

UNIVERSITY OF TARTU

Faculty of Social Sciences

SCHOOL OF ECONOMICS AND BUSINESS ADMINISTRATION

Ismaeel Adedeji Raji

Innovation in Estonian Public Sector Firms

Master's thesis

Supervisor: Prof. Kadri Ukrainski

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ABSTRACT

The study examines the drivers of innovation in Estonian public sector firms using survey to sample 113 employees from different public firms. The main research question assessed what drives innovation in public firms and the three sub-questions are as follows: why they innovate, what are the types of innovation used and what are the challenges or barriers encountered while implementing innovation activities. The empirical analysis suggests that public firms innovation is driven internally (by employees and management), public organization and political processes while the main purpose of innovation is to improve working conditions of employees and increase efficiency in output delivery. Also, service, administration, organizational and product innovation are the major types of innovation used in achieving these objectives. Lack of flexibility in laws, external rules and regulations, and the risk of technological failure are identified to be the most significant barriers to innovation. Findings also showed that Estonia and Nordic countries has some similarities and differences for instance they both have internal drive has the most important innovation driver but political drivers plays more significant role in Nordic countries compared to Estonia.

1. INTRODUCTION

Public sector innovation is about new ideas that create public values. The ideas have to be at least partly new (rather than improvements); they have to be implemented (rather than just being good ideas), and they have to be useful (Mulgan et al, 2007). Also, OECD/Eurostat (2005)¹ defined public sector innovation as the implementation by a public-sector firm of new or significantly improved products, services or processes, either within the structure of the public sector itself or in the way in which public services are provided. Despite the fact that some research has been carried out on public sector innovation, few of the studies have investigated what drives public firms to innovate. The reason for this gap is due to scarcity of data from public sector firms which affect measurement of innovation (Tönurist, 2015; Arundel & Huber, 2013; Bloch & Bugge, 2013; European Commission 2011; Bugge & Bloch 2016; Demircioglu & Audretsch 2017). However, “evidence shows that even a small innovation in the public sector may yield large outcomes or effects beyond the limits of the public sector itself” (Demircioglu & Audretsch 2017, pp. 1).

Public sector firms are often seen as conservative and bureaucratic and can therefore not innovate even though the public sector is credited with a breakthrough innovation such as the Internet (Bloch & Bugge, 2013). It is in this light that, many authors have suggested that innovation in the public sector is poorly understood and some also acknowledged that public sector firms are risk-averse and lack the incentives to be creative (Vickers et al, 2017; Bloch & Bugge, 2013). This lack of understanding has had a negative spillover effect in the realm of research and evidence showed that emphasis has been laid on private sector innovation than the public-sector innovation and as a result there is limited literature on public sector firm innovation (Demircioglu, & Audretsch, 2017; Mulgan & Albury, 2003; Bommert, 2010; Halvorsen et al., 2005).

Public sector firms contribute largely to innovation in many sectors of the economy which serves as the basis for privately owned firms to thrive (Sheehan, 2006; Aschhoff & Sofka 2009; Edler & Georghiou 2007; Edler & Yeow 2016; Edquist & Hommen, 2000). Public firms venture into innovations which require a chunk of resources to investigate or research to bring out inventions which may be difficult for individuals or private organizations to undertake.

¹ OECD - Organization for Economic Co-operation and Development.

This study seeks to examine what drives public sector firms to innovate. As Bell (2009) pointed out, any organization that intends to have a successful innovation must have a direction to serve as a guide and this would, in turn, lead to successful innovation. The direction might be influenced by many factors such as management and employees (internal drivers), political processes (mandated changes in the budget for organization and change in political direction), policy direction (legal framework or regulation), public organization, business (suppliers and clients/users), and citizens.

Innovation drivers are external or internal forces that motivate organizations to innovate. The first driver, employee's ability to innovate plays a vital role for public sector firm to be more innovative. According to Katz (1964, pp. 132): "an organization that depends solely upon its blueprints of prescribed behavior is a very fragile social system". The era of rigidly defined work has reduced drastically and has become more of knowledge-based. Innovative employees can help in generating new ideas which can be used as a foundation for innovation activities. Also, previous studies showed that employees innovative behavior depends on their interaction with co-workers (Anderson et al., 2004; Zhou and Shalley, 2003; Jeroen and Deanne, 2007). Moreover, management has several means of influencing their employees' behavior such as support for innovation, recognition, financial and non-financial reward, allocation of time and resources to innovation (Yukl, 2002).

The second driver, innovative activities can be motivated by political processes. This might happen because each political party needs the votes and support of their people. In order to achieve this, they need to show they are better than the opposition party, so the provision of public goods might be an important avenue to showcase their performance. For instance, mandated changes in the budget for the public organization. The third driver, legal framework or regulations are the possible instruments used for innovation policy. Therefore, providing a regulatory framework with the aim of promoting innovation are becoming more crucial in different countries. For instance, social regulation such as environmental protection is drafted for the protection of the environment, health, and safety of citizens. Also, institutional regulation such as employment protection also gives employees a sense of belonging and might influence perception on innovation. (Knut, 2012). The fourth driver, a public organization might also drive innovation activities because one organization innovativeness might influence others to invest in research and development.

Finally, business (suppliers and clients/users) and citizens might be a driving force to innovation activities by providing feedback and complaints to the public organization. For instance, new software was developed after receiving complaints from researchers due to security risk affecting Estonian ID cards issued since October 2014 (RIA, 2017)². Though, the above-mentioned drivers have been studied in Nordic countries, it would be of interest to know if the same is applicable in Estonia. Estonia has been one of the most successful country formally controlled by communist and the first country in the world to issue e-residency status to non-Estonians living around the globe which can be used to access electronic services, such as initiating and operating business. Therefore, with all the remarkable innovative achievements, understanding the driving force behind their innovation activities would be of great importance. To identify which of the drivers contribute to public firms' innovation, we need to understand the reason behind their innovativeness which brings us to the first question. After identifying the objectives, then we must know what types of innovations are used to achieve these objectives. The last question is about the challenges encountered during the implementation of innovation activities.

Innovation objectives can be viewed as the reason or purpose of carrying out innovative activities. The question of the objectives of public firms' innovation is essential in determining achievements and success in innovation activities (Hodge and McCallum, 2017). Bloch (2011) studied the objectives of public organization innovation of Nordic countries³ along key indicators and concluded that improved efficiency, quality of goods and services and user satisfaction were the most common identified objectives of public sector innovation activities among these countries. Additionally, the studies also revealed that objectives, like addressing social challenges, fulfilling new regulations, and improving working conditions, were found to be more informative and provided greater opportunity to distinguish different types of innovators.

