

**LAPPEENRANTA UNIVERSITY OF TECHNOLOGY**

School of Business and Management

Master's Degree Program in Supply Management

Master's thesis 2017

**Reflecting innovative capabilities of SMEs through public procurement –  
empirical evidence from clean power generation**

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## **ABSTRACT**

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**Title:** Reflecting innovative capabilities of SMEs through public procurement – empirical evidence from clean power generation  
**Faculty:** School of Business and Management  
**Major** Master's Degree Programme in Supply Management  
**Year** 2017  
**Master's thesis:** Lappeenranta University of Technology, 109 pages, 35 figures, 8 tables  
**Examiners:** Professor Veli Matti Virolainen  
Timo Kivistö  
**Keywords:** Innovations, gas turbines, public procurement, public-private partnership, SME

The purpose of this research is to gain an understanding whether and how small- and medium-sized enterprises are able to reflect ability to bring innovations to market by bidding for public contracts. There are particular signs of feasibility of leveraging public procurement as an innovative policy tools, yet the up to date academic findings appear to be in fragmented state. At this point, establishing a link with SMEs, the core players in national innovation systems, is the cornerstone of the research. By investigating these aspects in the context of Finland encompassing gas turbines sector, the current thesis aims to outline concrete challenges prevailing in the field and suggest concise practices and steps both purchasing and supplying parties may benefit from. The study is organized qualitatively and consists of semi-structured interview with the case company, questionnaire and documentary analyses of tendering documentation.

The results confirm that SMEs can be innovative public suppliers, whereas various main typical barriers hindering an access to public contracts still persist. The nature of innovations in state procurement is rather vague and implicit, meaning an absence of academic concepts and, hence, requiring from companies an ability to identify market's maturity level in order to reflect their innovative capabilities. Inasmuch as bidding for smaller lots does not possess any significant challenges, restricted entry modes and high volume contracts can be overcome and secured by joint bids, sub-contracting options and enhanced public-private partnerships.

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## **List of abbreviations and key terms**

CHP – Combined Heat and Power

EMAT – Economically Most Advantageous Tender.

ESPD – European Single Procurement Document

GDP – Gross Domestic Product.

GHG – Greenhouse Gas Emissions. Greenhouse gases are the ones that trap heat in the atmosphere and affect the global warming. The list mainly includes carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). (US Environmental Protection Agency 2017).

PPI – Public Procurement of Innovation. “Public Procurement for Innovation” and “Innovative Public Procurement” are used as synonyms.

PPP – Public-Private Partnership

Procurement – the process of purchasing goods or services including the entire set of phases starting from the evaluation of their necessity and ending with a contract accomplishment (Lloyd and McClue 2004, 4 – 6; Rolfstam 2012, 3).

Public procurement – “the designated legal authority to advise, plan, obtain, deliver, and evaluate a government’s expenditures on goods and services that are used to fulfill stated objectives, obligations, and activities in pursuant of desired policy outcomes” (Prier and McCue 2009, 329).

Purchasing – acquiring required sources of supply and services (Lysons and Farrington 2006, 7 – 8). Used as synonym to “procurement”.

R&D – Research and Development.

SCM – Supply Chain Management.

SME – Small- and Medium-sized Enterprises.

SRPP – Socially Responsible Public Procurement.

Tendering – the process of obtainment products, services or work from external sources, including stages of planning, selecting, evaluating and purchasing (van Weele 2009, 35)

# 1 Introduction

## 1.1 Background and relevance of research

Over the course of history, the biggest pattern that can be traced up to ancient times and which has always been common to a mankind's nature is development. Exploring of yet unexplored and obscure phenomena and tempting to determine key variables behind have always been an essential trigger of the right path of progress. As the fear was replaced by curiosity, earlier human species dared to conquer and control the fire, which gave the life to all of the following advances.

As the time flew, systematization has become an inevitable part of amelioration. Similarly, the fulfillment of state and public needs could not be handled extemporaneously, leading to what is known nowadays as public procurement. The earliest evidences of the ancestor of public procurement can be found in the territory of Syria in a form of red clay tablet which can tentatively be dated from the time period between 2400 and 2800 B.C. The order was placed for "50 jars of fragrant smooth oil for 600 small weight in grain" (Coe 1989, 87). Since then, purchasing in public sector has had a long and saturated history, in which it transformed from what was viewed as clerical functions to one of the most significant state leverage.

In an increasingly competing business world we currently live in, organizations are constantly pursuing various ways of developing their essence. Whereas such rivalry is in the business nature, it has not ever been more crucial than during the latest tough financial times. The business improvement tools yet outline comprehensive methodology, which has been on the emerging stage for the last century (Snee 2010, 9) with its origin coming from the works of Frederick Taylor in 1911 (Snee 2004, 5). However, there are no silver bullets, and none of the tools can cut through the complexity and provide instantaneous solutions to sophisticated issues. Instead, the gradual and meticulous approach is required. At this point, public procurement is acknowledged as a strategic weapon which can assist in such efforts.

Over the last decades, public procurement, which had been recognized mainly as an operational activity, has attained broader recognition as the strategic tool of the public policy for achieving various economical, political and social aims. Different latest studies have revealed strong importance of public procurement through the prism of its share in the gross domestic product value. Public contracts represent on average 12.8 per cent GDP of OECD countries and approximately 17 per cent GDP of EU (Jurčik 2013, 335; Loader 2015, 103). On the wider scale, Kidalov and Snider (2011, 1) argue that most nations spend nearly 20 per cent of the gross domestic product for public procurement, while in developing countries the number goes up to 50 per cent. Furthermore, Wittig (2000, 15) specifies an opportunity for better positioning on regional, national and international levels by countries upon utilizing a system-wide management approach to public procurement.

Even prior to the aforementioned intensifications of focus on prominence public contracts possess, there have been attempts to link the desired governmental policies and goals with public purchases. For instance, systematic integration of what has been viewed contemporarily as social sustainability on the policy level has remarkable relationships with public procurement, stemming from the 19<sup>th</sup> century in the UK and the USA, where fair and decent labor conditions alongside the tackle of unemployment have been notably enhanced by public procurement (McCrudden 2004, 258).

Consequently, a connection between the innovative agenda and state purchasing has been established. Fostering the market competition and stimulation of R&D have become the cornerstone of innovative public procurement, in which the proportions of GDP involved are managed properly in invigorating the necessity in innovative solutions in the line with public demand. For instance, Edler and Georghiou (2007, 949 - 950) reveal cumulative findings of greater impact of public contracts on innovations in the means of higher innovation stimulation by state purchasing rather than by direct R&D investments on longer time. Furthermore, according to the authors, Palmberg (2004) and Saarinen (2005) state that out of all innovations that have been brought to the market in Finland between 1984 and 1998, 48 per cent of lucrative projects were prompted by new requirements in public procurement.

Electricity generation remains one of the biggest areas to be explored in the pursuit of clean and efficient energy supply to match the growing requirements. Inasmuch as the plans of full reliance on the renewable and emission-free sources of energy persists as utopia, more staged and gradual transition is being designed, wherein natural gas that produces the lowest amount of emissions in comparison with other fossil fuels can play the fundamental role. Lately, worldwide natural gas consumption has been equal to 21 per cent of Total Primary Energy Supply (TPES) with the demand growing each year by 2.3 per cent (Richter 2010, 79). Nevertheless, not only the environmental concerns, but also the economic rationales, such as lower capital costs, imply the wider utilization of gas combustion technology for electricity production. Bolstered R&D have become the imperative key to gas turbines ascendancy, as various innovations have resulted in their strengthened position in the power generation market with the highest efficiencies among all of the other fossil fuels (Unger and Herzog 1998, 1), as it may be seen in the figure 1.

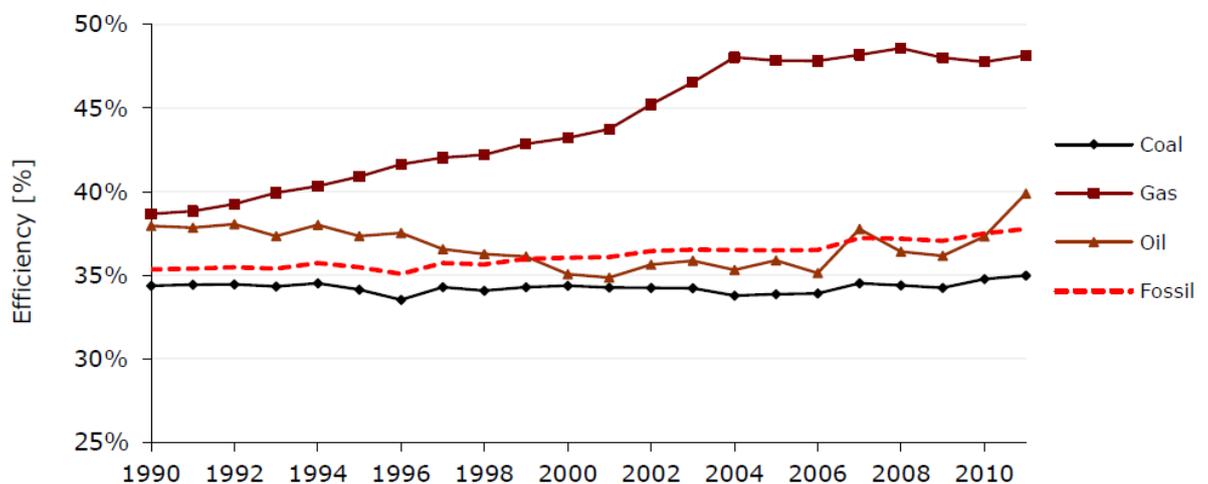


Figure 1. Comparative weighted average energy efficiency of fossil fuels (Hussy, Klaassen, Koornneef and Wigand 2014, 3).

Presently, an emphasis put academically on the area of public procurement is specifically high at the moment (Eßig and Glas 2016, 20), even though the overall scientific findings compiled to the date are still limited to the extent of fragmented studies (Thai 2001, 10; Telgen, Harland and Knight 2007, 16; Snider and Rendon

2008, 311; Uyarra and Flanagan 2010, 3). Public procurement represents relatively new area of study, and the previous researches have widely broad scope, whilst the gap existing should be narrowed by conceptual theorizing taking into consideration the complexity, specificity and limitations (Snider and Rendon 2008, 310 – 311). The amplification of the complexity grows exponentially in the cases when small companies are involved into the public procurement, which is the vital element of the current thesis.

## **1.2 Research problem and objectives**

The importance of the present research lies firstly within the accumulation of modern scientific knowledge from different global viewpoints. Even though the focus of the thesis has been put onto the context of Finland mainly, the non-linear nature of SMEs' and public procurement possesses strong geographical differences. Thus, the proper comprehension of them is fundamental in order to invigorate the basis and interpretative value of the work. Secondly, in-depth investigation of feasibility of approaching innovative public contracts is conducted from the perception of small and young gas turbines manufacturer in the context of Finland. The examinations are also aimed at gathering new practical insights related to the organization of tendering processes and assistance of public purchasing agencies to SMEs. Moreover, the overall degree and appearance of innovativeness in public procurement is evaluated. The results are, hence, anticipated to enlarge the state of academic knowledge significantly by presenting new observations derived from the scope of innovative public procurement of gas turbines in the context of a particular country considering the size and related peculiarities of companies. The aforementioned delimitation is specifically important to be adhered to for the proper generalization of the results and outline of further research opportunities based on them.

