggestions for public sector organizations that are implementing a digital innovation

1. *Business – IT alignment*
   There is not enough collaboration between the IT department and the business side during various stages from the digital innovation implementation process. This should be more encouraged, by in particular: knowledge sharing. Both parties should be involved and heard in all of the stages.

   > "I often see that innovative ideas come from the IT department only. Much more than from the management or from other teams. The business side often only has to deal with implementation. That is too late and therefore a major pitfall. All parties should cooperate from the outset." (P3, 2019)

2. *Collaborations with other organizations*
   Many corporations fulfil the same tasks. Knowledge sharing is therefore very important to find out the best practices. However, this critical knowledge can also come from beyond the organization's industry; the commercial sector for instance. The offense against commercial sector organizations within public sector organizations should be mitigated, so they will be more open to ideas from the other side. This can help to get new insights for improving current processes, systems and workforce skills. (P1, P2 & P5)

> "There are good opportunities laying in collaborating with other organizations, also outside the corporation world." (P5, 2019)

3. *Organizational wide involvement*

   To make a digital innovation successful, the innovation needs to be accepted by its users. This encourages the social approval. For public sector organizations, users can be the workforce and/or the citizens. Their support is therefore very important. To get their support; the benefits and the importance of implementing the digital innovation should be clearly communicated to them. As stated before, many employees work within public sector organizations because they feel an urge of social responsibility. Connecting the benefits of an innovation to this will encourage intrinsic motivation, which will again, encourage acceptance. (P2, P6 & P7)

   > "If people see what the innovation can bring, they can indeed start to enjoy it. They will embrace it more, just like with the smartphone a few years ago. Once you know what it brings, you will accept it more easily. Support for innovation among both, employees and users, is a very important factor for success. The organization must emphasize the positive and show what it can do and bring." (P6, 2019)

4. *Resource balance*

   Resources like money, knowledge and time are quite rare within public sector organizations. Therefore, it is very important that the right balance is found between those elements, to be an efficient organization with an optimal operational process. By finding the right balance, digital innovations can be implemented more efficiently and successfully. (P1, P2, P3, P4, P5, P6 & P7)

   > "Ideas are put on paper, but they also have to be realized. That is often too difficult. Then you come back to the shortage of time, money and knowledge. You really have to bet on that, to find the right balance. That is a big challenge, but a very important one." (P6, 2019)

5. *Getting inspired*

   Many public sector organizations are focussing on the digitization of their processes these days, but often the hoped-for results do not come true. To innovate, organizations need to get inspired. This barely happens from within their own organization, because they work with the same people, systems and processes day-to-day. This makes it hard to come up with new ideas. Organizations have to break out of this 'bubble' that they live in and go outside. This will encourage out-of-

the-box thinking, which is positive if an organization is stuck into a routine. Bringing the environment into the organization is also an option to ensure this, by hiring an external consultant for instance. (P2 & P4)

> "Broaden your world. If necessary, hire external consultants who will come talk about a technology, specific problem or specific organization. This way you can inspire employees, so that they come up with their own new ideas. What I think is important: do not just keep thinking about a solution internally with your own employees, but go out or do something out of the box. Then you will get a more clear view if what you are dealing with and you can imagine much better what is needed to solve it. Take it as broadly as possible." (P2, 2019)

6. *Better screening and commercializing of ideas*

There should be better screening of ideas, to discover the potential benefits and the potential costs. This can make a digital innovation more attractive than it seems at first, or more unattractive than it seems at first. By discovering these elements, they can be used to convince both, the management and/or the teams. This will affect their perceived usefulness and their ease/difficulty of use. In addition, a more efficient commercialization plan can be made up. Since the culture of public sector organizations is more risk and change averse, and the change capacity is low, the commercialization plan should be adjusted to these factors. Both, the business side and the IT side should be involved in this and the steps should be small. This makes the change less scary and considerations can be better weighed and communicated. (P2, P3 & P4)

> "Think more from the business side, and think smaller. This way you can make the risk considerations more though out and it is all less scary." (P2, 2019)