On types of innovation, Gault (2018) identified different innovations such as service innovation, service delivery innovation, administrative or organizational innovation, policy innovation, and systemic innovation. Additionally, Bloch (2011) and De Vries, Bekkers, and Tummers (2014) have also outlined different types of innovation in their studies.

² RIA – Republic of Estonian Information System Authority.

³ Nordic countries are: Denmark, Finland, Iceland, Norway, and Sweden.

Public firm innovation faces huge activities and implementation challenges. This can be due to several reasons from management structure, operational structures, public policy regulation restrictions, budgetary cuts, government policy directions. Moussa et al (2018) outlined different barriers in their study such as lack of problem-solving skills, resistance to change and short-term budgets as the major factors that impede innovation in the public organization. It was also revealed that the most important factor hindering innovation in the public firms is risk aversion, especially where the firms have had a bad innovation project experience (Koch et al., 2006; Koch and Hauknes, 2005). This is because public funds need to be protected and accounted for.

The author observed that most of these studies above were conducted in the Nordic countries and as such, there is little evidence from the Eastern and Central Europe perspective. However, the Nordic countries have been stable in terms of governance but the study area which is Estonia is a transitional country that gained stable governance almost 28 years ago. Also, Estonia is currently one of the leading countries in terms of E-governance. The government has invested so much in innovation to improve the public sector and has also laid the foundation for private organizations to build on. Therefore, studying Estonia might bring out different or similar results as compared to developed Nordic countries that have been studied. Also, OECD and EU have also stressed the need to understand innovation in the public sector (Bloch and Bugge, 2013). This study would, therefore, be unique by unveiling factors that drive innovation in Estonian public-sector firms.

The data used in this study was collected through questionnaire from various public sector firms' employees and management in Estonia. The questionnaire was sent to one or more employees from each public firm to gather different opinions on innovation. Since the data was self-reporting, thus it reflects subjective opinion and we have chosen to analyze it using a Logit model. The result from the models show that the most associated drivers to innovation activities are internal drives, public organizations, and political driving forces.

The study has been organized into five sections. The first section gives an overview of the background to the study and the key objectives of the research. The second section also examines the relevant theories from both an appreciative inquiry and provides relevant information about the work done in the same field of study. The third section gives an account on the methodology which spelled out the collection and organization of the data. The fourth section involves the

analysis of the data as well as the interpretation of the findings. The last section gives the conclusion, limitation, and recommendation of the study.

2. LITERATURE REVIEW

According to APSII (2011, pp. 4),⁴ “Public sector innovation is defined as the implementation of a significant change in the way an entity operates in the products it provides. Thus, Innovation comprises new or significant changes to products, operational processes, organizational methods, or the way an entity communicates with users”. APSII explains that innovation is crucial for policy formulation and delivery of public goods and services and that the policy environment today is complex, volatile and sophisticated, and requires innovative approaches to adequately address them (see APSII, 2011). However, innovation is almost synonymous with the private sector rather than public sector firms and this stems from the perception that the public-sector firms are only responsible for providing the regulatory framework to enable innovation in the private sector to thrive (Bloch & Bugge, 2013).

Innovation is defined by Gault (2018) as the implementation of a new or significant improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. That is, for an activity to be qualified as an innovation, the said thing must be new to the organization or to the market and if the thing is already existing, there must be clear improvement or enhancement in the characteristics of the old version to the new version. Similarly, innovation in the public sector is also defined by Mulgan (2007) as new ideas that work at creating value followed by a qualification of ideas (Bloch & Bugge, 2013). In general terms, innovation in public or private sector firms can be categorized into radical or incremental. Radical innovation refers to introducing something novel or new while the incremental innovation basically talks about improving or enhancing an existing product. Innovation activities are all activities (be it scientific, technological, organizational, financial and commercial) conducted within or outside the organization which actually, or are intended to, lead to the implementation of innovations (OECD, 2005; Bloch, 2011).

⁴ The Australian Public Sector Innovation Indicators.

From the literature, different authors have outlined different types of innovation in the public sector. Table 1 below displays the authors and their classifications of innovation in the public sector.

Table 1: Types of Public Sector Innovation used by different authors.

Author(s)	Types of Innovation
Bloch (2011)	Product innovation, product innovation new compared to others, process innovation, process innovation new compared to others, product-process innovation, organizational, and communication innovation
Gault (2018)	Services innovation, service delivery innovation, administrative or organizational innovation, policy innovation, and systemic innovation
Koch & Hauknes (2005)	Process, service, administrative, system, conceptual, and radical innovation
De Vries, Bekkers, & Tummers (2014)	Process innovation, product or service innovation, governance innovation, and conceptual innovation.
Halvorsen et al. (2005)	Process innovation, administrative innovation, system innovation, conceptual innovation, radical innovation and a new or improved service innovation.

source: compiled by author

As pointed out earlier, this study seeks to understand the factors that drive innovation in the public sector firms. Factors that drive innovation are basically factors that motivate public sector firms to innovate. Understanding this foundation of innovation in the public sector would help to understand the objectives that innovation would achieve. Again, different authors have outlined

different factors that serve as the antecedent for innovation in the public sector. For instance, DeVries (2014) indicated that external environmental factors (political mandates), organizational factors such as structural and cultural features of an organization, innovation level such as intrinsic attributes of an innovation (e.g. complexity of the innovation), and individual/employee level such as the characteristics of individuals who innovate (e.g. empowerment). Similarly, Bloch and Bugge (2013) also outlined the following as the major factors that serve as the genesis for innovation: internal drivers (by management and employees), political driving forces, public organizations, business (suppliers and users), and citizens.

In addition, Bugge et al. (2011) listed internal drivers, political drivers, and business as factors that serve as the foundation for innovation in the public sector. Halvorsen et al. (2005) categorized factors that motivate innovation into push and pull factors. The author listed these factors as accounting for push factors of innovation: policies and political targets, popular opinion, international agreements, laws, regulations and standards, technological and scientific developments and other societal developments. Among the pull factors, the following were listed: user needs and preferences, organizational overstretch or frustration with the status quo, lobbyist, and technological interdependencies.

Last but not the least, Koch and Hauknes (2005) also outlined problem-oriented drivers, non-problem-oriented improvement, political push, the growth of a culture of review, support mechanisms for innovation, capacity for innovation, competitive drivers, and technological factors as factors that propel innovation. Finally, Bloch (2011) mentioned the following as the major factors that influence innovation in the public sector: internal driving forces (by employees and management), political forces (mandated changes in budget for organization, change in political direction and deregulation), public organizations, enterprises (suppliers, clients/users) and citizens (clients/users).