As the research objective explained above encompasses practicability of bidding for innovative public contracts for a small gas turbines company and the overall recognition of patterns in the nature of the theoretical framework and empirical results, the main research question can be outlined as follows:

- **How can a small gas turbine company reflect innovative capabilities in public contracts?**

In order to obtain a comprehensive and pervasive answer to the main research question, there are several research sub-questions listed below to be answered:

- What are the innovative aspects of gas turbines and how are they reflected by SMEs in comparison with large manufacturers?
- How is innovativeness considered and outlined in the public contracts?
- What are the main obstacles in access to public contracts and how small suppliers are expected to mitigate them?

### **1.3 Structure of the thesis**

The thesis consists of six main chapters. Role of the introduction lies within presenting the topic of the research in general and its academic relevance, specifically in the light of preceding studies and areas requiring further investigations. Consequently, the scope and delimitations of the paper are explained, as well as the concrete research questions are outlined.

The theoretical part is divided into two chapters. Firstly, the concepts of public procurement and innovation are discussed separately, followed by examination of public procurement as the innovative policy tool in the form of public procurement for innovation. Secondly, small and medium-sized enterprises are analyzed from the perception of their innovative capabilities and appearance as suppliers for public contracts.

After the methodology chapter, there is the empirical part of the thesis. Initially, results from the case company interview are presented and analyzed.

Subsequently, the secondary data obtained from the tenders' documents is examined, with the analyses of the survey results ending the chapter. Once the empirical findings are presented, the conclusion and discussion points form the final section of the thesis, in which clear and concrete answers to the research questions are to summarize the results of the work. At the same time, this chapter

evaluates the reliability and validity of the research and provides suggestions for further research.

#### **1.4 Conceptual framework**

The main goal of this section is to provide visually the overall feature of the research, including the main concepts and expectations as well as the process of transition and interrelation among them according to the hypotheses and assumptions. The importance of such scheme should not be underestimated, as it represents “the soul” of any piece of academic work (Imenda 2014, 185). When it comes to the framework of a research, there are certain structural differences between theoretical and conceptual frameworks to be accounted. Theoretical framework is the reference to the utilization of theory and set of concepts, which are specifically connected in order to offer an explanation for particular phenomenon (ibid).

However, not all of the researches can be conducted purely deductive based only on the theories. Forasmuch as there is a need in the holistic synthesis and analysis of the key variables and the nature of relationships between them, more complex conceptual framework has to be designed. As argued by Jabareen (2009, 51), conceptual framework does not appear as a collection of concepts, but rather as an integrated system, in which each element plays indispensable role, whereas the assumptions possessed comprise ontological, epistemological and methodological dimensions.

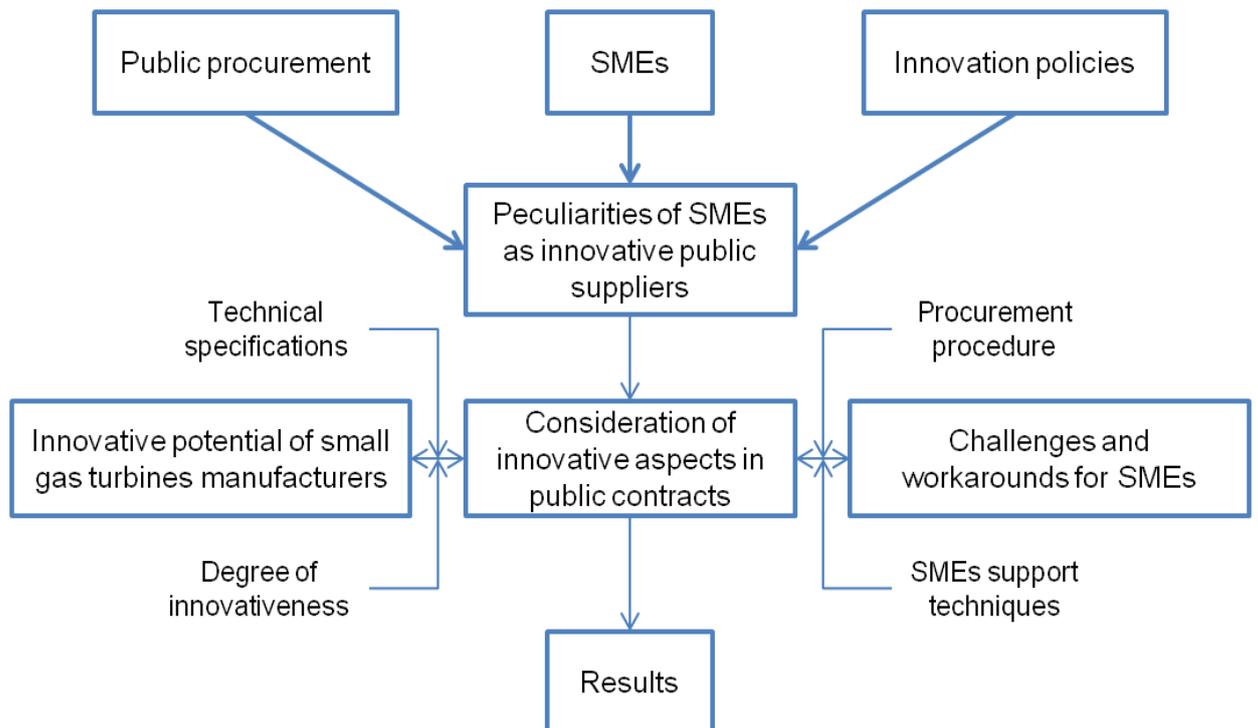


Figure 2. Conceptual framework of the thesis

The detailed visualization of the current research can be viewed in the figure 2. One of the main distinctions of the model is the comprehensive and all-inclusive model, since all of the elements involved into the thesis are assigned with the specific roles and are in the constant interrelation. Furthermore, the author emphasizes the framework as the prerequisite for forthcoming generalizations of the results and topics for additional research, because upon the proper recognition of contextual factors within the model to be adjusted according to specific characteristics can assist in the application of the results to other industries and market. It is, however, the subject for additional inquiries.

## 2 Public Procurement and Innovations

In order to grasp the concepts of innovative public procurement and the role SMEs undertake in it, it is vitally important to start the gradual literature review from more general concept to be further narrowed. However, any efforts of systematization of the public procurement towards taxonomy demand preceding explanation of the concept as such and deeper analyses of its nature and roots.

The choice of academic sources to rely on is essential aspect determining the overall quality of the theoretical basis. Over the last decades, academic journals have become the most favorite venue for scientific publications, particularly because of possibility to present studies in details within restricted amount of pages. Moreover, in comparison with books, which used to serve as the main space for research findings in the past, journals allow to compare various perspectives with possible commentaries on them advancing future work on topics (Tsui 2016, 17), whereas books aim at presenting simplified subjective opinions. At this point, only one book is used in order to delineate and outline basic definitions of procurement, purchasing and sourcing.

Inasmuch as the value of insights presented in journals is justified, the choice of exact journals is more ambiguous. As argued by Tsui (2016, 17), in the modern business research highly ranked A journals do not necessarily mean the highest quality of their publications, since a lot of unique and excellent papers are published in lower tier journals. Thus, sources from top tier topic-oriented Journal of Purchasing and Supply Management (Caldwell et al. 2005; Karjalainen and Kempainen 2008; Mateus, Ferreira and Carreira 2010; Bergman and Lundberg 2013; Loader 2015; Loader and Norton 2015), Journal of management studies (Damanpour, Walker and Avellaneda 2009) and Journal of Public Procurement (Thai 2001; Rothery 2003; Snider and Rendon 2008; Hommen and Rolfstam 2009; Prier and McCue 2009) are supplemented by the ones available from less known journals, such as Journal of Emerging Economies & Islamic Research (Bakar et al. 2016) and conference and forum proceedings, as well as from various national and European legislative directives, reports and guidebooks to consummate the overall diversity and wider applicability of the current section.

## **2.1 Definitions**

### **2.1.1 Procurement, purchasing and sourcing**

The initial debates on the outlining the comprehensive definition of public procurement come from the point of confusion among the mix of different alike conceptions. Namely, procurement, purchasing and sourcing are the dominant terms discussed at such matter along with the variety of comparable variations. Practically they are used on the complementary basis in the context of public procurement to anticipate extra confusion. However, it may be determined that purchasing is an inevitable part of any procurement regime. In fact, whereas purchasing may be viewed from different angles and, thus, defined as the function, process or profession, the supply chain management viewpoint by Lysons and Farrington (2006, 7 – 8) depicts it as the transactional and commercial activities supplementing supplier management's strategic processes in the overall picture of procurement, which, on its turn, represents contextually acquiring required sources of supply and services "by any means".

Arrowsmith's (2005) definition of procurement favored by Rolfstam (2012, 3) describes it as the process of purchasing goods or services from the external agents. Convenient at further exploiting, it neglects the inclusive and holistic nature of the contemporary viewpoint. According to Lloyd and McClue (2004, 4 – 6), the term of "procurement" delineated by 41 United States Code. 403(2) includes the entire set of phases of acquiring goods and services, starting from the evaluation of their necessity and ending with a contract accomplishment. Similarly, Bakar et al (2016, 2) indicate stages defined by Bodnar and Hopwood (2004) of making a purchasing decision, selecting a supplier, receiving goods or services and conducting payment and related contract administration as the fundamental parts of procurement. More particular and narrow stages with respective explanations can be seen in the table 1.

Table 1. General steps of procurement process by Bodnar and Hopwood (author's own creation based on Bakar et al 2016, 2).

<b>Requirement decision</b>	Requesting goods or service within organization (e.g. internal document) to be approved by purchasing department
<b>Source selection</b>	Nominating s source of supply and verifying the contract existence with a supplier
<b>Request for quotation (RFQ)</b>	Suppliers of choice receive the RFQ. Similar to purchase request, the RFQ, however, specifies both the application closing dates and bid submission instructions
<b>Supplier selection</b>	The vendor is chosen according to the criteria and requirements presented by a customer
<b>Purchase order outline</b>	A document confirming the order and specifying its price, amount, dates and conditions of delivery and payment
<b>Obtainment of the purchase</b>	Applicable with the pre-arranged delivery. The delivery may also be arranged from the in-house source
<b>Invoice verification</b>	Validating and ensuring that the goods delivered match the goods requested and the fulfillment of cost and quantity requirements
<b>Supplier payment</b>	The closing stage is the payment to the supplier according to the payment specifications agreed. The payment is conducted only after the invoice is verified

As it may be derived, the contemporary academic literature views the procurement as the all-inclusive process of procure to pay (P2P). Such supply chain management-based perspective is specifically economical in the light of the focus on time- and quality-oriented competition that is prevailing nowadays and reflected by the increased importance of efficient flow of goods, information and funds. One of the most systematically designed interpretations of procurement with respect to purchasing and sourcing concepts can be seen in the figure 3.