7. *Standardization of processes*

Many public sector organizations use very customized systems, that are produced by only a few suppliers. This creates a great dependence and only a few fall-back options. It also makes it very hard to get objective opinions on their systems, to make them more efficient. Moreover, this dependence makes the supplier feel like he has no pressure to either innovate or improve their system. If public sector organizations would meet certain system standards, there will rise more options for collaborations with suppliers and other organizations that own standardized systems. This will also mitigate the 'not invented here' culture. (P4, 2019)

“Nowadays, organizations have to meet more and more standards, so that it is easier to change and to adapt. This way they have a bigger choice of suppliers and are less dependent. Organizations can also work better together, and the 'not invented here' culture can be prevented. It becomes easier to join forces between different organizations and thereby improve performance. Collaborations with private organizations can also contribute to this.” (P4, 2019)

6 CONCLUSION

In this chapter, the interpretations of the results and the conclusions based on these will be presented, to provide answers for the earlier introduced research questions:

I. Is implementing digital innovations in public sector organizations a risky business?
II. What is repressing digital innovation in public sector organizations?
III. How can public sector organizations manage the hazards among digital innovations?

To answer these questions, a qualitative approach was chosen. A case study and a focus group were conducted to gather primary data. This data will be supported by secondary data, gathered by a literature research.

6.1 Research question 1: Is implementing digital innovations in public sector organizations a risky business?

While analysing the digital innovation implementation process of the case organization and taking the opinions of the domain specialists about this topic into consideration, we can conclude that Desouza et al.'s (2009) five cyclic stages are represented in the innovation implementation processes of public sector organizations. Besides that, the results show that while implementing digital innovations in public sector organizations all five-risk types can arise: strategic, compliance, operational, financial and reputational risks.

Therefore, we can conclude that implementing digital innovations in public sector organizations is indeed a risky business.

6.2 Research question 2: What is repressing digital innovation in public sector organizations?

Various innovation barriers contributed to the digital innovation backlog of public sector organizations. By conducting the literature research, five common innovation barriers were found: short-termism, lack of incentives, culture of risk aversion, organizational arrangements and lack of resources. The following three of these innovation barriers were also supported by the results from the case study and the focus group: culture of risk aversion, organizational arrangements and lack of resources.

Besides that, the innovation barrier 'lack of incentives' was also mentioned during the case study, but not during the focus group, and the innovation barrier 'short-termism' was not mentioned during the case study or the focus group at all.
Thereafter, the results of both, the case study and the focus group introduced four new innovation barriers for public sector organizations: lack of urgency, poor business – IT affiliation, conflict of interests and social responsibility. Finally, the focus group with domain specialists introduced two extra innovation barriers that public sector organizations face: supplier dominance and lack of inspiration sources.

Therefore, we can conclude that the following innovation barriers are repressing digital innovation in public sector organizations:

Table 8 Innovation barriers for public sector organizations

Literature research	Case study	Focus group
Short-termism		
Lack of incentives	Lack of incentives	
Culture of risk aversion	Culture of risk and change aversion	Culture of risk and change aversion
Organizational arrangements	Organizational arrangements	Organizational arrangements
Lack of resources	Lack of resources	Lack of resources
	Lack of urgency	Lack of urgency
	Poor Business – IT affiliation	Poor Business – IT affiliation
Supported by one source	Conflict of interests	Conflict of interests
Supported by two sources	Social responsibility	Social responsibility
Supported by three sources		Supplier dominance
		Lack of inspiration sources

6.3 Research question 3: How can public sector organizations manage the hazards among digital innovations?

By analysing the innovation risk management process of the case organization, we can conclude that Tummala and Burchett's (1999) five risk management elements are represented in the innovation risk management process of public sector organizations. According to our literature research, there are four responses to hazards: avoidance, transference, reduction and acceptance. The results of the case study and the focus group mainly focus on avoidance and reduction strategies.

Therefore, we can conclude that public sector organizations can perform the following actions to mitigate or avoid certain hazards:

Table 9 Actions to mitigate or avoid hazards

Case organization	Focus group
Business – IT alignment	Business – IT alignment
Collaboration with other corporations	Collaboration with other organizations
Resource balance	Resource balance
Organizational wide involvement	Organizational wide involvement
Urgency creation	
Culture change	
	Getting inspired
Supported by one source Supported by two sources	Better screening and commercialization of ideas
	Standardization of processes

7 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This chapter discusses the limitations of this research and proposes directions for future research.