The study is also interested in unearthing objectives on why public sector firms innovate. This essentially talks about the end results of innovation or outcome of innovation. Like the drivers, available literature indicates that different authors have identified different reasons why public firms innovate. Bloch and Bugge (2013) and Bloch (2011) identified addressing social needs challenges, fulfilling new regulations, increasing efficiency, improving quality of goods and

services, improving user satisfaction, improving online services and improving working conditions as the main outcome of innovation. For instance, the Estonian identification card which has multipurpose usage enhances efficiency because it enables users to sign documents, make bank transactions and access hospital facilities just to mention a few. In other words, users can stay in the comfort of their homes or offices and undertake transactions without any stress (Alender 2018). Similarly, De Vries et al (2014) also pointed out that outcomes of public sector innovation are increasing effectiveness, increasing efficiency, tackling societal problems (e.g. addressing unemployment), increasing customer satisfaction, involving citizens and private partners. Again, no study was seen on why public-sector firms innovate in Estonia and this study intends to fill the gap. Already, De Vries et al (2014) have established a relationship between innovation types (process innovation, product or service innovation, governance innovation, and conceptual innovation) and outcomes of innovation (effectiveness, efficiency, involving citizens, involving private partners and customers satisfaction).

The third critical area that this study intends to cover is the type of innovation that could be employed to achieve the objective of innovation. In the current study, we consider the following four basic kinds of innovation. These are product innovation, process innovation, organizational/administrative innovation and communication innovation/market innovation (Bugge et al, 2011). Bugge et al (2011) defined product innovation as the introduction of service or good that is new or significantly improved compared to the existing services or goods in your organizations. Valkama, Bailey, and Anttiroiko, (2013) indicated that organizational/administrative innovation is fundamentally adapting new organizational forms as well as introducing changes in the governance relationship. They ensure new structures are adapted to suit the kind of product or service they intend to implement.

Windrum (2008) explained service innovation as the introduction of a new product or enhancement in the quality of an existing service or product offered by an organization. Finally, communication innovation or market innovation is the implementation of a new method of promoting the organization or its services and goods or new methods to influence the behavior of individuals (Bugge et al, 2011). In this study, we consider the following kind of innovation: Policy, administrative, and conceptual innovation. Windrum (2008) explained that policy innovations are

the changes to the thought or behavioral intentions associated with a policy belief system. The underlying assumption under the policy innovation concept is similar to the administrative/organizational innovation because the essence is to improve on existing structures or rules. Sometimes, the government implements a certain policy to protect consumers, thus, certain policies are implemented by the government to ensure that consumers get the best from their innovators.

Another key innovation is conceptual innovation and it is defined by Windrum (2008) as the development of new worldviews that challenge assumptions which underpin existing service products, processes, and organizational forms. Bloch & Bugge (2013) defined service delivery innovation as new ways of delivering services to and interacting with the users. Finally, systemic innovation is defined as the involvement of new or improved channels of relating with other organizations and knowledge bases (Bloch & Bugge, 2013).

It is important to point out that, even though the countries studied by Bloch & Bugge (2013) have some similarities with Estonia such as Finland, the researcher strongly believed that different results may be obtained from the Estonian public sector firms due to differences in culture and technology (Afonso, Schuknecht & Tanzi, 2005). This study adopts the drivers employed by Bloch & Bugge (2013) to examine what drives innovation in the public-sector firms in Estonia: internal drive (by employees and management), political process (new political directions), policy direction (legal framework and regulations), public organizations, businesses (as suppliers and as clients/users), citizens - clients / users (i.e. feedback, complaints; influence from associations).

The final aim of the study seeks to examine barriers that hinder smooth innovation activities in public-sector firms. Every positive step certainly has some negative factors that could withhold the fulfillment of a positive plan if not curtailed timely. Thus, organizations are human institutions and obviously have some weaknesses that could prevent the successful implementation of innovation in the public sector. These barriers may arise due to several reasons like management structure, operational structures, public policy regulation restrictions, budgetary cuts, government policy directions. Barriers are the problems that derail innovation in the public sector (Rainey et

al., 1995; Wise, 1999). Thus, the organization could have very good ideas but may fail to implement it due to some challenges.

A study by Bloch (2011) revealed the following as barriers to public sector innovations: procurement challenges (suppliers), user challenges, political barriers, policy challenges, political factors, budgetary cuts, and incentive structures (rules and regulations and innovation framework) were identified as barriers in most countries surveyed. The other examples of the barriers to public sector innovation include new policies, regulations or policy orientations, and changes implemented at a higher level of government that directly has an impact on organizations at lower levels (Bloch, 2011). Similarly, Kattel et al (2013) also added political factors which includes organizations (lack of flexibility in laws and regulations, lack of incentives for organization as a whole to be innovative, lack of budgetary funding) and culture (risk of failure, lack of cooperation within the organization), other internal conditions (inadequate time allocated to innovation, lack of incentives for staff to innovate), and external conditions (contractual rules hinder collaboration with suppliers, lack of main suppliers' capability to provide innovative solutions, resistance of users to changes).

Golembiewski & Vigoda, (2000) pointed out that successful innovations do not flourish in the traditional and old bureaucratic model, which means public organizations often restrain ideas that can promote innovation due to a long process that the said idea must undergo before permission is granted and this discourage employees from coming up with new ideas.

In addition, many authors (Moussa et al, 2018; Mulgan & Albury, 2003; Matthews, 2009; Vigoda-Gadot 2003a; Manimala, Jose & Thomas, 2006; Bloch & Bugge 2013; Halvorsen et al., 2005; Koch and Hauknes, 2005) have acknowledged barriers in the public-sector organization as the major problem that inhibits innovation in the public sector. In this study, the following barriers were assessed: lack of flexibility in laws, the risk of technological failure, regulatory framework, insufficient funds, lack of skills and development, external rules and regulations. *Table 2* below shows opinions of different scholars on drivers, objectives, types of innovation and key findings addressed by them. Their choice of drivers and innovation types was based on their studies and several factors such as cultural norms, social rules, and technical standard.

Table 2: Objectives, Innovation type, Drivers and Key finding by different authors.