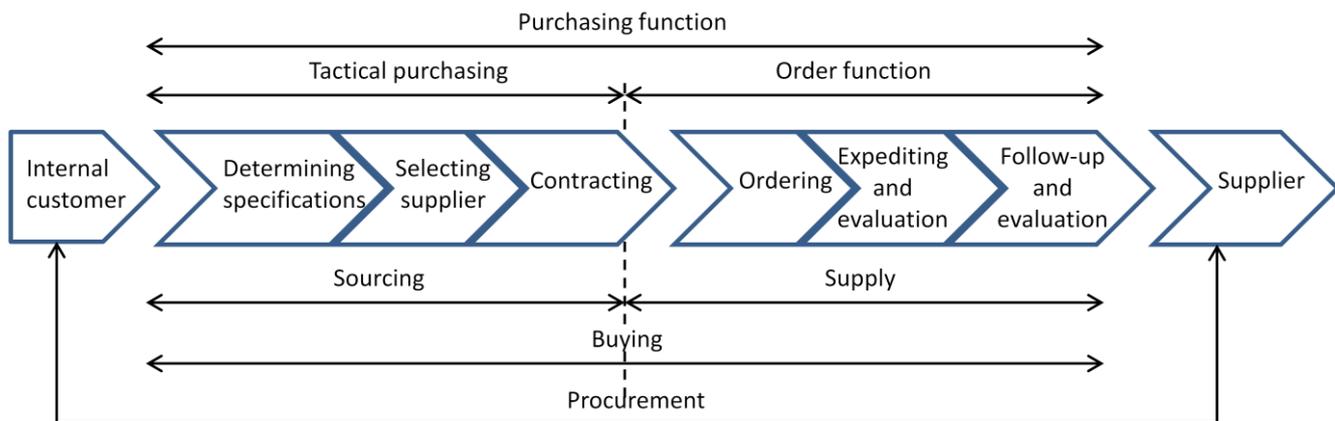


Figure 3. Purchasing process model (author's own creation based on van Weele 2009, 9).

The figure 3 clearly illustrates the major differences among purchasing, sourcing and procurement that must always be accounted. The procurement as a separate organizational unit appears to be the ultimate stage of purchasing integration to cover all the intermediate stages of buying. Similarly, Li (2007, 59 – 61) discusses the gradual development of purchasing function along with the supply chain management towards more sophisticated and formalized process as a part of strategic supply management rather than a tactical function. Additionally, the author emphasizes the unification of sourcing implicitly by not mentioning the actual term itself, but by deliberating the long-term management of the supplier base, its constant development and strategy formation.

### 2.1.2 Public procurement

Inasmuch as the differentiation among the jungle of procurement concepts is presented and further acknowledged throughout the overall research, the next point is defining the buyer. In the context of public procurement, where the purchasing is performed by a public body, “public” is referred to what belongs to society in general, unlike to which is held privately (Snider and Rendon 2008, 312). Yet there might be certain differences when setting the boundaries on what organization is considered public. For example, China’s government procurement definition encompasses only state and social organizations and institutions, while

governmentally-owned firms' procurement activities are related to the ones of private sector (Rothery 2003, 370 – 371).

In principle, the key aspects are similar between public and private procurement. It is obvious that in both cases there are goods and services to be procured, and the procurers are always trying to maximize the value for the money spent.

Nevertheless, the scholars have acknowledged the presence of particular differences between the aforementioned types of procurement, especially because of notably higher complexity and stricter regulations in the framework of public procurement. Moreover, Telgen et al (2007, 16 – 19) stress the findings of the Dutch government procurement organization indicating that whereas 80 per cent of public procurement is broadly similar to the one in private sector, the rest 20 per cent is divergent because of various demands. Subsequently, the authors present the cumulative academic findings of the distinct public procurement demands, which may be found in the table 2.

Table 2. Specific demands of public procurement (author's own creation based on Telgen, Harland and Knight 2007, 17 – 19).

<b>External demands</b>	<ul style="list-style-type: none"> <li>• Transparency</li> <li>• Integrity</li> <li>• Accountability</li> <li>• Exemplary behavior</li> </ul>
<b>Internal demands</b>	<ul style="list-style-type: none"> <li>• Several goals at once</li> <li>• Importance of political goals</li> <li>• Interests of many stakeholders</li> </ul>
<b>Demands originating from the context</b>	<ul style="list-style-type: none"> <li>• Budget as the main driver</li> <li>• Openness of budgets</li> <li>• Different departments dependent on budget</li> <li>• Distinct cultural setting</li> </ul>
<b>Demands on process</b>	<ul style="list-style-type: none"> <li>• Scrupulous limits on legislative framework</li> <li>• Difficulties in establishing the long-term relationships</li> <li>• Cooperation with other public agencies</li> </ul>
<b>Numerous goals of public body</b>	<ul style="list-style-type: none"> <li>• Huge volumes of purchases</li> <li>• Reciprocity – purchasing from vendors who are the taxpayers themselves</li> <li>• Public sector sets and controls the regulations it operates within</li> </ul>

Finally, the overall definition of public procurement to be referred to is formulated by Prier and McCue (2009, 329) as follows:

*“Public procurement is the designated legal authority to advise, plan, obtain, deliver, and evaluate a government’s expenditures on goods and services that are used to fulfill stated objectives, obligations, and activities in pursuant of desired policy outcomes.”*

Such explanation fully matches the conventional understanding of the phenomenon by the majority of authors of disparate academic sources who refer to broad definition of public procurement as a process of obtaining particular goods, services or works by governmental organizations and agencies from third parties in different contractual forms (Kidalov and Snider, 2011, 1; Loader, 2015, 103)

### 2.1.3 Innovation

The academic literature of innovations is indeed saturated at the moment and has a long history of continuous development. It is unsurprising given the widespread acknowledgment of innovation in general as the main source of economies boost, sustaining competitive advantage and creating value (Damanpour, Walker and Avellaneda 2009, 650). Whereas the term innovation itself became used massively mainly in the second half of the 20<sup>th</sup> century, it was still implicitly regarded as highly important and discussed extendedly even in the 19<sup>th</sup> century, for example by Veblen in 1899 (Baregheh, Rowley and Sambrook 2009, 1323). Subsequently, authors state that due to such academic focus there is no any single and commonly accepted definition of innovation, since many of them are very comparable and overlapping. Similarly, Dewar and Dutton (1986, 1422) argue that the essential differences resulting from innovation types make the search for a unified definition irrelevant in general. However, according to the authors, an innovation may conventionally be referred to as any “idea, practice or material artifact perceived to be new by the relevant unit of adoption”.

The typology of innovations appears to be rather complex, as it may be applied to individual person, separate organization unit or the entire organization, the whole sector, industry or organizational population as such (Damanpour et al 2009, 652). Moreover, the consideration is put onto what can be produced – tangible goods and products or intangible services, while new processes can be technological or organizational depending on how the products are produced (Edquist and Zabala-Iturriagagoitia 2012, 1758). Based on the degree of novelty, the innovations may either be incremental or radical, as accepted by scholars. Incremental innovation represents the gradual improvement and minor adjustments of the existing products and technologies, while radical (or disruptive) type of innovation involves fundamental changes leading to the development of completely new products or technologies which dramatically disrupt the existing market (Dewar and Dutton 1986, 1422 – 1423; Koberg, Detienne and Heppard 2003, 23). Furthermore, deeper analyses reveal certain derivations of the aforementioned types of innovation. Koberg et al (2003, 23 – 24) review the three types of incremental innovation by Herbig (1994), while Schmidt and Druehl (2008, 348) refer to four

kinds of disruptive innovations in consonance with the types of diffusion. They are, however, very product-specific and may be applied only to particular examples. Therefore, the differentiation between incremental and radical innovations will be preferred during the following work.

#### **2.1.4 Public procurement of innovation**

Even though the academic interest to the topic has been growing rapidly, certain issues within the taxonomy are still present at the moment. To begin with, there is confusion present to a certain extent with the actual term describing the innovativeness in public procurement. According to Lember, Kattel and Kalvet (2014, 14), the abovementioned phenomenon has been specified under different names over the last decades. “Innovation-oriented public procurement”, “enlightened public purchasing”, “public-technology procurement”, “innovative public procurement”, “strategic public procurement”, “public procurement of innovation” and “public procurement for innovation” – in spite of minor contextual differences, all of the described names are referred to state purchasing aimed at fostering the innovation. Considering the EU terminology (Semple 2014, 5), the term “public procurement of innovation” (PPI) is used hereinafter to avoid extra confusion.

The role of market and demand in triggering innovations and technological developments has been long acceded by scholars (Raiteri 2015, 1), forming the modern demand-pull school. Accordingly, public procurement of innovation is referred initially by Edquist and Hommen (2000) to state orders on products that “do not exist at the moment, but can be developed within reasonable time” (Hommen and Rolfstam 2009, 20; Guerzoni and Raiteri 2012, 4). However, the definition does not consider various side aspects. Types of innovations discussed previously certainly have the effect reflected by differentiation in the European Commission’s (2016b) between public procurement of innovation solutions (PPI) involving the innovations which are already or almost already available in particular degree, and pre-commercial procurement (PCP) when radical changes are required. Equivalently, Uyarra and Flanagan (2009, 3) emphasize the holistic nature of public procurement as the innovative instrument by highlighting the

homogeneity of academic explanations that do not consider the diffusion of innovation by consolidating current products and services, and advances in transmission of existing services. The degree of public demand and tendencies (Hommen and Rolfstam 2009, 22) may also implicitly affect the innovative agenda of companies by cherishing the modernizations despite the existence of state orders. Moreover, the authors suggest that project size, technological ramification and legislative barriers must be considered and analyzed adequately in any specific context. Taking into account all of the factors and externalities, the EU guidebook's for public procurement of innovation definition of the PPI as the binding element that narrows the gap between advances in technology and processes and public sector stakeholders who benefit from them is accepted.

## **2.2 Relevance of public procurement as innovative policy tool**

As it has already been discussed previously, it is not surprising that public procurement has become a strong leverage in achieving disparate high-hanging fruits, as achieving economic goals and getting the best value for the money spent is one of the most crucial dimensions of public procurement. As stated by Kidalov and Snider (2011, 1), there is a clear evidence of public procurement's gain of foothold as national policy leverage during the global economic crisis of 2008 – 2009. Such notable shares of GDP involved in public contracts may effectively be used in invigorating the necessity in innovative solutions in the line with public demand. In fact, innovative public procurement represents only one type of governmental innovative public policies. Inasmuch as a public policy is defined as the total amount of all direct and indirect state actions that have an effect on the citizens (Snider and Rendon 2008, 313), the aggregate comparative peculiarities of four dominant innovative policy tools identified by Aschhoff and Sofka (2008, 6) are described in the table 3.