7.1 Limitations

This research has some limitations within the conducted approaches and the discovered relationships between certain elements.

First of all the generalizability of this research is influenced by a few factors. The research focussed on a very specific type and definition of innovation. Other types and definitions of innovation are not covered by this research. Besides that, the case study focussed on a specific part of the studied target group, namely housing corporations. Housing corporations cannot represent the public sector as a whole. To compensate this, data was also gathered from domain specialists and literature, which do cover the public sector as a whole. Moreover, the data gathered by the case study and the focus group were focused on Dutch public sector organizations. In addition, a personal interest of communication science was taken into account, while selecting the case organization. The structure, regulations and abilities of public sector organizations can differ tremendously per country. Therefore, this research is not necessarily generalizable to other countries. These factors affect the external validity of this research in a negative manner.

The interviewees and participants of the case study and focus group, were not selected in a random manner. They were chosen based on their knowledge and/or involvement in certain processes. Although this research focusses on the Dutch public sector, not all used data in the literature research was based on the Dutch public sector. This because of an absence of adequate literature theories within the specific context. Finally, to answer the second research question, innovation barriers were chosen as the main repression of the will to innovate. This was also linked to the public sector's digital innovation backlog, but there can be more elements of repression that contributed to the stage the public sector's digital innovation program is in now. These are not represented in this research. These factors affect the internal validity of this research in a negative way.

The researcher conducted the interviews and the focus groups herself. This encouraged a subjective perception on the data. Besides that, both approaches were conducted in an environment that was able to influence their willingness to share information and thereby the outcomes. These factors affected the construct validity in a negative manner.

7.2 Suggestions for future research

The research brought up various concepts, which could be further examined and researched.

This research focusses on digital product and process innovation. However, there are many types of innovations that all deserve their own research. Future research could focus on a different type of definition of innovation within public sector organizations.

As stated before, public sector organizations among different countries differ tremendously. Therefore, it would be interesting to see what kind of results are gathered in other countries. In the part where suggestions for the management of digital innovation hazards are mentioned, there is a focus on only two out of four risk responses: avoidance and reduction. Future research could focus on the other two risk responses: acceptance and transference. The limitations also stated that, except for innovation barriers, other repressions could be discovered for the digital innovation backlog of public sector organizations. This could be a subject for further research. The conclusions of this research can also be used to make a comparison of digital innovation hazards between the public sector and the commercial sector. Finally, it would be very interesting to conduct this research in another time frame, for instance; 20 years from now. With new organizations, regulations and innovations.

8 REFERENCES

- Abdul-Kader, S. A., & Woods, J. C. (2015). Survey on chatbot design techniques in speech conversation systems. International Journal of Advanced Computer Science and Applications, 6(7).
- Agarwal, Ritu, and Jayesh Prasad. "The antecedents and consequents of user perceptions in information technology adoption." Decision support systems 22, no. 1 (1998): 15-29.
- Ambira, C., & Kemoni, H. (2011). Records management and risk management at Kenya Commercial Bank Limited, Nairobi. South African Journal of Information Management, 13(1), 1-11.
- Antheunis, M. L., Valkenburg, P. M., & Peter, J. (2007). Computer-mediated communication and interpersonal attraction: An experimental test of two explanatory hypotheses. CyberPsychology & Behavior, 10(6), 831-836
- Baird, J., & Stull, J. (1992). The Seven C's of Communication.
- Baregheh, A., Rowley, J., & Sambrook, S. (2009). Towards a multidisciplinary definition of innovation. Management decision, 47(8), 1323-1339.
- Beck, M., Lopes-Bento, C., & Schenker-Wicki, A. (2016). Radical or incremental: Where does R&D policy hit?. Research Policy, 45(4), 869-883.
- Bekkers, V.J.J.M., Duivenboden, H. van & Thaens, M. (2006). Information and communication technology and public innovation: assessing the ICT driven modernisation of public administration. Amsterdam: IOS Press.
- Bekkers, V. (2007). Beleid in beweging: achtergronden, benaderingen, fasen en aspecten van beleid in de publieke sector. Den Haag: Uitgeverij LEMMA
- Bekkers, V.J.J.M. & Korteland, E.H. (2006). Governance, ICT and the innovation agenda of public administration: a comparison of some European policy initiatives. In:
- Bergemann, D., & Morris, S. (2005). Robust mechanism design. Econometrica, 73(6), 1771-1813.
- Borgelt, K., & Falk, I. (2007). The leadership/management conundrum: innovation or risk management?. Leadership & Organization Development Journal, 28(2), 122-136.
- Brown, T. (2001). Modernisation or failure? IT development projects in the UK public sector. Financial Accountability & Management, 17(4), 363-381.
- Burns, T. & Stalker, G. (1961). Management of innovation. Londen: Tavistock.
- Buningh, J. (2019) Participant 3 (P3) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)