Author	Objectives	Country under study	Types of Innovation	Drivers	Key Findings
Bloch (2011)	To develop a measurement framework for collecting internationally comparable data on innovation in the public sector.	Denmark Finland Iceland Norway Sweden.	Product Product innovation new compared to others Process innovation Process innovation new compared to others Product-process Organizational Communication	Internal driving forces (Management & Staff) Political forces Public organizations Enterprises Citizens - As clients / users (i.e. feedback, complaints; influence from associations)	The most common objectives of public firms are to improved efficiency, quality of goods and services, and user satisfaction. Bureaucracy and detailed regulation may also hinder innovation. Lack of incentive to innovate for both management and staff might as well hinder innovative activities.
Bloch & Bugge (2013)	To shed light on the measurement framework on innovation process in public sector firm.	Denmark Finland Iceland Norway Sweden UK	Product Product innovation new compared to others Process innovation Process innovation new compared to others Product-process Organizational Communication	Internal-management, Internal-staff, Political driving forces, Public organization, Businesses (suppliers, users), Citizens.	The most important barriers to innovation are lack of funding, inadequate time and lack of internal incentives. Risk aversion does not seem to be a great barrier to innovation. Internal drivers (management and staff) and political drivers were cited as the most important factor for innovative activities.

Vickers, Lyon, Sepulveda, McMullin, 2017	To find out how different logics are combined in the activities of innovating hybrid organizations.	United Kingdom	Organizational (excluding SE form –common to all cases, Improvements to existing services/system, New services and treatments, Outreach/marketing	NA	Social innovation was found to be related to key stakeholders such as public sector funders services and service delivery partners.
Demircioglu & Audretsch 2017	Examine the likelihood of innovative activity in the public sector.	Australia	Service, Organizational, Administration and Product.	Internal (employee and management)	Internal factor such as experimentation and motivation to make improvement in the public sector are strongly associated with innovation which is consistent with self-determination theory which suggested that individual behaviors should be self-motivated and self-determined. Organizations' concerns for employees' wellbeing and health can affect employees' perceptions of reforms and innovations. Budget cut does not affect the likelihood of innovation activity. Increased barrier to innovation is the highest and statistically most significant predictor of innovative activity.
Bommert, B. (2010).	To investigate whether collaborative innovation is a suitable new form of public sector innovation.	United Kingdom	Collaborative innovation	NA	The paper illustrates capacities, which government needs to develop to successfully implement collaborative innovation.

source: compiled by the author.

Bloch (2011) sampled views of 1970 employees from five Nordic countries (Denmark, Finland, Iceland, Norway, Sweden). Similarly, Demircioglu & Audretsch (2017) sampled 21,093 employees from the Australian Public Service Commission and Vickers et al (2017) also interviewed 88 individuals from England across eight cases. On other hand, Bloch & Bugge (2013) study was built on the work of existing data by MEPIN project (Measuring Public Innovation in the Nordic Countries). All the studies listed above employed empirical data in their analysis. Bloch (2011); Demircioglu & Audretsch (2017); Vickers et al (2017) used primary data while Bloch & Bugge (2013) used secondary data in their analysis. Bloch & Bugge (2013) acknowledged that the main objective of the public firms is to improve efficiency, quality and user satisfaction while Demircioglu & Audretsch (2017) agreed that organizations' concern for employees' well-being and health can affect employees' perceptions of reforms and innovation. Moreover, Demircioglu & Audretsch (2017) suggested that budget cut does not affect the likelihood of innovation activity while Bloch (2011) supported that bureaucracy and detailed regulation may also hinder innovation. Bloch & Bugge (2013) and Demircioglu & Audretsch (2017) agreed that internal factor plays a key role in driving organizations innovative activities.

3. Methods and data.

The study has employed a survey design to sample employees from the Estonian public sector firms. Employees of different public sector firms were surveyed because of diversity in views and opinions and the need to analyze the organization-level issues. According to Neuman (2009), sample sizes should be chosen with the population under study in mind. Sampling techniques provide the framework for selecting the right entities or respondents and variables for the study. The questionnaire was the instrument used for data collection. The questionnaire was employed because studies on the related topic conducted in other countries are more of qualitative analysis (Bloch 2011; Bloch & Bugge 2013) with different findings and not enough quantitative analysis. The questionnaire was designed by the author based on previous studies on the topic of public sector innovation (Bloch 2011; Demircioglu & Audretsch, 2017). The questions on the selected variables were on a five-point Likert scale with the following answer choices: Strongly Agreed; Agreed, Disagreed, Strongly Disagreed and Undecided/Neutral. The opened and closed responses part of the questionnaires allowed the respondents to choose from the list provided or to fill in the answers with their own text.

The items in the questionnaire were based solely on public sector innovation: innovation objectives, innovation activities, sources of innovation investment, innovation implementation challenges and barriers. The first part of the questionnaire fetched information about the respondent, the second part is based on why public firms innovate and what drives the public firms to innovate while the third part is on the types of innovation and the last part is on barriers and challenges of implementing innovation activities. The questionnaire was submitted to 420 employees (respondent) of various public sector firms electronically via e-mail - The response rate was 26.90% (113 employees responded). According to OECD (2012), the number of employees in Estonia public sector firms (central government) is 16045, therefore our sample only covers 0.7% of the total employees' population. Meaning that the outcome should not be viewed as benchmarking and overinterpretation of the results from this study should be avoided.

The dependent variable in the econometric analysis is the dummy variable for whether the firms innovate or not. The determining factors of that were analyzed using a Logit model because our dependent variable is dichotomous and having a categorical outcome variable violates the assumption of linearity in normal regression. Also, a Logit model is used to show how significantly independent variables are correlated with the dependent variables.

The independent variables in this study form the following groups: innovation drivers, innovation aims, types of innovation and challenges and barrier of implementing innovation activities. The logistic regression model as illustrated by Maja et al. (2004) is as follows:

$$\ln \left(\frac{p(x)}{1-p(x)} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i$$

Equating the expression above as y :

$$y = \ln \left(\frac{p(x)}{1-p(x)} \right) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i$$

$$p(x) = \frac{e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)}}{e^{(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)} + 1} = \frac{e^y}{e^y + 1}$$

Note that $p(x)$ is interpreted as the probability that the dependent variable equals been innovative or not.

Interpretation of terms.

- y denotes the logistic regression expression
- $p(x)$ is the estimated probability of public sector firms being innovative given the independent variables.
- β_o is the intercept from the logistic regression equation (the value of the criterion when the predictor is equal to zero).
- $\beta_i x_i$ is the regression coefficient multiplied by value of the independent variable where $i = 1, 2, 3, \dots$
- Base e denotes the exponential function.