*Table 3. Comparison of four innovative policy instruments (author's own creation based on Aschhoff and Sofka 2008, 6).*

	<b>Public</b>	<b>Regulations</b>	<b>Research</b>	<b>R&amp;D</b>
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	<b>procurement</b>		<b>units &amp; universities</b>	<b>subsidies</b>
<b>Input</b>	Finances	None	Expertise	Finances
<b>Motivation for firms</b>	Boost of sales	Obligation	Access to knowledge and expertise	Sharing of costs and risks
<b>Selection object</b>	State	None	Organization	State
<b>Success influence</b>	Market risk reduction	Market risk reduction	Innovative opportunities	Cost reduction
<b>Essential risk</b>	Limited demand	High economic risks and costs	Limited knowledge application	Decrease of private R&D expenditures

The R&D subsidies and universities and research units are the direct governmental instruments, while public procurement and regulations are the demand-side tools. However, it may be admitted that R&D subsidies are recognized as the biggest alternative to innovative public procurement (Guerzoni and Raiteri 2012, 1). The use of public procurement to trigger innovations is discussed more profoundly below.

## **2.3 Legal implementation**

### **2.3.1 Public procurement process and supplier selection methods**

As it has already been mentioned, there are different definitions and models of modern supply chain viewed procurement. Subsequently, it has been determined that the logic behind the designing purchasing by public authorities is generally similar to that of by private companies. For instance, McKeivitt and Davis (2013, 470) state that Irish public organizations are advised to execute the procurement process of three dominant steps represented in the figure 4.

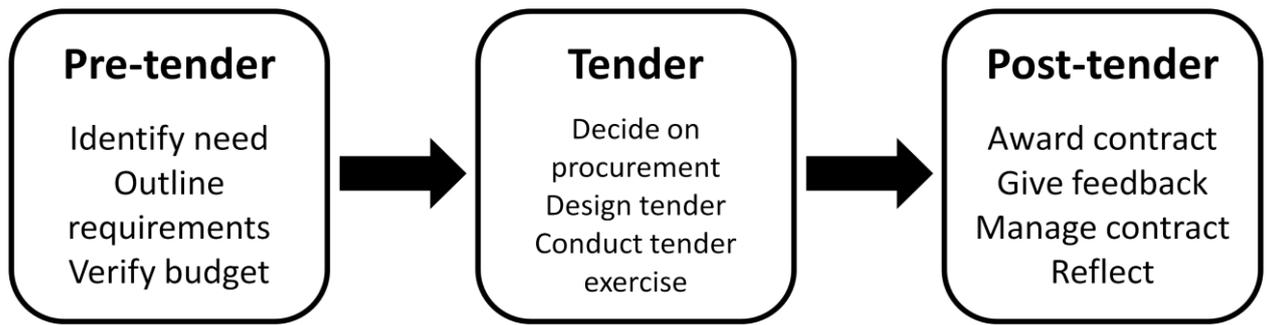


Figure 4. Public procurement process (author's own creation based on McKevitt and Davis 2013, 470).

Meanwhile, according to Eßig and Glas (2016, 20 – 21), Shapper et al. (2006) proposed a conceptual model (see figure 5) for strategic management of public procurement showing various aspects to be considered when making sourcing decisions. The present framework illustrates the three main objectives of public procurement:

- Achieving of political and business goals
- Following public procurement rules
- Getting best value for money spent

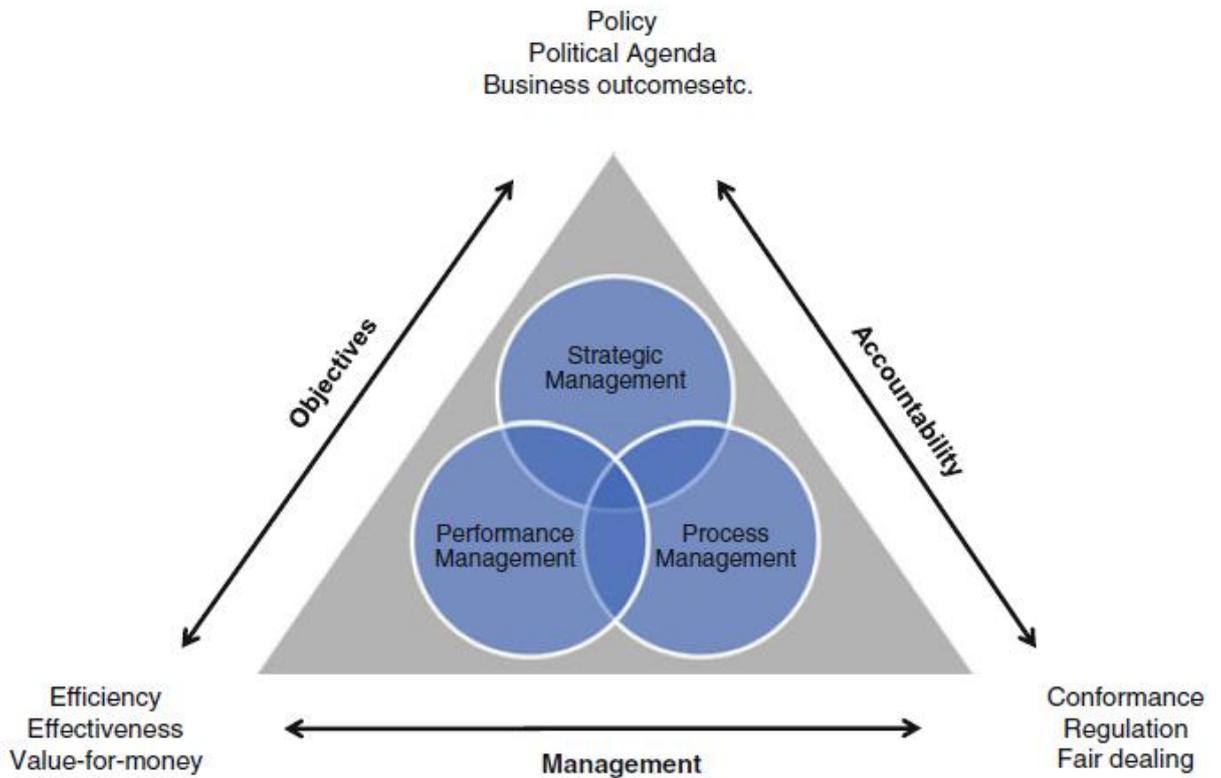


Figure 5. Public procurement management model (Eßig and Glas's (2016, 21) adaptation of Shapper et al. (2006)).

Obviously, the crucial paradigm of public procurement is achieving the highest quality at minimum costs (Bergman and Lundberg 2013, 75), i.e. the best value for the money spent. It is reflected by the enormously stricter regulations in comparison with private purchasing field, partly in the designing the form of procurement. To begin with, there are two main modes of public procurement of goods and services – auctions and direct negotiations (Lalive and Schmutzler 2011, 2). However, direct negotiations are more applicable to less tightened private sector, in which companies are free to decide on how to organize the purchasing. When it comes to public money requiring transparency and traceability, direct negotiations may easily become a subject of corruption, protectionism and discrimination (Chong, Staropoli and Yvrande-Billon 2014, 4), the crucial points of the European public procurement agenda since the 1970s (Gelderman, Ghijsen and van Brugman 2006, 704). On the contrary, auctions can assist in reducing costs by intensifying the competition leading to the necessity in

entering with lower bids, as well as in better selecting the most efficient supplier (Lalive and Schmutzler 2011, 2). Competitive bidding in a procurement process would reduce favoritism, fraudulent deals and promote openness of the system for many suppliers to participate, which also helps in price reduction and quality improvement. Public procurement officers are usually influenced by the political actors in the procurement processes which may demand favoritism and secluded practices that hinder accountability whilst the public is demanding much accountability and good services from the public servant in the process. Whilst the academic debates on the pros and cons of the auctions and direct negotiations offer interesting topic for further discussion, the fact that the EU legislation demands that public contracts above certain thresholds be organized through tendering process (McKevitt and Davis 2013, 470) stresses the higher importance of tendering forming, evaluation and supplier selection methods.

Bids evaluation and supplier selection is normally done either on the basis of the lowest price, which has been the dominant approach in the USA (Bergman and Lundberg 2013, 73), or on the basis of quality consideration. Whilst it is relatively simple and straightforward approach, there are certain drawbacks to be taken into consideration. The obligation to choose the lowest bid has high potential to get the offer with almost unacceptable quality, since the suppliers at this case pursue the goal of cutting costs as much as possible. Additionally, it leaves less space for assessing and dealing with the abnormally low tenders. According to the article 55 of the EU Directive 2004/18/ec, tenders that appear to be unproportionally low in relation to the goods and services to be procured may be rejected only after the buyer requests certain specifics and details it considers appropriate.

In the EU, the cost factor only has been used notably less frequently, but the incorporation of quality aspects into the tender assessment modes prevails (Bergman and Lundberg 2013, 73). Known widely as the Economically Most Advantageous Tender (EMAT), the contract-awarding principle represents the multicriteria combining the cost and quality factors to obtain the highest value with desired characteristics.

There is a lot of academic literature available presently describing the design of the supplier selection methods in comprehensive details. In order to determine the

universal and holistic approach regardless of specific external factors, it is better not to refer to only one source of literature but to address this issue to several documentations. Thereby, several conjunction points could be drawn which are graphically illustrated in figure 6.