- Cahn, J. (2017). CHATBOT: Architecture, design, & development. University of Pennsylvania School of Engineering and Applied Science Department of Computer and Information Science.
- Cancho, R. F. I., & Solé, R. V. (2001). The small world of human language. Proceedings of the Royal Society of London. Series B: Biological Sciences, 268(1482), 2261-2265.
- Cankar, S. S., & Petkovšek, V. (2013). Private and public sector innovation and the importance of cross-sector collaboration. Journal of Applied Business Research, 29(6), 1597.
- Chance, D.M., 2004, An introduction to derivatives and risk management, 6th edn., Thomson, Singapore.
- Chandrasekar, R. (2014). Elementary? Question answering, IBM's Watson, and the Jeopardy! challenge. Resonance, 19(3), 222-241.
- Collis, J., & Hussey, R. (2003). Business research (ed.).
- Cooper, R. G., Edgett, S. J., & Kleinschmidt, E. J. (1999). New product portfolio management: practices and performance. Journal of Product Innovation Management: AN INTERNATIONAL PUBLICATION OF THE PRODUCT DEVELOPMENT & MANAGEMENT ASSOCIATION, 16(4), 333-351.
- Cooper, R. G., & Edgett, S. J. (2008). Maximizing productivity in product innovation. Research-Technology Management, 51(2), 47-58.
- Crawford, C. M. (1987). New product failure rates: a reprise. Research management, 30(4), 20-24.
- Creswell, J. W. (2009). Mapping the field of mixed methods research.
- Damanpour, F., & Schneider, M. (2006). Phases of the adoption of innovation in organizations: effects of environment, organization and top managers 1. British journal of Management, 17(3), 215-236.
- Davenport, T. H. (1993). Process innovation: reengineering work through information technology. Harvard Business Press.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use and user acceptance of information technology. MIS Quarterly, 13(3), 319–340.
- Demner-Fushman, D., Chapman, W. W., & McDonald, C. J. (2009). What can natural language processing do for clinical decision support?. Journal of biomedical informatics, 42(5), 760-772.
- Desouza, K. C., Dombrowski, C., Awazu, Y., Baloh, P., Papagari, S., Jha, S., & Kim, J. Y. (2009). Crafting organizational innovation processes. Innovation, 11(1), 6-33.
- Dewar, R. D., & Dutton, J. E. (1986). The adoption of radical and incremental innovations: An empirical analysis. Management science, 32(11), 1422-1433.

- Dionne, G. (2013). Risk management: History, definition, and critique. Risk Management and Insurance Review, 16(2), 147-166.
- Dix, A. (2009). Human-computer interaction (pp. 1327-1331). Springer US.
- Doz, Y., & Kosonen, M. (2014). Governments for the future: Building the strategic and agile state. Sitra Studies, 80, 18.
- Engelberger, J. F. (1982). Robotics in practice: Future capabilities. Electronic Servicing & Technology magazine.
- Fichman, R. G., Dos Santos, B. L., & Zheng, Z. E. (2014). Digital innovation as a fundamental and powerful concept in the information systems curriculum. MIS quarterly, 38(2).
- Fishenden, J., & Thompson, M. (2012). Digital government, open architecture, and innovation: why public sector IT will never be the same again. Journal of public administration research and theory, 23(4), 977-1004.
- Frotan, A. (2019) Participant 1 (P1) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Goswami, S., & Mathew, M. 2005. Definition of innovation revisited: An empirical study on India information technology industry. International Journal of Innovation Management, 9: 371–383.
- Gruhn, R. E., Minker, W., & Nakamura, S. (2011). Statistical pronunciation modeling for non-native speech processing. Springer Science & Business Media.
- Haagen, M. (2019) Participant 5 (P5) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Halman, J. I. M. (2018). Met zekerheid in onzekerheid: over innovatie en het nemen van innovatierisico's.
- Hoecht, A., & Trott, P. (2006). Innovation risks of strategic outsourcing. Technovation, 26(5-6), 672-681.
- Hood, C. (2008), The risk game and the blame game. Government and Opposition, 37, 1, pp. 15– 37.
- Howells, J. R. (2002). Tacit knowledge, innovation and economic geography. Urban studies, 39(5-6), 871-884.
- Interviewee 1, (2019). Personal interview. 03 June 2019 (M. Rosbergen, Interviewer)
- Interviewee 2, (2019). Personal interview. 03 June 2019 (M. Rosbergen, Interviewer)
- Interviewee 3, (2019). Personal interview. 11 June 2019 (M. Rosbergen, Interviewer)
- Interviewee 4, (2019). Personal interview. 11 June 2019 (M. Rosbergen, Interviewer)