The four models that was analyzed to show how significantly independent variable is associated with the dependent variable are discussed below:

In the first model, we assess which objectives are most significant for public sector firms engaging in innovation. A simple method to assess the significance of the various objectives for innovating firms is to run a logistic regression of the binary outcome that takes value 1 if the firm decides to innovate and 0 otherwise on the reported objectives. The objectives or the reasons for innovating, considered in this paper are: (1) addressing social needs and challenges (Health problems and inequalities), (2) fulfilling government regulations (policies or politically mandated changes), (3) reduce regional disparities, (4) improving working conditions of employees, (5) increasing efficiency in output delivery (costs per service/good), (6) improving user satisfaction and improving environmental services. Each of the above-mentioned objectives takes the value on a five-point Likert scale with the following answer choices: Strongly Agreed, Agreed, Disagreed, Strongly Disagreed, and Undecided/Neutral. Some of the innovation objectives considered here have also been studied in Bloch (2011).

The second model assess which innovation types are most significant for public sector firm engaging in innovation. Logit regression of the binary outcome that takes 1 if the firm decides to innovate and 0 if otherwise is run to assess the significance of various innovation types. The innovation types considered in this paper are (1) service innovation, (2) administrative innovation, (3) organization innovation, (4) conceptual innovation, (5) systemic innovation, (6) policy innovation, and product innovation. The above-mentioned innovation types are alternatives

provided in the questionnaire for the respondent to choose from the list. Some of the innovation types considered here have also been studied by different authors (see Table 1).

In the third model, we assess which innovation drivers are most significant for public sector firms engaging in innovation. A simple method to assess the significance of the various drivers for innovating firms is to run a logistic regression of the binary outcome that takes value 1 if the firm decides to innovate and 0 otherwise on the reported drivers. The drivers considered in this paper are: (1) internal drives (management and employees), (2) political processes (mandated changes in budget for organization and change in political direction etc.), (3) policy direction (legal framework and regulation), (4) public organizations (other organizations), (5) businesses (suppliers and users) and citizens - As clients / users (i.e. feedback, complaints; influence from associations). The above-mentioned innovation drivers are open alternatives provided in the questionnaire for the respondent to choose from the list. Some of the innovation drivers considered here have also been studied in DeVries (2014), Halvorsen et al. (2005) and Bloch and Bugge (2013).

The fourth model assess which innovation barriers are most significant for public sector firms engaging in innovation. Logit regression of the binary outcome that takes 1 if the firm decides to innovate and 0 if otherwise is run to assess the significance of various innovation barriers. The innovation barriers considered in this paper are (1) lack of flexibility in law (2) external rules and regulations, (3) insufficient fund, (4) regulatory framework, (5) lack of skills and development and risk of technological failure. Each of the above-mentioned barriers takes the value on a five-point Likert scale with the following answer choices: Strongly Agreed, Agreed, Disagreed, Strongly Agreed, and Undecided/Neutral. Some of the innovation barriers listed above have also been studied in Kattel et al (2013) and Moussa et al., (2018).

The type of organizations also influences the innovative activities (Wise, 1999), for example, a firm that deals with service delivery will focus on innovation to improve their service and interaction with people (Borins, 1998; Vigoda-Gadot, 2009; Laegreid et al., 2011; Wynen et al., 2014). Therefore, types of organizations are accounted for by the set of their respective dummy variables. All the models listed above were estimated with a set of dummy variables and without a set of dummy variables. The dummy variable is introduced to eliminate the influence of organizations with higher respondents over others. Hence to minimize the likely biasness. The

respondent's work location and employment may have a bearing in his/her response to the question and have to be controlled for.

Appendix 1 shows the descriptive statistics of the variable used in the analysis. The employment status shows 64.6% of the respondents indicated they were full-time employees while 35.4% were part-time employees. This demographic information is similar to what Demircioglu and Audretsch (2017) reported in their study. Their sample consisted of 87% full-time employees. This indicates that majority of the respondents were full-time employees and it is good for this study because it is expected that full-time workers would have access to more information regarding the steps taken by the firm in the context of innovation. The analysis showed that 75.2% of the employees work at the capital city (Tallinn) while 24.8% work in the other cities of Estonia. That information is relevant as the location of firms also plays important role in innovativeness and acceptance of reform (Fernandez and Wise, 2010; Nasi et al., 2011). The analysis shows that 66.3% of the respondents used service innovation, 41.5% and 46% used administrative and organizational innovation respectively while 28.3% used conceptual innovation. Also, 32.7% indicated they used policy innovation and 34.5% used systemic innovation while 23% indicated they used product innovation. Some of the innovation types listed above were also analyzed by Bloch & Bugge (2013) and they found that the share of product innovation ranges from 38% in Sweden to 72% in Iceland, product-process innovation ranging from 65% in Finland to 84% in Denmark, organization innovation ranging from 50% in Sweden to 80% in Iceland and communication innovation from 40% in Finland to 88% in Iceland. The results obtained in this study shows that the share of organization innovation in Estonia and Sweden are quite similar.

Table 3 below shows the firms from which we received responses to the questionnaire in various sectors of the socio-economic structure (environment, economic affairs, and communication, social affairs, rural affairs, justice, and finance). The survey showed that 4.6% of the respondents have spent less than one year with their firm while 74.3% have spent between one to five years. Remaining respondents (21.1%) have spent five years and above. From the results, the majority of the respondents had been with the organization for one to five years and Daveri and Parisi (2010) pointed out that the more years employees spend with an organization, the more experience they become and this in turn influence innovation activities positively because most of the respondents might have been involved in organization innovation activities.

Also, 19.3% of the respondent are from administrative department, 12.8% are from research and development, 11.9% are from the quality control department, 11% are from sales and marketing department, 5.5% are from the finance department, 4.60% are from production department, 6.4% are from the information technology department while 28.4% does not specify their departments.

Table 3: Ministries, public sector firms and number of respondents from each firm.