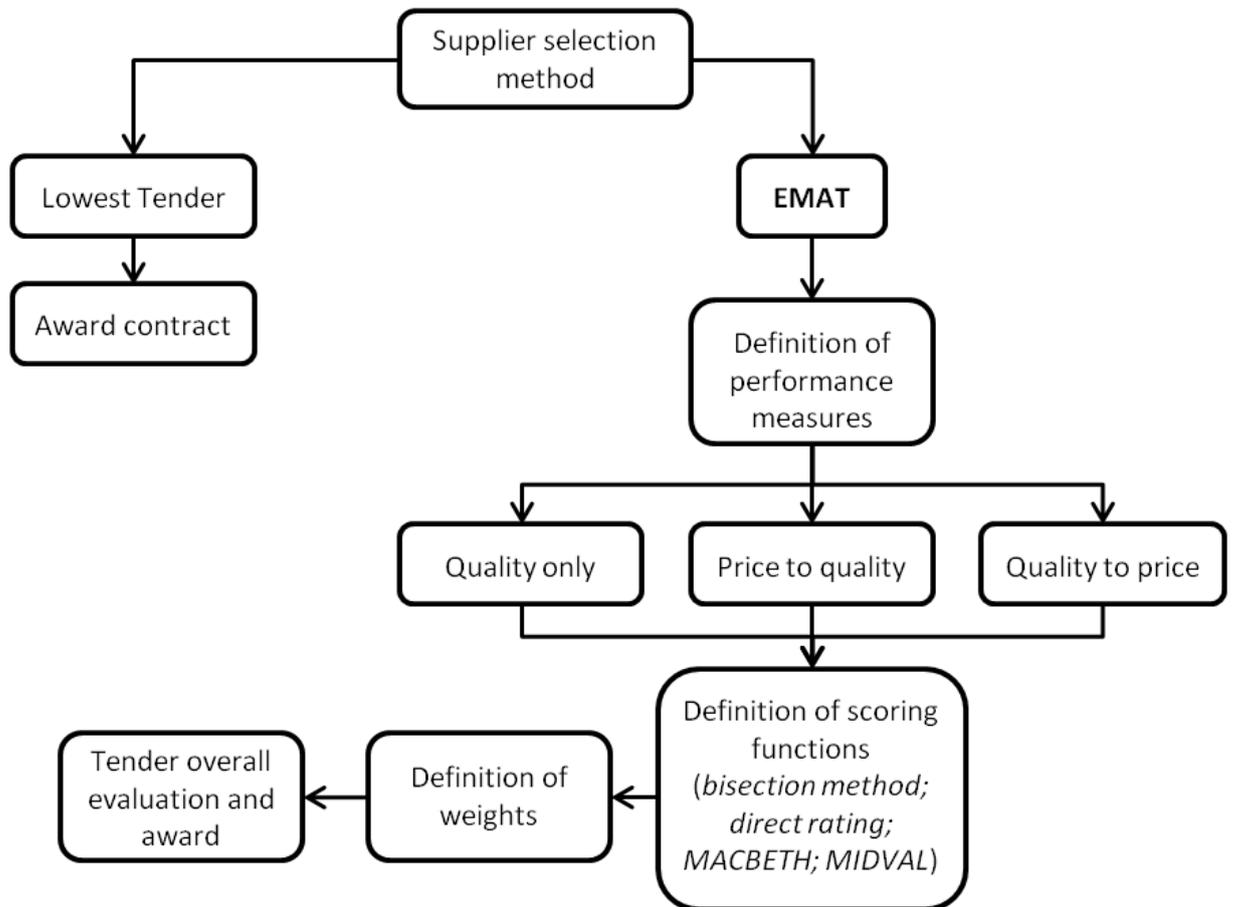


Figure 6. Supplier selection and tender evaluation methods (author's own creation based on Mateus, Ferreira and Careira 2010, 208 – 210; Bergman and Lundberg 2013, 75).

The variations in adjusting the scoring rules in EMAT have become the dominant force in leveraging the public contracts as the public policy tool in achieving different economic, social, environmental and political goals. Namely, a public body may incorporate particular aspects it considers important in the procurement procedure to stimulate the suppliers to follow the higher standards and enhance the competition. Importantly, the requirements may appear on different stages in various forms, e.g. social criteria as a part of technical specifications by providing the evidence of compliance (credentials and certificates) in the preface of a tender

bidding, or more sophisticated demands in concrete innovative solutions in environmental management. Whereas the innovativeness in public procurement keeps the preeminent role of the present paper, the phenomenon public procurement for innovation (PPI) is discussed separately in the later parts.

### **2.3.2 PPI tendering process**

Since nowadays PPI is escalating popularity, there has been a great emphasis on PPI guidebooks and academic literature. The majority of guidelines recognize PPI as a circular process, not as a linear one. Moreover, no models are represented as the universally accepted approaches, but rather as the general recommendations, which must be adjusted according to specific factors in any case.

Since the main principles of public procurement in general remain similar in the one aimed at fostering the innovations, the changes in the procurement process are faced only within certain stages. The generic adaptation of several models outlining the process of public procurement of innovation can be seen in the figure 7.

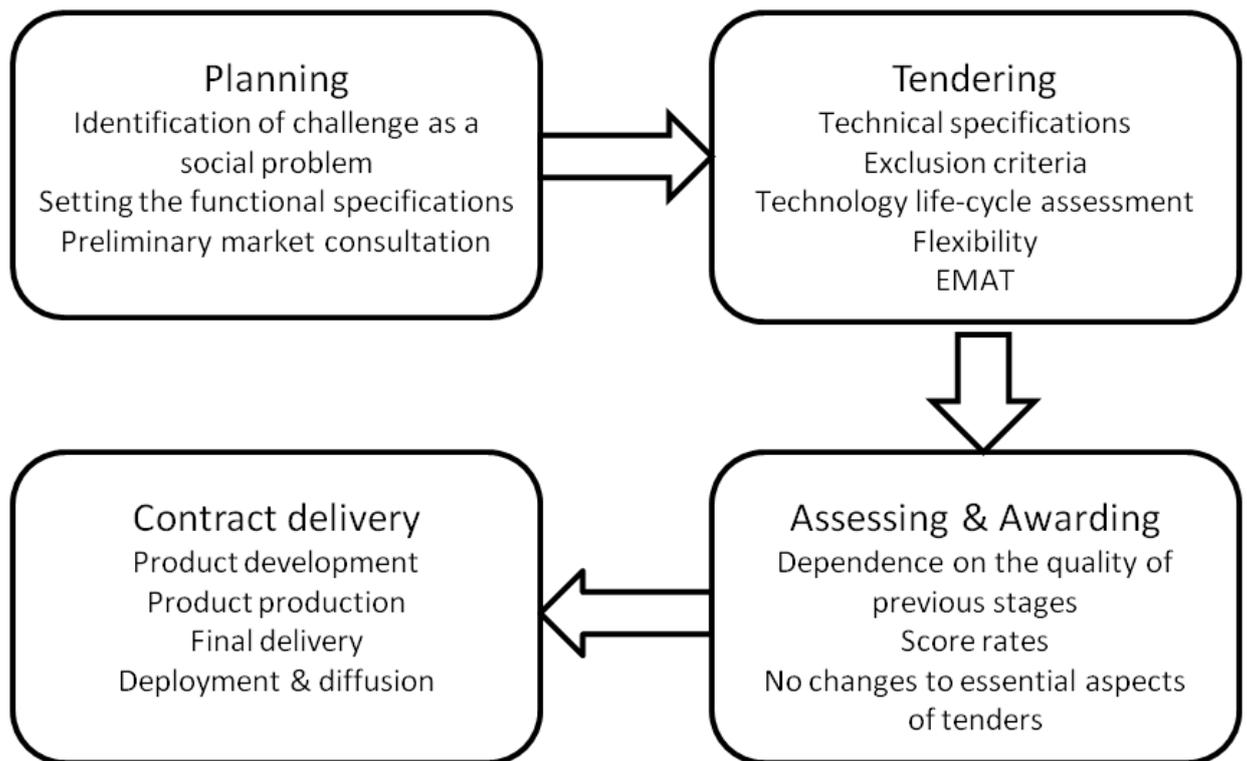


Figure 7. Stages of PPI process (author's own creation based on Edler et al 2005; Edquist and Zabala-Iturriagoitia 2012, 1759; Semple 2014, 19 – 23).

### Planning stage

The starting point of innovative procurement process is the planning stage in which a public body should consider current challenges or mission the authority has to resolve and formulate it in the terms of social problems that have to be mitigated by specific innovations. It is, however, highly challenging to set the concrete functional specifications based on the societal issues given the large amount of the final users and their varying demands. At this point, the question of time required for the preparation becomes especially relevant. For instance, Edler et al (2005, 1 – 2) highlights the relatively large amount of time needed and its positive correlation with the complexity of products or services to be procured innovatively. Additionally, authors argue that the identification of requirements and outlining the specifications from the end user perspective is essential in the PPI.

The forecasting of public demands is usually highly dependent on the products to be developed through public purchase and typically encompasses the time period of one year, whereas Can (2015, 8 – 9) argues that it should be extended at least up to five years.

As it has been mentioned by Semple (2014, 19), preliminary market consultation is vigorously decisive tool to obtain the market's data and inform possible suppliers of the innovative procurement plans. Whereas the legal regulation of it is slightly controversial, it is generally defined by new directives that the preliminary market consultation is accepted inasmuch as it is performed transparently and equally among all candidates and has no further impact on the following procurement stages. The general structure of the process of preliminary market consultation is represented in the figure 8.

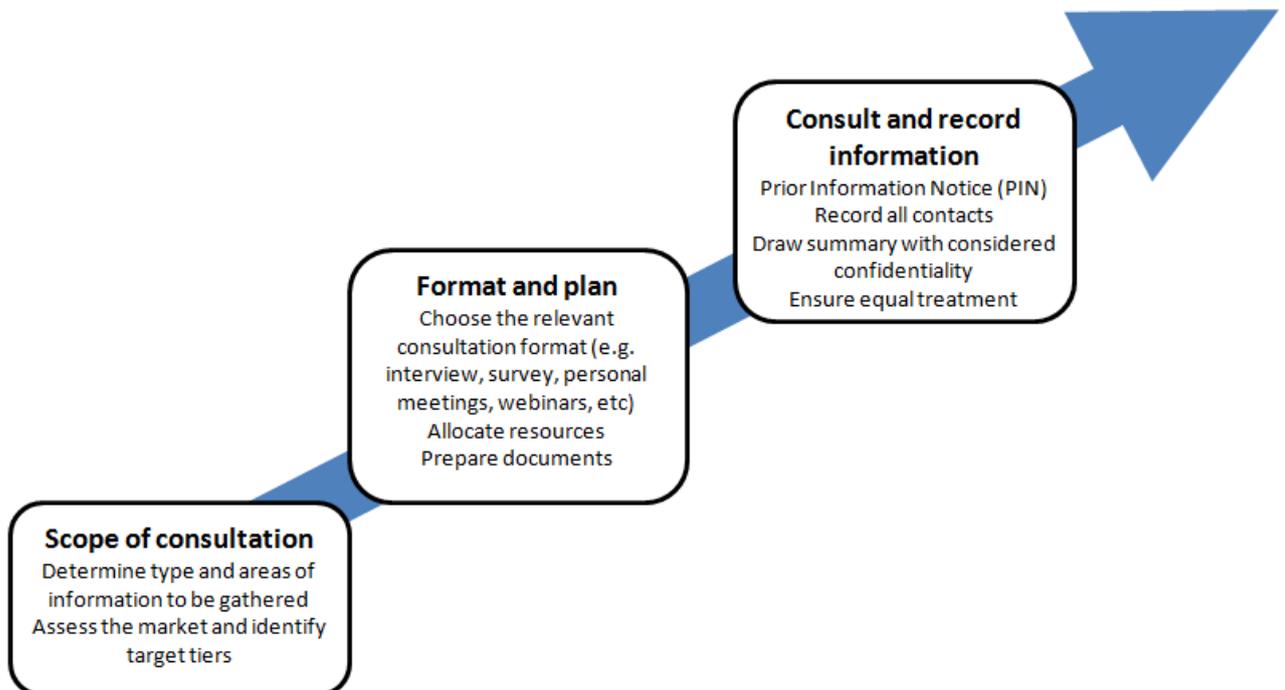


Figure 8. The process of preliminary market consultation (author's own creation based on Semple 2014, 19).

## **Tendering stage**

The initial point of the tendering stage is the launching of the bidding process by a tender. The functional specifications have to be converted into technical specifications of the tender with the core in the needs, structure of the tender and risk management strategies. Moreover, the preceding stage of market consultation plays crucial role in setting the requirements that match the innovative capabilities of potential suppliers (Edler et al 2005, 2). It is certainly coherent, since large divergence between the needs and possibilities would significantly decrease the practicability of achieving the anticipated innovations.

The exclusion criterion is relatively new concept and mainly emphasized in socially responsible public procurement (SRPP). Similarly, it is more met in the SRPP literature. Nevertheless, taking into account the mutual complementarity of PPI and SRPP it may be partially used in the PPI models to enhance their diversity and higher applicability. Furthermore, since many public purchasing bodies favor the use of the European Single Procurement Document (ESPD), which naturally provides the basic reasons why tender may be rejected, the exclusion criteria has to be acknowledged.