- Interviewee 5, (2019). Personal interview. 11 June 2019 (M. Rosbergen, Interviewer)
- Jaskyte, K. (2011). Predictors of administrative and technological innovations in nonprofit organizations. Public Administration Review, 71(1), 77-86.
- Jenssen, J. I., & Jørgensen, G. (2004). How do corporate champions promote innovations?. International Journal of Innovation Management, 8(01), 63-86.
- Jeong, M., & Lee, G. G. (2006, December). Jointly predicting dialog act and named entity for spoken language understanding. In 2006 IEEE Spoken Language Technology Workshop (pp. 66-69). IEEE.
- Jeyaraj, A., & Sabherwal, R. (2008). Adoption of information systems innovations by individuals: A study of processes involving contextual, adopter, and influencer actions. Information and Organization, 18(3), 205-234.
- Kholod, A. (2017) The Brief History of Artificial Intelligence and Chatbots. https://api2cart.com/business/brief-history-artificial-intelligencechatbots/. 16.08.2017.
- King, G., Keohane, R. O., & Verba, S. (1994). Designing social inquiry: Scientific inference in qualitative research. Princeton university press.
- Klein Etink, R. (2019) Participant 7 (P7) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Koch, P., Cunningham, P., Schwabsky, N. & Hauknes, J. (2006) (2e ed.). Publin: summary and policy recommendations. Oslo: NIFU STEP.
- Lahtiranta, J. (2019). Personal interview - EHealth. 22 march 2019 (M. Rosbergen, Interviewer)
- Lawrence, P. (84). J. lorsch (1967). Organization and environment.
- Legner, C., Eymann, T., Hess, T., Matt, C., Böhmann, T., Drews, P., ... & Ahlemann, F. (2017). Digitalization: opportunity and challenge for the business and information systems engineering community. Business & information systems engineering, 59(4), 301-308.
- Manual, O. (2005). Guidelines for collecting and interpreting innovation data.
- McMillan, J. H. & Schumacher, S. (1993). Research in education: A conceptual understanding. New York: HaprerCollins.
- McTear, M., Callejas, Z., & Griol, D. (2016). The conversational interface: Talking to smart devices. Springer.
- Morgan, D. L. (1997). The focus group guidebook (Vol. 1). Sage publications.
- Mulgan, G., & Albury, D. (2003). Innovation in the public sector. Strategy Unit, Cabinet Office, 1, 40.
- Nambisan, S. (2013). Information technology and product/service innovation: A brief assessment and some suggestions for future research. Journal of the Association for Information Systems, 14(4), 215.