Ministries	Public sector firm (In Estonian)	Public sector firm (In English)	Number of respondents
Ministry of the Environment	AS Eesti Kaardikeskus	Estonian Map Centre Ltd	7
Ministry of Economic Affairs and Communications	AS EVR Cargo	EVR Cargo Ltd	6
Ministry of Social Affairs	AS Hoolekandeteenused	Welfare Service Ltd	13
Ministry of Economic Affairs and Communications	AS Tallinna Sadam	Port of Tallinn Ltd	1
Ministry of Rural Affairs	AS Vireen	Vireen Ltd	4
Ministry of the Environment	Eesti Keskkonnauuringute Keskus OÜ	Estonian Environmental Research Centre	7
Ministry of Justice	AS Eesti Vanglatööstus	Estonian Prison Industrial Ltd	4
Ministry of Finance	AS Elering	Elering Ltd	7
Ministry of Economic Affairs and Communications	AS Eesti Liinirongid	Estonian Rail-Trains Ltd	6
Ministry of Economic Affairs and Communications	AS Metrosert	Metrosert Ltd	6
Ministry of Economic Affairs and Communications	AS Eesti Post (Omniva)	Estonian Post Ltd	10
Ministry of Finance	AS Riigi Kinnisvara	State Real Estate Ltd	5
Ministry of Economic Affairs and Communications	AS Tallinna Lennujaam	Tallinn Airport Ltd	5
Ministry of Economic Affairs and Communications	AS Teede Tehnokeskus	Technical Centre of Estonian Roads Administration	8
Ministry of Finance	AS Eesti Energia	Estonian Energy Ltd	5
Ministry of Economic Affairs and Communications	AS Kredex Krediidikindlustus	KredEx Credit Insurance Ltd	3
Ministry of Rural Affairs	Eesti Põllumajandusloomade Jõudluskontrolli AS	Estonian Livestock Performance Recording Ltd	5
Ministry of Economic Affairs and Communications	AS Saarte Liinid	Island Lines Ltd	7
	teised	Others	4
			113

source: compiled by the author.

4. Results and Interpretation

This section presents the analysis and interpretation of data obtained from the respondents of different public sector firms. The main idea of the research is to investigate what drives innovation in public firms. The dependent variable in this study is the dummy variable for the firm being innovative (do you innovate or not), Thus, it captures whether the public firm has implemented any innovation activities for the past three years or not. Among all the respondents 80.5% choose “yes” which might indicate rather higher level of innovative activity in the Estonian public sector firms. The study employed logistics regression to analyze the data. however, before logistic regression was conducted, a preliminary analysis was conducted with VIF to check for multicollinearity. the result obtained was between 1.90 and 4.59, thus it can be concluded that multicollinearity symptoms do not seem to affect the results. According to Demircioglu and Audretsch (2017) multicollinearity problem does not threaten the validity of models if the VIF score is less than 10.

From the AIC criterion, the model with the dummy variables was more preferable than the model without the dummy variables because the AIC value in the model without a set of dummies was smaller as compared to the other. Additionally, the pseudo-R-squared in the model with a set of dummies had a higher value than the other.

The results in Table 4 shows the outcome of the logistic regression to assess the objectives of public sector innovation, i.e. why do public sector firms innovate. Most of the independent variables are statistically insignificant except improve working condition of employees and increase efficiency in output delivery which was significant in both models i.e. the intention to improve working condition of employees and increase efficiency in output delivery was statistically significantly associated with the firm being innovative.

Table 4: Innovation objectives

Variables	Model without organization dummies	Model with organization dummies	Marginal effect without organization dummies	Marginal effect with organization dummies
Addressing social needs challenges	-0.387 (0.783)	-1.106 (0.800)	-0.0098	--0.0169
Government regulation	1.735 (0.110)	2.893 (0.193)	0.0440	0.0442

Regional disparity	0.105 (0.933)	0.559 (0.775)	0.0027	0.0085
Improve working condition	1.217** (0.040)	7.293** (0.048)	0.0309	0.1110
User satisfaction	-0.055 (0.948)	-1.338 (0.407)	-0.0014	-0.0204
Improve environmental service	-1.069 (0.433)	-4.401 (0.191)	-0.0271	-0.0672
Efficiency in output delivery	2.032** (0.047)	3.239** (0.048)	0.0516	0.0495
Employment status	1.885 (0.061)	2.045 (0.071)	0.0742	0.0858
Work location	1.020 (0.030)	1.509 (0.058)	0.0227	0.0534
Constant	-8.993**	-9.525**	-	-
Log-likelihood model	-10.514	-5.891	-	-
chi2	25.88	35.12	-	-
Aic	37.03	31.78	-	-
Bic	58.85	59.06	-	-
pr2	0.552	0.749	-	-

standard error in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Improved working condition and increased efficiency in output delivery are broad objectives identified by the respondents. The marginal effects of improving working conditions of employees are higher compared to increased efficiency in output delivery. The above-mentioned objectives were also analyzed by Bloch (2011) and concluded that the most common objectives of public firms are to increase efficiency, improve quality of goods and services, and improve user satisfaction. The possible explanation for this positive association might be that when employees are satisfied with their jobs, they become emotionally attached to it and sought for ways to assist the firms to survive and this, in turn, causes them to think and bring out more innovative ideas to make the firm more competitive.

Though the types of innovation implemented by each firm are based on the objectives of the firms, this study also checked the most preferred innovation types used by the Estonian public firms to achieve their objectives. The study found that service, administrative, organizational and product innovation was statistically significantly associated with the firm's implementation of innovative activities. Service innovation had the highest marginal effect among other types of innovation. This findings support the view by Sheehan (2006) who emphasizes that service innovation has

emerged as the main source of job creation and improved organizations' performance (see Table 5).

Table 5: Types of innovation.

Variables	Model without organization dummies	Model with organization dummies	Marginal effect without organization dummies	Marginal effect with organization dummies
Service	0.155*** (0.001)	0.169*** (0.005)	0.1450	0.1465
Administrative	0.055** (0.025)	0.046** (0.041)	0.0751	0.0951
Organizational	0.039** (0.028)	0.041** (0.024)	0.1091	0.1134
Conceptual	-0.0089 (0.579)	-0.0056 (0.731)	-0.0279	-0.0147
Systemic	-0.015 (0.182)	-0.025 (0.186)	0.0569	0.0485
Policy	0.007 (0.498)	0.006 (0.568)	-0.0690	-0.0739
Product	0.006** (0.046)	0.005** (0.045)	0.0161	0.0270
Constant	0.790***	0.733***	-	-
Log-likelihood model	-4.498	-1.909	-	-
chi2	37.91	43.08	-	-
Aic	21.68	20.08	-	-
Bic	0.138	7.199	-	-
pr2	0.808	0.910	-	-

standard error in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Also, the analysis was carried out to show the association between the firm being innovative and the innovation drivers. The most significant drivers of innovation are internal drives (management and employees) and public organization. And that for the firms that do not innovate or innovate less, the political process is a significant driver of innovation. The marginal effect of internal drives is higher than that of public organization and political processes (see Table 6). From the results of Bloch and Bugge (2013) on the impact of internal actors on innovative activities. They established that 80 % of the respondents choose management while 70% choose internal staff as drivers of innovation. Also, 60% of the organization acknowledge political driver as one of the important drivers of their innovative activities. Comparing the results of Bloch and Bugge (2013) with the current study shows that Estonian public sector innovation thrives more on internal drivers (94.6%,

see Appendix 1) while public sector innovation in the Nordics thrives more on internal factors and political driver.