Exclusion criteria outline a comprehensive list of various cases where certain personal factors of suppliers may lead to its exclusion from the tendering procedure (e.g. when tenderer fails to present evidence of social contribution or non-discrimination practices). Additionally, the Finnish Ministry of Employment and the Economy (2013, 18) outlines possible types of financial crimes, tax violations or severe professional misconduct. At the same time, the list also defines the bases on which participants may not be excluded (e.g. political or any other personal views). In order to verify compliance with eligibility criteria, suppliers are usually obliged to support their tenders with evidence documentation. Yet, the Finnish Ministry of Employment and the Economy (2013, 18) emphasize an importance for purchasing bodies of fair examination of suppliers and irrelevance of direct rule for providing certain documents or meeting particular certifications, since companies, because different resources, should have equal opportunities of demonstrating compliance in other ways. The aforementioned abnormally low

tenders may also be the reason of excluding suppliers from tendering unless they provide sufficient explanations on request.

Whereas the nature of PPI underlines specific quality criteria to be developed and met by suppliers, Economically Most Advantageous Tender (EMAT) must be used as the contract-awarding principle (European Commission 2014, 29). Additionally, technological life cycle evaluation is indicated by Edler et al (2005, 2) as the enormously inevitable tool in identifying the most advantageous tender if properly integrated into the tender specifications. One of the main reasons behind is that the life cycle evaluation helps in differentiation the direct purchasing costs and the entire costs; hence, the best value may be determined.

Last, but not the least, the point of flexibility is essential in the tendering stage considering the various possible scenarios of innovation development. It is obvious that even since the procurement body always has to set the realistic targets and boundaries suppliers are able to achieve, there always might be the cases of simple inability to produce the innovations in the required forms or of other outcomes of the R&D process. Therefore, in order to facilitate the forthcoming awarding stage, the tenders must be designed in a flexible manner so certain changes may be applied (Edler et al 2005, 7). It is, however, vital to keep these changes outside of the dominant tender's aspects, i.e. the alterations may "clarify, specify or optimize" the tenders as long as the fair competition is preserved (Semple 2014, 23).

### **Assessing and awarding stage**

Evaluation of tenders and following award of the contract require systematic approach, in which the public procurer has to utilize the multi-disciplinary knowledge and expertise to properly assess the technical, operational and economic requirements set in the award criteria (Edler et al 2005, 3). Award criteria as such can significantly increase the value in the cases when there are particular aspects above minimum technical performance requirements defined for the contract. The actual differences between various tenders are much more noticeable if they are subjects to scores (The Finnish Ministry of Employment and

the Economy 2013, 24), which is especially relevant in the case of sophisticated technical indicators involved in the procurement of innovations.

As it has become common with EMAT principle, there are cost- and price-related criteria and specific qualitative criteria that may be distinguished. Edler et al (2005, 3 – 4) indicates the positive correlation of the degree of accuracy of technical specifications and the role of financial criteria. Similarly, the weight of specific qualitative parameters grows alongside the complexity of requirements and inability of the competitors to meet all of the predefined technological aspects, which might occur due to robustness and novelty of the technology to be procured. Whereas in the majority of public procurement cases cost efficiency is usually the prevailing criterion, the situation may be different in the procurement of innovations.

Discussed in the preceding stage, the tenders designed flexibly allow application of various changes required when, for example, the tenderers cannot meet ex ante all of the specifications. The awarding step in such cases would specifically need particular alterations and clarifications in the tender to assess the bids fairly and transparently inasmuch as the essential factors remain unaffected (Semple 2014, 23).

Overall, Edler et al (2005, 3) emphasize the high dependence on the quality of the previous phases, since the selection may be performed well only if the requirements are well defined and the goals and targets of the procurement are realized clearly.

### **Contract delivery**

The ultimate stage of the innovative public procurement process is the conclusion of a contract and the final delivery. The contract matters do not differ significantly from the ones of ordinary public purchases. It is, nevertheless, important to make the choice of the type of the contract to be signed with the winning supplier in advance, and as stated by Wojtczak (n.d.) the dominant types of contracts used in the PPI include supply contracts, supply and installation contracts and works

contracts. Nordic Public-Private Innovation Network's Guide for public procurement of innovation in the health sector (n.d., 22) indicates the contract requirements as the leverage to stimulate and manage the innovations. For example, an option to prolong the contract may appear valuable if the products or services within the boundaries of procurement require additional development, whereas smaller companies may benefit from possibility of sub-contracting if their capabilities do not match specific needs of buyer or sizes of the tender.

Once the contract is signed, the process of delivery takes its place. As discussed by Edquist and Zabala-Iturriagagoitia (2012, 1759), it consists of the actual product development, its manufacturing and further delivery to the purchasing authority. Taking into account the distinct peculiarities of technology, Nordic Public-Private Innovation Network (n.d., 22) emphasizes the significance of the intermediate stages of testing and implementation. Accordingly, well designed contracts must regulate them in order to launch the pilot test of the innovative solutions to examine them accurately and mitigate any possible losses, which might be unacceptably large, after the implementation occurs. Moreover, successful deployment of the innovations demands precise and conscientious monitoring (Edler et al 2005, 3). Even though it is an important part of any public procurement regime, the weight becomes even larger in the case of sensitive innovations.

## **2.4 Classification of PPI**

At the outset, Telgen et al (2007, 19 – 20) define the balance of interests in public procurement. By its means, there are primary interests of the shareholders to acquire goods or services in the cost-effective way, secondary interests going beyond the contract and the competition interests. Interestingly, secondary interests represent the incorporation of additional criteria to the purchases, such as innovation, social and environmental aspects. Even though analogous viewpoints are rare to be faced across similar literature, it is coherent to conventional understanding of the PPI as such and depicts solid basis for further systematizations of the concept.

Moving from top to down, the primary differentiation in public procurement in relation to innovations underlines the purchase of common products with no innovation and the purchase of new technologies and services (Aschhoff and Sofka 2008, 2). Such elementary categorization is definitely easy to comprehend, but it does not consider the abundance of side factors.

Coterminously, the Hommen matrix schematizing different types of innovative public procurement was used as the prevailing tool by both scholars and practitioners over certain period of time. Extended by Rolfstam (2012, 7 – 11), it currently recognizes additional co-operative and distributed innovative public procurement in addition to already accepted direct and catalytic PPI. Based on the final users of innovations, the abovementioned kinds of the PPI are explained as follows:

- Direct PPI occurs when the purchasing agency is also the final user. In other words, the buyer utilizes own demand and needs to stimulate innovation. Edquist and Zabala-Iturriagoitia (2012, 1758 – 1759) argue that the resulting products may be diffused and used by others, whereas Rolfstam (2012, 9) emphasize such diffusion as the co-operative PPI.
- Catalytic PPI underlines that the purchasing agency appears to be an intermediate, i.e. it coordinates and induces the procurement while the final end-user is the broad public and located beyond the organization and its needs (Edquist and Zabala-Iturriagoitia 2012, 1759). However, Rolfstam (2012, 8) indicate that a public body may announce any kind of an opportunity without concrete details or incentives to procure it. Suppliers then have to act independently to exploit it.

Subsequently, Edquist and Zabala-Iturriagoitia (2012, 1759) describe the second dimension concerning the character of the innovation process and results with three types of PPI:

- Pre-commercial procurement (PCP) encompasses the purchase of the expected research results, which is different from procurement of non-

existing goods and services. It is, however, different from the definition of PCP by the European Commission presented above.

- Adaptive PPI involves incremental innovation which can be new for the area of procurement.
- Developmental PPI is referred to radical innovations during public procurement resulting in totally new goods or services.

Slightly different taxonomy is drawn by Edler and Georghiou and argued to be exclusive in the mean of the absence of analogous systematizations (2007, 953 – 954), in which three categories include levels, strategies and approaches to public procurement of innovation. Accordingly, it is described deeper below:

- Two levels of innovative public procurement consist of general public procurement, in which innovation is the crucial touchstone of the overall tendering and assessing process, and of strategic procurement involving the demand for innovation as the market stimulation tool and used by decentralized sectoral policy makers.
- Procurement strategies described by the authors overlap to a certain extent with the aforementioned classification based on the role of the public purchaser. Co-operative procurement encompasses the situation in which public and private purchasers procure and further utilize the innovations jointly. The catalytic procurement as the procurement strategy is fully similar to what has already been presented whither public authority takes the role of buyer while the final user and the source of the real demand is a private organization.
- In procurement approaches an emphasis is put on the pre-commercial procurement versus commercial procurement. Specifically, authors argue that the PCP aims at products and services requiring additional R&D, hence it may practically be stated that the PCP is comparable to R&D contracts, especially since the WTO General Procurement Agreement and various EU directives do not regulate PCP, which is the biggest difference from commercial procurement. Moreover, there must be at least two suppliers involved to ensure the transparency and restrict the monopoly.

## 2.5 Benefits of PPI

There are numerous reasons why proper adoption of PPI practices may be beneficial from different perspectives. Whereas in typical buyer-seller relationships both parties intend to maximize own value, the context of public procurement involving the money of the taxpayers sets other priorities. In this case, the very rare occasions of adversarial relationships result in the benefits for three parties – buyer, suppliers and society. However, it has been widely accepted that the properly designed and implemented public procurement always bring two inevitable benefits. Firstly, by procuring significantly developed and advanced products and services public authorities may make the commitment to solving certain social problems and challenges and enhance the overall distribution of public services. Secondly, such public demand may implicitly stimulate the market to bolster the innovative capabilities despite the actual presence of related public contracts and motivate suppliers to advance their innovative agenda to meet the future needs which might be expected in public procurement (Edquist, Vonortas, Zabala-Iturriagagoitia and Edler 2015, 68). Equivalently, Caldwell et al. (2005, 315) argue that public procurement of innovation may intensify the competitiveness of markets, an aspect which is partially neglected by contemporary PPI literature. Furthermore, Can (2015, 5) indicates that the local markets can obtain value by three crucial points. Firstly, multinational enterprises strongly consider the public procurement in the location decision making process. Secondly, innovative public procurement may strongly enhance the interaction on the market and mitigate the information issues hindering the proper procurement. Thirdly, the quality and efficiency of the products and processes will be essentially improved. For society it can also mean the better infrastructure and the overall increased quality of life.

It has also been broadly argued that small and medium enterprises may harvest the biggest benefits of the inclusion of innovative criteria to public contracts (Aschhoff and Sofka 2008, 16; Lember et al 2014, 17; Raiteri 2015, 4). Since small and medium size enterprises are recognized as the core players in national innovation systems – e.g. SMEs represent 99.3 per cent of all German companies with 13.9 per cent investments in R&D expenditure (Frietsch, Neuhäusler and

Rothengatter 2013) and given the overall tendency of simplifying public procurement process and creating the favorable conditions for smaller companies, impressive changes may occur in economically challenged regional markets in which SMEs play the dominant roles. As the result, new skilled job places and industries and sectors development can take place.