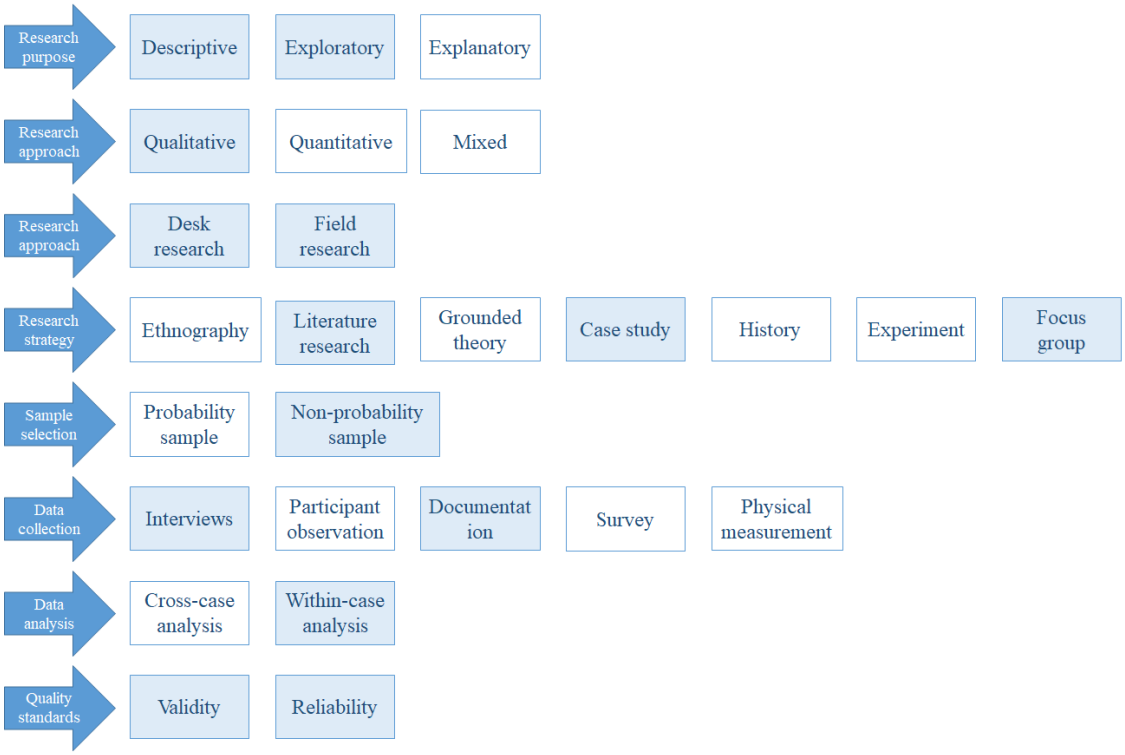
- Negroponte, N., Zellmeister, G., & Petit, C. (1995). A vida digital (p. 88). São Paulo: Companhia das Letras.
- Osborne, S. P., & Brown, L. (Eds.). (2013). Handbook of innovation in public services. Edward Elgar Publishing.
- Osborn, A. F. (1953). Applied Imagination, Scribner. Charles Scribner, New York.
- Osborn, A.F. (1963) Applied imagination: Principles and procedures of creative problem solving (Third Revised Edition). New York, NY: Charles Scribner's Sons.
- Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge: How to benefit from digitalization in practice. International Journal of Information Systems and Project Management, 5(1), 63-77.
- Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage.
- Puusa, A., & Juuti, P. (2011). Mitä laadullinen tutkimus on. Teoksessa Menetelmäviidakon raivaajat. Perusteita laadullisen tutkimuslähestymistavan valintaan. Vantaa: Hansaprint.
- Radnor, Z., & McGuire, M. (2004). Performance management in the public sector: fact or fiction?. International Journal of Productivity and Performance Management, 53(3), 245-260.
- Rashad, M. Z., El-Bakry, H. M., Isma'il, I. R., & Mastorakis, N. (2010). An overview of text-to-speech synthesis techniques. Latest trends on communications and information technology, 84-89.
- Reguia, C. (2014). Product innovation and the competitive advantage. European Scientific Journal, ESJ, 10(10).
- Sabbagh, K., Friedrich, R. O. M. A. N., El-Darwiche, B. A. H. J. A. T., Singh, M. I. L. I. N. D., Koster, A. L. E. X., Bilbao-Osorio, B., ... & Lanvin, B. (2013). Digitization for economic growth and job creation: Regional and industry perspective. The global information technology report, 2013, 35-42.
- Sansonnet, J. P., Leray, D., & Martin, J. C. (2006, August). Architecture of a framework for generic assisting conversational agents. In International Workshop on Intelligent Virtual Agents (pp. 145-156). Springer, Berlin, Heidelberg.
- Schilling, M. A. 2008.Strategic Management of Technological Innovation (2 ed.). New York: McGrawHill.
- Schumpeter, J.A. (1939). Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process (Volume 1 and 2). McGraw Hill: New York.
- Seddon, J. (2008). Systems thinking in the public sector: The failure of the reform regime... and a manifesto for a better way. Triarchy Press Limited.