Table 6: Innovation drivers

Variables	Model without organization dummies	Model with organization dummies	Marginal effect without organization dummies	Marginal effect with organization dummies
Internal drivers	0.674*** (0.000)	0.696*** (0.000)	0.0263	0.0272
Political processes	-0.029** (0.050)	-0.037** (0.039)	-0.0011	-0.0014
Policy direction	-0.008 (0.882)	-0.011 (0.839)	-0.0003	-0.0004
Public organization	0.079** (0.043)	0.091** (0.019)	0.0031	0.0036
Businesses	-0.048 (0.544)	-0.055 (0.447)	-0.0019	-0.0022
Citizen	-0.040 (0.369)	-0.063 (0.163)	-0.0018	-0.0025
Constant	0.327***	0.372***	-	-
Log-likelihood model	-14.997	-10.950	-	-
chi2	31.36	37.91	-	-
Aic	73.52	70.22	-	-
Bic	54.43	50.67	-	-
pr2	0.669	0.808	-	-

standard error in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7 below shows the outcome of the logistic regression that was performed to ascertain the importance of barriers – lack of flexibility in laws, risk of technology failure, insufficient fund, lack of skills and development, external rules and regulation and regulatory framework on the likelihood of innovative activities. The logistic regression model was statistically significant, Chi-square = 16.908, $p < 0.05$. Of the six predictor variables, only three were statistically significant in both models: lack of flexibility in laws, the risk of technological failure, and external rules and regulations. The most innovating firms find rigid laws and rigid external rules and regulations as the most significant barriers to innovation. Similarly, the firms that do not innovate or innovate less find technological failure as a significant barrier to innovation. The marginal effects of rigid laws are higher compared to the risk of technology failure and external rules and regulations.

Table 7: Barriers to Innovation.

Variables	Model without organization dummies	Model with organization dummies	Marginal effect without organization dummies	Marginal effect with organization dummies
Lack of flexibility in laws	1.224** (0.022)	2.045** (0.040)	0.0445	0.0631
Risk of technological failure	-0.410* (0.063)	-3.244* (0.104)	-0.0152	-0.100
Insufficient fund	-0.649 (0.511)	0.838 (0.659)	-0.0241	0.0259
Lack of Skills	-0.781 (0.279)	-1.206 (0.326)	-0.0290	-0.0372
External rules and regulations	0.922** (0.024)	2.912** (0.033)	0.0342	0.0899
Regulatory framework	1.662 (0.078)	5.625 (0.153)	0.0617	0.1740
Constant	-2.340	-7.254	-	-
Chi2	16.91	25.00	-	-
AIC	44.00	39.90	-	-
BIC	63.09	64.45	-	-
pr2	0.361	0.533	-	-

standard error in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The outcome reflects that having rigid laws is positively associated with innovative activities because there will be a laid down rules for the firms to follow. Bloch and Bugge (2013) acknowledge that the most important barriers are lack of funding, inadequate time and lack of internal incentives while risk was as well observed not to be an hinderance of public sector innovation. However, this study obtained a contrary finding as the risk of technological failure is a significant barrier to innovation. Moreover, Demircioglu and Audretsch (2017) pointed out that increased barriers to innovation are the highest and statistically most significant predictor of innovative activity because innovative employees are more likely to identify innovation in their organization, but the study did not specify the exact barriers they looked into. The positively associated barriers might be connected to employees innovative ability to provide ways of tackling those barriers while the negatively associated barriers might attribute to employees been risk-averse.

The study also explored models with dummy variables and models without dummy variables. These were added in order to improve our model specification, i.e. to capture organizational level

effects. The analysis revealed that the models with the organizations' dummy variables were preferred as compared to the models without the organizations' dummy variables. This finding is also supported by Demircioglu and Audretsch (2017) who also in his findings acknowledged that model with dummy variables are more preferred compared to the model without dummy variables.

Finally, the result obtained in Estonia as compared to Nordic countries might be as a result of transition period in Estonia which is less than one-third of a century ago. Also, Innovative achievement has taken a positive shape in Estonia public firms as a result of availability of e-voting, e-residency and e-government. Moreover, cultural values can also be responsible for our results because Estonia has been previously ruled by both Denmark and Sweden. Likewise, they share boarder and have linguistic ties with Finland.

5. Conclusion

The study was conducted to find out what drives innovation in Estonian public sector firms. The thesis was guided with four research questions. Focusing on drivers of innovation, objectives of innovation, types of innovation and barriers involved while implementing innovation activities in public firms. The study employed online survey to gather data from public sector firm employees in Estonia. The results were analyzed with the Logit model.

The analysis established that most public sector firms in Estonia innovate to address social needs and challenges, to fulfill government regulations, reducing regional disparities, increasing efficiency in output delivery, improve environmental service, improve employees' conditions and improve user satisfaction as indicated in the questionnaire. Among all these reasons for innovation, increasing efficiency in output delivery and improvement of working condition happens to be the most significant objectives. These were achieved through service, administrative, organizational, conceptual, policy, systemic and product innovation. Likewise, service, administration, organizational and product innovation are the most significant types of innovation compared to others which are - conceptual, policy and systemic innovation. Innovation is driven internally (employees, management and organizational strategies), political processes and public organization. Also, the analysis shows that the lack of flexibility in laws, external rules and

regulations and risk of technological failure are the most significant barriers that innovating firms face.

In comparison to other studies, public sector firms in Estonia thrive more on internal drive and public organizations, but less in political processes while the Nordic countries thrive more on internal and political drivers. Also, findings showed that Estonia and Sweden have similar share of organization innovation compared to other Nordic countries in the context of innovation. In addition, the main objectives of public sector firms in Estonia are increasing efficiency in output delivery and improvement of the working condition of employees while in Nordic countries are increased efficiency, improved quality of goods and services, as well as improved user satisfaction. Furthermore, findings showed that the most important barriers to innovation in Estonia public sector firms are lack of flexibility in laws, external rules and regulations, and risk of technological failure while in Nordic countries are lack of funding, inadequate time and lack of internal incentives. Also, risk seems not to be a hindrance to public sector innovation in Nordic countries while risk of technological failure is a significant barrier to innovation in Estonia public sector firms. Transitional period, Innovative achievement and cultural values might be the reasons for the result obtained in Estonia compared to Nordic countries.