Finally, the supplier's perspective of benefits is covered by the EU Guidance for public authorities on Public Procurement of Innovation (Semple 2014, 14). Accordingly, PPI can assist companies in the working with reliable public customers, meaning reduced costs and shared risks, the chances to unveil the R&D potential and commercialize ideas, obtainment of knowledge and expertise, access to innovation investments on different geographical scopes and improved publicity.

### **3 Small- and Medium-sized Enterprises as innovative suppliers for public sector**

The role of the present chapter is scoped on discussing the nature and features of the SMEs with their further application to the preceding findings related to interrelation of public procurement and innovations. The findings are to be presented in a form of a tool by deconstructing the conceptual framework to be used in the following empirical examinations. More importantly, the aim is put not only on identifying the benefits, but also on revealing various obstacles and shortages associated with smaller companies' fulfilling public orders alongside approaches of enhancing the performance. Consequently, the empirical part is to be executed based on these results.

#### **3.1 SMEs taxonomy**

When referring to small and medium size enterprises, certain researches are based dominantly on the amount of employees in companies. Whilst this factor is mainly crucial, it is not, however, the only exclusive one. It is rather broadly common on the global scope.

According to the previously mentioned, SMEs defining contains various differences among regions. In the European Union, the definition is presented in the EU recommendation 2003/361 (2016). The main indicators of enterprise as an SME are amount of employees and either its turnover or total balance sheet (see table 4).

Table 4. Definition of SMEs in the EU (European Commission, 2016a).

<b>Company category</b>	<b>Staff headcount</b>	<b>Turnover</b>	or	<b>Balance sheet total</b>
Medium-sized	< 250	≤ € 50 m		≤ € 43 m
Small	< 50	≤ € 10 m		≤ € 10 m
Micro	< 10	≤ € 2 m		≤ € 2 m

Yet, Kidalov and Snider (2011, 10) argue that according to EC EIDG (2005) the abovementioned definition of SMEs is not mandatory for EU members to stick to. For instance, for legal reasons, the UK government uses own definition of SMEs as any business with less than 250 employees (Loader and Norton 2015, 3). Nonetheless, in the public procurement context, the UK government support with assistance for SMEs up to 500 employees, whilst France assists high-tech SMEs with up to 1000 employees (Kidalov and Snider, 2011, 10). Furthermore, minor critical arguments related to common EU definition could be found from academic literature of smaller EU states, e.g. Tatrai (2013, 47) specifies unequal regarding of companies employing less than 250 employees in Hungary and Slovakia in comparison with developed EU countries as France and Germany. As an outcome, genuinely micro enterprises are not favored properly. Similar worries are shared by Slijepčević et al (2015, 9 – 10), showing worse participation of SMEs in public procurement from new EU-members and ex-transition countries on the examples of Croatia and Bosnia and Herzegovina. Notwithstanding, such trend has become a driving force for new EU-members, e.g. their authorities are more accurate in filling in contracts values, whereas procurers of Finland, the Netherlands, Ireland and Sweden do not represent similar perception (Vincze et al 2010, 8 – 9).

Interestingly, there is a lack of common definition factors and indicators for SMEs in USA, even within its government. Due to its relative nature, the size is not a

dominant factor, since a company small in one sector may be truly big in another. Thus, staff headcount and turnover are basic factors, while certain technical limits previously issued by the US governmental agencies, such as the US Department of Commerce, the US Small Business Administration and the US Department of Agriculture, have to be considered (United States International Trade Commission 2010). Moreover, heading towards transparent status of SMEs, Congress and Small Business Administration has set various protective regulations from possible fraud and manipulation alongside contractors' responsibility for recertifying statuses of small business annually as of 2010 (Kidalov and Snider 2011, 9 – 10).

However, some developing countries have totally different criteria of SMEs identifying. According to Yalamalle and Suresh (2013, 137), Indian manufacturing SMEs are defined under MSME Act 2006, in which the classification for micro, small and medium enterprises is dependent on amounts of investments into plant and machinery, excluding costs of land, building etc.

Loader and Norton (2015, 3) emphasize the homogeneous categorization in a mean of a lack of the appropriate differentiation in current scholar sources by sub-grouping of SMEs in order to investigate a correlation between various variables as sectors of activities and successful experience in public contracts. Thus, it is vital to consider the abovementioned facts when defining small and medium size enterprises as one of the most important limitations.

### **3.2 Innovative capabilities of SMEs**

As achieving economic goals and getting the best value for the money spent is one of the most crucial dimensions of public procurement, pattern among innovations and SMEs could be identified. Aschhoff and Sofka (2008, 1) emphasize innovations in the global scale as the key driver of economic growth and present the promotion of R&D as vital element of current EU policies and certainly of Lisbon strategy. Frietsch et al. (2013) recognize SMEs as the core players in national innovation systems – e.g. SMEs represent 99.3 per cent of all German companies with 13.9 per cent investments in R&D expenditure. Within patenting activities, SMEs' share of patents is less in comparison with large

multinational enterprises. However, when SMEs are actually active on international level, they do outperform MNEs, especially in emerging technological fields, as it might be observed in the figure 9. Meanwhile, Hughes and Mina (2010, 7 – 8) define patents as the most comprehensive tool of securing intellectual property, yet highly resource-demanding one, whilst there are certain tools and approaches that do not demand similar volumes of resources.

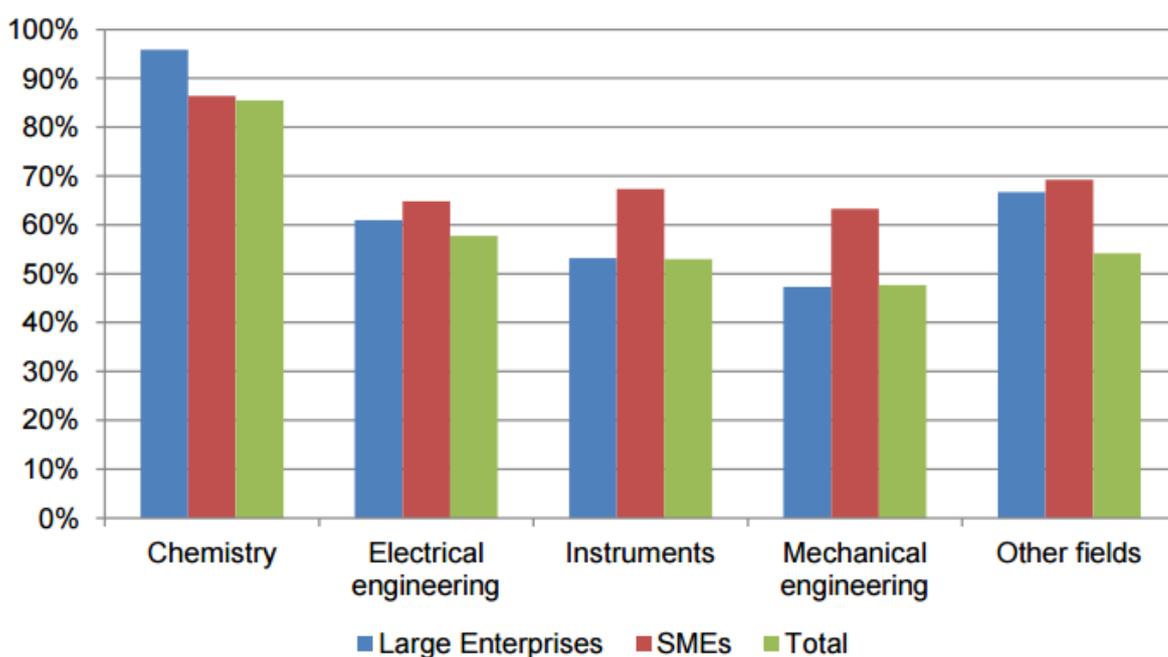


Figure 9. EPO applications of German applicants in relation to applications at the German Patent and Trademark Office, 2006 – 2008 (Frietsch et al. 2013)

Whereas SMEs are identified and recognized as highly appealing suppliers of public contracts towards innovative economic growth, slightly more controversial argues may be observed within the scientific community related to an appearance of public procurement as the promising market for small and medium enterprises. Loader and Norton (2015, 2) states that public procurement has been identified as an attractive field for SMEs, since it offers reliability, stability, guarantees of payment and further growth opportunities. However, only limited number of SMEs is willing to work primarily for public contracts. For instance, in 2006, only 7 per cent of UK SMEs was attracted by collaborating with public sector, partly due to the fact of higher costs, as bidding for state contracts is 10 – 50 per cent more

expensive than for those in private sector (Karjalainen and Kemppainen 2008, 231). Furthermore, according to Loader and Norton (2015, 2), Federation of Small Businesses (2013) stated that 78 per cent of SMEs had not bid or worked for governmental contracts. Therefore, the variety of scientific studies is aimed at resolving and understanding the abovementioned phenomena of low participation and success rates of SMEs in public procurement.

### **3.3 Factors and barriers influencing SMEs' successful performance in public contracts**

Whilst there is a huge number of possible reasons for small and medium size enterprises not having proper access for public procurement, some factors remain similar across many countries. Thomassen et al. (2014, 5 – 6) present following set of factors that have certain impact on SMEs' capabilities of securing public contracts:

- The overall size and value of contract;
- The type of contract;
- The type of procurer;
- Publication of information in advance;
- The type of tendering process;
- The selection criteria used.

At once, authors define the value of contract as the most crucial factor recognized by stakeholders influencing general rate of SMEs' access to above-threshold contracts. The present concern is widely accepted within scientific community (Vincze et al 2010, 41; Jurčík 2013, 337; Loader 2015, 105). SMEs are less successful above the following thresholds: for micro-enterprises the value is 100.000 Euros; small enterprises have fewer share above 300.000 Euros; medium enterprises lose the ground above 5 million Euros (Thomassen et al. 2014, 49). Moreover, World Bank Group (2016, 4) analyzes the aforementioned factor from the perception of transaction costs, summing up high costs as significant issue for

all types of bidders, and particularly for SMEs hindering their access and performance in public procurement.

Vincze et al. (2010, 59) report similar factors and their extent of an impact. According to the report, types of tendering do not play significant role, as SMEs win open, restricted, negotiated and competitive dialogues.

Truly, connections among public procurement and small and medium size enterprises are identified as mutually beneficial. Many mature markets involve broader engagement of SMEs at legislative level, e.g. higher participation and better achievement of value for money spent remain prior in UK policy since the first UK procurement review over thirty years ago (Loader and Norton 2015, 2). Furthermore, according to Loader (2015, 105), the governmental programme in the UK cleared the target of awarding 25 per cent of state contracts to SMEs. Yet, such goals should not be mixed up with potential allocation of quotas, which will be discussed later.

However, it has already been mentioned, the main barriers and challenges of SMEs towards enhanced access to public contracts remain similar to those identified over twenty years ago. The taxonomy of those issues differs upon the perceptions of scholars. Loader (2015, 104) investigates the general obstacles affecting success of SMEs, which are the internal capacity and capability, the view of stakeholders and the external environment (the most relevant to public procurement field).

Karjalainen and Kemppainen (2008, 231) argue that contemporary academic sources tend to sub-group reasons of SMEs' low participation in public procurement into three categories: bidding process, contract size and inappropriate information sharing. Whereas such systematization is mostly related to processes within tendering, Loader (2015, 104) fits the obstacles into those emerging from the public sector (external) and those related to resources of SMEs (internal).