- Shannon, C. E., & Weaver, W. (1959). The mathematical theory of communication.
- Shawar, B. A., & Atwell, E. (2007, January). Chatbots: are they really useful?. In Ldv forum (Vol. 22, No. 1, pp. 29-49)
- Ståhle, P., & Grönroos, M. (2000). Dynamic intellectual capital [sup TM]: knowledge management in theory and practice. WSOY.
- Sterk, T, (2019) Participant 6 – (P6) Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Stulz, R. M. (1996). Rethinking risk management. Journal of applied corporate finance, 9(3), 8-25.
- Stulz, R. M. (2003). Risk management and derivatives. South-Western Pub.
- Thaens, M. (2006). Verbroken verbindingen hersteld? Over de noodzaak van een bestuurskundig perspectief op ICT en strategisch innoveren in de publieke sector. Den Haag: Uitgeverij Lemma
- Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Research commentary—Digital infrastructures: The missing IS research agenda. Information systems research, 21(4), 748-759.
- Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. Omega, 3(6), 639-656.
- Van den Dool (2019) Participant 4 (P4) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Van Rij, I. (2019) Participant 2 (P2) - Focusgroup. 8 july 2019 (M. Rosbergen, mediator)
- Verma, A., & Cutcher-Gershenfeld, J. (1996). Workplace Innovations and Systems Change in the Government Sector. Public sector employment in a time of transition, 201-241.
- Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation. Oxford University Press on Demand.
- Waarts, E., & Van Everdingen, Y. (2005). The Influence of National Culture on the Adoption Status of Innovations: An Empirical Study of Firms Across Europe. European Management Journal, 23(6), 601-610.
- Walters, A. C., & Ramiah, V. (2016). Is it possible to be too risk averse? Considerations for financial management in the public sector. Applied Economics Letters, 23(17), 1210-1214.
- Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. MIS quarterly, xiii-xxiii.

- Wei, C., Yu, Z., & Fong, S. (2018, February). How to build a chatbot: Chatbot framework and its capabilities. In Proceedings of the 2018 10th International Conference on Machine Learning and Computing (pp. 369-373). ACM.
- Weizenbaum, J. (1966). ELIZA---a computer program for the study of natural language communication between man and machine. Communications of the ACM, 9(1), 36-45.
- Wester, F., & Van Selm, M. (2006). Inhoudsanalyse als systematisch-kwantificerende werkwijze. Onderzoekstypen in de communicatiewetenschap, 121-150.
- Willcocks, L. P., Lacity, M., & Craig, A. (2015). The IT function and robotic process automation.
- Windrum, P., & Koch, P. M. (Eds.). (2008). Innovation in public sector services: entrepreneurship, creativity and management. Edward Elgar Publishing.
- Yoo, Y., Boland Jr, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for innovation in the digitized world. Organization science, 23(5), 1398-1408.
- Yu, Z., Xu, Z., Black, A. W., & Rudnicky, A. (2016). Chatbot evaluation and database expansion via crowdsourcing. In Proceedings of the chatbot workshop of LREC (Vol. 63, p. 102).
- Zhang, Y., & Fan, Z. P. (2014). An optimization method for selecting project risk response strategies. International Journal of Project Management, 32(3), 412-422.
- Zouridis, S. & Termeer, C.J.A.M. (2005). Never the twain shall meet. Een oxymoron: innovatie in het openbaar bestuur. Bestuurskunde. Jrg. 14, nr. 7/8, p. 13-23.

9 APPENDICES

9.1 Research design summary



9.2 Interview questions

1. Hoe ziet de implementatie proces van een digitale innovatie eruit?

    a. Hoe verloopt de idee generatie? en wie zijn hierbij betrokken? welke rol spelen zij?

    b. Hoe verloopt de screening van ideeën? en wie zijn hierbij betrokken? welke rol spelen zij?

    c. Hoe wordt er ge experimenteert met het idee? en wie zijn hierbij betrokken? welke rol spelen zij?

        i. Hebben de gebruikers al een rol?

    d. Hoe wordt het idee commercialiseert? en wie zijn hierbij betrokken? welke rol spelen zij?

    e. Hoe wordt het idee geïmplementeerd? en wie zijn hierbij betrokken? welke rol spelen zij?