The study is also subject to several limitations. First, the survey was used in gathering data on the various aspects of the public sector firm's innovation activities at one moment of time and thus its results do not provide evidence on causal relationships. The study employed self-reported answers collected with a questionnaire and there might be biasness on the part of the respondents.

Second, lack of measurement framework for innovation in the public-sector firms as compared to the private sector firms that have measurement framework such as the Community Innovation Survey (hereinafter CIS) questionnaire (Bloch and Bugge, 2013; Demircioglu and Audretsch, 2017). The author is of the opinion that a longitudinal study would have been a preferred method because one could follow specific firms over time to see what drives innovation and which type of innovation suites such drive for a specific period.

Third, the sample size of the study poses also limitations; the limited sample size was the result of the most respondents not submitting their answers. The response rate is 26.90%.

However, responses were obtained from distinct number of firms representing various parts of the public sector. Future studies should aim to use longitudinal study in their data collection because it would assist to know the process undertaken until innovation is complete and factors that drive it. Researchers should try to increase also the sample size and for that purpose data could be gathered from neighboring countries, in case of Estonia these are Latvia and Lithuania in particular, to see if similar results could be obtained. The outcome of the study does not cover the substantial share of the public sector firms' employees, so overinterpretation of the study results should be avoided and the outcome should not be viewed as benchmarking.

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Appendix 1:

Descriptive statistics.

Variable	Obs	Mean	Std.Dev.	Min	Max
Innovation	113	0.80531	0.397726	0	1
Social needs and challenges	113	3.964602	0.812065	1	5
Government restriction	113	3.80531	0.874831	1	5
Reduce regional disparity	113	3.80531	0.800205	1	5
Improved working condition	113	4.035398	0.800995	1	5
User satisfaction	111	3.882883	0.828347	1	5
Environmental service	113	4.035398	0.800995	1	5
Efficiency output delivery	113	4.115044	0.787766	1	5
Improved product	113	4.017699	0.79037	1	5
Access to learning & development	113	3.929204	0.787365	1	5
Service innovation	113	0.663717	0.474542	0	1
Administrative innovation	113	0.415929	0.495077	0	1
Organizational innovation	113	0.460177	0.500632	0	1
Conceptual innovation	113	0.283186	0.452553	0	1
Policy innovation	113	0.327434	0.471367	0	1
Systemic innovation	113	0.345133	0.477529	0	1
Product innovation	113	0.230089	0.422764	0	1
Internal source (revenue)	113	0.858407	0.350185	0	1
External fund (Government)	113	0.327434	0.471367	0	1
External fund (loan & credit)	113	0.115044	0.320497	0	1
International funding	113	0.424779	0.496511	0	1
Internal drives	113	0.946903	0.225226	0	1
Political processes	113	0.141593	0.350185	0	1
Policy direction	113	0.327434	0.471367	0	1
Public organization	113	0.150443	0.359097	0	1
Businesses	113	0.20354	0.404424	0	1
Citizen	113	0.415929	0.495077	0	1

Flexibility in law	113	3.566372	1.117044	1	5
Risk of technology failure	113	3.584071	1.178116	1	5
Insufficient fund	113	3.59292	1.169838	1	5
Lack of skills and development	113	3.690265	1.052884	1	5
External rules & regulations	113	3.566372	1.059617	1	5
Regulatory framework	113	3.610619	0.920342	1	5
Job duration	113	2.247788	0.750369	1	5
Employment status (Full time)	113	0.646018	0.480334	0	1
Work location (Tallinn)	113	0.752212	0.433651	0	1
Job types	113	4.920354	2.803511	1	8

Appendix 2: Definitions of Variables.

Innovation: “In the last three years, has your organization implemented any innovation activities?”
(1= Yes, 0 = No).

Aims of public firms to innovate

- a) My organization’s innovation strategies address the social needs and challenges. (1 = strongly disagree through 5= strongly agree).
- b) My organization’s innovation systems can fulfill the required government regulations. (1 = strongly disagree through 5= strongly agree).
- c) My organization’s innovation systems can fulfill the required government regulations. (1 = strongly disagree through 5= strongly agree)
- d) My organization’s innovation strategies have helped in reducing regional disparities. (1 = strongly disagree through 5= strongly agree)
- e) Innovative system of the organization has improved working conditions of the employee. (1 = strongly disagree through 5= strongly agree).
- f) There is an improved user satisfaction of our services due to adopted innovative strategies. (1 = strongly disagree through 5= strongly agree).

g) My organization's innovation strategies have increased efficiency in output delivery. (1 = strongly disagree through 5= strongly agree).

h) My organization's innovation strategies have improved environmental services. (1 = strongly disagree through 5= strongly agree).

Types of Innovation

a) Which of the following innovation processes is your organization undertaking? (1= service, 2= administrative, 3= organization, 4= Conceptual, 5= Policy, 6= Systemic, 7= Product

b) My organization is always seeking innovative ways to improve services/products. (1 = strongly disagree through 5= strongly agree).

c) My organization provides access to effective learning and development. (1 = strongly disagree through 5= strongly agree).

d) What are the sources of Innovative Investment? (1= internal fund (revenue), 2= external fund from government, 3= external fund (loan or credits), 4= international or foreign fund).

e) Who drives your organization's innovation activities? (1= internal drives (management, employees), 2= political processes (mandated changes in budget for organization and change in political direction), 3= policy direction (legal framework, regulation), 4= public organizations (other public organizations), 5= businesses (suppliers and users), 6= citizens - As clients / users (i.e. feedback, complaints; influence from associations)).

Barriers

a) Lack of flexibility in laws hinders the organization's innovation activities. (1 = strongly disagree through 5= strongly agree)

b) The organization has a regulatory framework for innovative activities and programs. (1 = strongly disagree through 5= strongly agree).

c) Risk of technological failure discourages innovation investments. (1 = strongly disagree through 5= strongly agree).

d) Insufficient funding prevents innovation activities. (1 = strongly disagree through 5= strongly agree)

e) Lack of skills and development hampers compliance with innovation and procedure. (1 = strongly disagree through 5= strongly agree).

f) External rules and regulations obstruct innovation development and implementation. (1 = strongly disagree through 5= strongly agree).

Demographics

What is your employment status? (1= full time, 0= part-time)

Where is your place of work located? (1= Tallinn, 0= outside Tallinn)

How many years have you been working with your organization? (1= < 1 year, 2= 1 – 5years, 3= 6 – 10 years, 4= 10 – 15 years, 5= 16 years & above).

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