2. Wat zijn voor jullie Barriers om te innoveren?
(short-termism, lack of incentives, culture, organizational arrangements, lack of resources)

    a. Innovatie planning/budgets termijnen? (1 jaar, 5 jaar)?

    b. Is er ruimte voor innovatief denken? (Strategie?)

    c. Zijn er beloningen voor mensen die innovatief denken?

    d. Wat zijn de gevolgen van het introduceren van een onsuccesvolle innovatie?

    e. Ervaren jullie competitie van andere organisaties? kunnen jullie huurders verliezen?

    f. Is er veel onzekerheid?

    g. Heerst er een innovatieve cultuur?

    h. Wat doet de organisatie om innovatie te stimuleren? Van boven?

    i. Zijn er organisaties waar jullie naar opkijken als het gaat om innovatie?

    j. Heeft de organisatie de juiste middelen om te innoveren? (Budget? hr?)

3. Welke risico's komen jullie tegen tijdens het implementeren van een digitale innovatie? (Strategisch, compliance, operationeel, financieel, reputatie)

    a. In welke fase van het innovatie implementatie proces komen jullie deze tegen?

4. Hoe worden deze risico's beheerd? wie zijn hierbij betrokken? welke rol spelen zij?

    a. Hoe worden risico's geïdentificeerd? wie zijn hierbij betrokken? welke rol spelen zij?

    b. Hoe worden risico's gemeten? wie zijn hierbij betrokken? welke rol spelen zij?

    c. Hoe worden risico's ge evalueert? wie zijn hierbij betrokken? welke rol spelen zij?

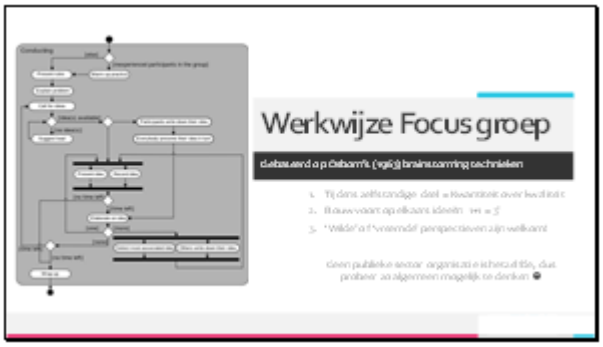
    d. Hoe worden de plannen opgesteld voor de omgang met de risico's? wie zijn hierbij betrokken? welke rol spelen zij?

    e. Hoe waren de risico's gemonitord? wie zijn hierbij betrokken? welke rol spelen zij?

5. Zijn er dingen waarvan je vindt dat ze anders zouden moeten?

6. Denk je dat er verschillen zijn in deze processen in vergelijking met de private sector?

9.3 Focus group presentation slides

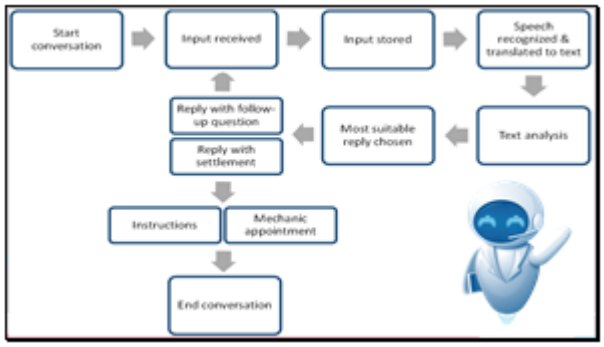


Wat zijn barrières voor innovatie binnen publieke sector organisaties?

Hoe kan de organisatie het beste omgaan met deze barrières?

Barrières

Actie



Welke risico's kunnen komen kijken bij het implementeren van deze chatbot?

Risico Types

1. Strategische risico's
2. Compliance risico's
3. Operationele risico's
4. Financiële risico's
5. Reputatie risico's

Gevonden risico's

Hoe kan de organisatie de gevonden risico's het beste beheren?

Gevonden risico's

Actie


Dankjewel!!!