On a general level, bidding process is highly resource-consuming and affects all types and sizes of businesses (Karjalainen and Kemppainen, 2008, 231; Loader, 2015, 104; Loader and Norton, 2015, 3). Jurčák (2013, 338) defines selection

phase as the biggest cause of different obstacles for SMEs, according to the feedback received from them. The administrative burden SMEs have to face consists of submitting large amount of certificates as the pre-condition, time and costs of preparing full document packages, and possible language skills issues, especially relevant when dealing with cross-border procurement (e.g. translation of certificates and standards) (Karjalainen and Kemppainen, 2008, 232; Jurčík, 2013, 338 – 339).

The overall sizes of contracts, as it has been previously discussed, remain vitally significant factor of the rate of SMEs' success on performing public contracts. According to Karjalainen and Kemppainen (2008, 231), Bovis (1998) explains large sizes and values of contracts as an outcome of bundling pursuing reducing of administrative work for authorities. Accidentally, SMEs are simply not able to bid for such massive values or extensive lengths (Loader, 2015, 105) due to limited internal capabilities.

However, even upon overcoming certain obstacles and, therefore, being able to successfully participate in tendering procedure, 30 per cent of SMEs after all stated that information related to procurement opportunities was not delivered to them properly (Kidalov and Snider, 2011, 19). Inadequate access to relevant information and procurement opportunities is discussed as the most massive barrier blocking SMEs (Fee, Erridge and Hennigan 2002, 328, Karjalainen and Kemppainen, 2008, 232). Even though in Europe, the Tenders Electronic Daily (TED) is supposed to provide centralized and comprehensive information concerning the above-threshold contracts, ones below those thresholds are to be advertised by various sources, whereas not all of SMEs have skills and expertise necessary for accessing such contracts.

## **3.4 Towards an enhanced access of SMEs to public procurement**

### **3.4.1 Favorable conditions for SMEs**

In order to eliminate the pressure SMEs have been facing, certain proposals and methods may be observed within scientific community. Importantly, the empirical observations of practices adopted at national levels play the significant role there, since the supportive recommendations are formed on the basis of isolated and generalized best practices.

Wittig (2000, 15) suggests four levels where public policymakers may affect better SMEs integration: removing barriers to participation, procurement assistance for SMEs, preferences or subsidies for SMEs and quotas for SMEs. However, over time, some of proposals have got deeper investigations, whereas some of them have received controversial comments.

According to Jurčík (2013, 337), the EU issued the “European Code of Best Practices facilitating access by SMEs to public procurement contracts” in 2008 in order to facilitate and develop better practices of optimizing tendering procedures for participation of SMEs. Kidalov and Snider (2011, 7) find the aforementioned code valuable, since it provides clear recommendations on assistance practices for SMEs, such as various training programmes and information centers. Moreover, it obligates to provide feedback to all tendering participants, which is specifically crucial for smaller companies, as discussed beyond.

To overcome excessive administrative burdens, it is recommended to allow submitting only the summary of relevant information, so only winning participants would be required to submit the whole package of supporting documents and certificates (Jurčík, 2013, 338).

Possible quotas for SMEs are presently faced negatively, as it would violate principles of equal opportunities and create discrimination (ibid). Yet, Kidalov and Snider (2011, 5) identify European practices weak due to its advisory nature and lack of enforcement. In comparison, regulations and policies of transparency and

equal opportunities enhance SMEs set-asides. Notably, these measures are fully legal.

Overcoming of huge contract sizes in relation to limited SMEs' capabilities is widely accepted in dividing contracts into lots (Karjalainen and Kemppainen, 2008, 231; Vincze et al. 2010, 52; Jurčík, 2013, 338; Loader, 2015, 105) and involving SMEs as sub-contracting parties, since sub-contracting provides more opportunities (Loader 2015, 106). As the purchasing agencies do not directly award the sub-contracting options to companies, providing them with the particular means of reaching the contractors might be highly beneficial. For example, the joint database in which SMEs interested in working as the sub-contractors may expose the data and further search for contract assignments available while larger companies may directly run own selection processes. Another option of performing large contracts for small companies is the consortia or temporary company group, in which the products and services of several providers may be jointly bided, as it is advised and approached by Italian state-owned electricity and gas provider (Enel 2016). The EU law defines such phenomenon as horizontal collaboration and regulates by the Article 101 of the Treaty on the Functioning of the European Union (TFEU) in order to set the boundaries for fair competition and prevent market leveraging (European Commission 2011).

Reducing impact of limited technical and financial capabilities may be achieved by joint fulfillment of certain technical and financial data (Vincze et al. 2010, 45), which may be especially crucial in cross-border procurement. At the same time, improving dialogue and communication channels is critical component of facilitating SMEs' broader participation in public procurement. One of the most relevant successful examples is the practice of online feedback system adopted by UK procurers (Loader 2015, 105), allowing to identify and eliminate obstacles SMEs tend to face. Possibility to get the evaluation of performance and explained specific reasons behind the selection of the winner may definitely boost the knowledge and experience of smaller companies and give the chances to cherish and enhance the forthcoming biddings.

Finally, potential use of IT-solutions and shift to e-procurement is recognized significantly beneficial, as it would allow easier and better access to larger pool of

opportunities, as well as to information needed. Yet, Karjalainen and Kemppainen (2008, 232) discuss identified tendency of smaller companies being permanently excluded from supply chains with high level of information integration due to their basic internal information systems aimed at optimizing administrative tasks. Meanwhile, lack of knowledge and resources may force companies intentionally not use tools of e-procurements, e.g. Yalamalle and Suresh (2013, 140) report tendency of SMEs in India being aware of benefits from e-procurement not willing to invest major resources in order to implement it.

### 3.4.2 Responsive Supply Chain

The main power is held by public purchasing agencies, and, hence, it is absolutely crucial for smaller companies to have cherished circumstances under which they are able to start supplying the state-owned clients. Nevertheless, in order to match to the certain extent of demand and requirements small companies must also lay specific solid groundwork. Neglected by contemporary PPI academic literature, responsive supply chains (RSC) appear to represent essential prerequisites for developing and producing the innovative products in accordance with the market tendencies because of strengthened agility (Gunasekaran, Lai and Cheng 2008, 550 – 551). Whereas modern markets have formed large varieties of various kinds of product characteristics, the table 5 depicts two fundamental ones with respect to the types of supply chains.

*Table 5. Matching types of supply chains with characteristics of products (author's own creation based on Aitken, Childerhouse and Towill 2003, 131).*

	Functional Products	Innovative Products
Efficient Supply Chain	Match ↑	Mismatch ↓
Responsive Supply Chain	Mismatch ↓	Match ↑

As it is stated by Gunasekaran et al. (2008, 550 – 551), essential aim of a supply chain is the extermination of non-value adding activities towards lean production with considerable cost savings. Whilst the aforementioned benefits are definitely important, authors argue that the speed and flexibility have to be compromised within such supply chains. Subsequently, it is defined that there are three prevailing determinants of RSC, which are the use of IT and related systems, knowledge management and collaborative networking with partners. All of the previously mentioned factors can be powerful tools that enable capabilities to react immediately and in a cost efficient manner within competitive environments in accordance with new market demands.

### **3.4.3 Public-private partnership**

Inasmuch as various functional and capability-related issues might be mitigated by smaller companies, there are specific challenges that cannot be overcome in isolation. Public-private partnerships (PPP) appear to be highly applicable and attractive mechanism of bolstering the assets and efforts utilized towards synchronizing the expertise and technological advances, specifically through the myriad of administrative and business issues. Signs of the aforementioned form of partnership can be traced in both public procurement (Essig and Batran 2005, 221; Hodge and Greve 2009, 33) and innovation-related (Martin and Scott 2000, 437; Samii, Van Wassenhove and Bhattacharya 2002, 991; Yuan and Skibniewski 2009, 258) literature alongside the indication of potential to bring innovative solutions in public procurement on governmental level by Finnish Ministry of Economic Affairs and Employment (Martikainen 2017).

The concrete boundaries of such partnership are blurred and, hence, no ultimate definitions exist, especially taking into consideration varieties of law systems and sectors (World Bank Group 2015). Generally, it may be stated that PPPs are a form of long-term contractual collaboration including both public and private parties implementing legal relations (Iossa, Spagnolo and Vellez 2013, 1) in order to develop products and services with mutually shared risks, costs and benefits (Klijn

and Teisman (2003, 137). That is, an emphasis is being put onto balancing the state and commercial interests and aligning the activities, motives and resources across entire supply chains.

There are several key advantages PPPs are in the possession of in comparison with the traditional forms of partnerships. As the cooperation is the dominant feature, public and private sectors are able to combine the skills and capabilities to achieve enhanced benefits. According to Petković, Djedović–Nègre and Lukić (2015, 2 – 3), these multiple benefits may be grouped and outlined through three main dimensions, which are synergy effect, shared leadership and value created for the society. At the same time, SMEs may particularly benefit from the “competitive dialogue” instrument implemented under EU legislation, in which suppliers can be involved at the earliest stages of public procurement procedures towards supplier relationship concepts (Essig and Batran 2005, 229). Since access to information and restricted entry modes remain notable barriers for smaller suppliers, proper implementation of PPP can significantly boost the performance and participation in public bidding. Moreover, given the fact that under the public-private partnership framework extra space for innovations is created by outlining the object of purchase through the expected results (Martikainen 2017), whereas Finnish Transport Agency (2013, 6) states that the use of output specification, a tool that has the vital role in obtaining the benefits of PPP, enables innovations, the fact which is the main rationale for the use of PPP, such hybrid partnership appears to be highly desirable for organizations aiming at delivering innovations to community.

### **3.5 Summary & deconstruction of conceptual framework**

Within the theoretical overview conducted above, various features and insights related to public procurement as an innovative policy tool and an appearance of SMEs in it have been presented deductively by starting from general terms and theory with the following process of narrowing them down towards specific and concrete parameters. At this point, the figure 10 is designed in order to outline a coherent and analytical framework encompassing the key theoretical points to be

further utilized as a substratum of the empirical part of the thesis. Specifically, it is developed by deconstructing the conceptual framework of the research (figure 2).

In general, there are particular traces suggesting the overall maturity and saturation of academic studies encompassing an area of public procurement and, to a certain extent, appearance of SMEs in it. Whereas the boundaries between public procurement of innovation as a procedure and innovativeness in public contracts in general are blurred within the scholar literature, and the topic is only on the stage of emergence, available at the moment state of academic knowledge and practical guidebooks particularly allow to outline the fact of prevalence of general obstacles and barriers SMEs have to face in public contracts in innovative state procurement as well. In other words, there is a strong necessity in the check of typically known aspects hindering SMEs' enhanced performance despite innovativeness. Yet, innovative aspects are not isolated, and the approach should be holistic. Specifically, empirical investigations must also account a degree of responsiveness case company's supply chain has and prominence of its external resources management is organized and the forms of partnerships it should seek to establish. The aforementioned insights are utilized systematically in the figure 10.

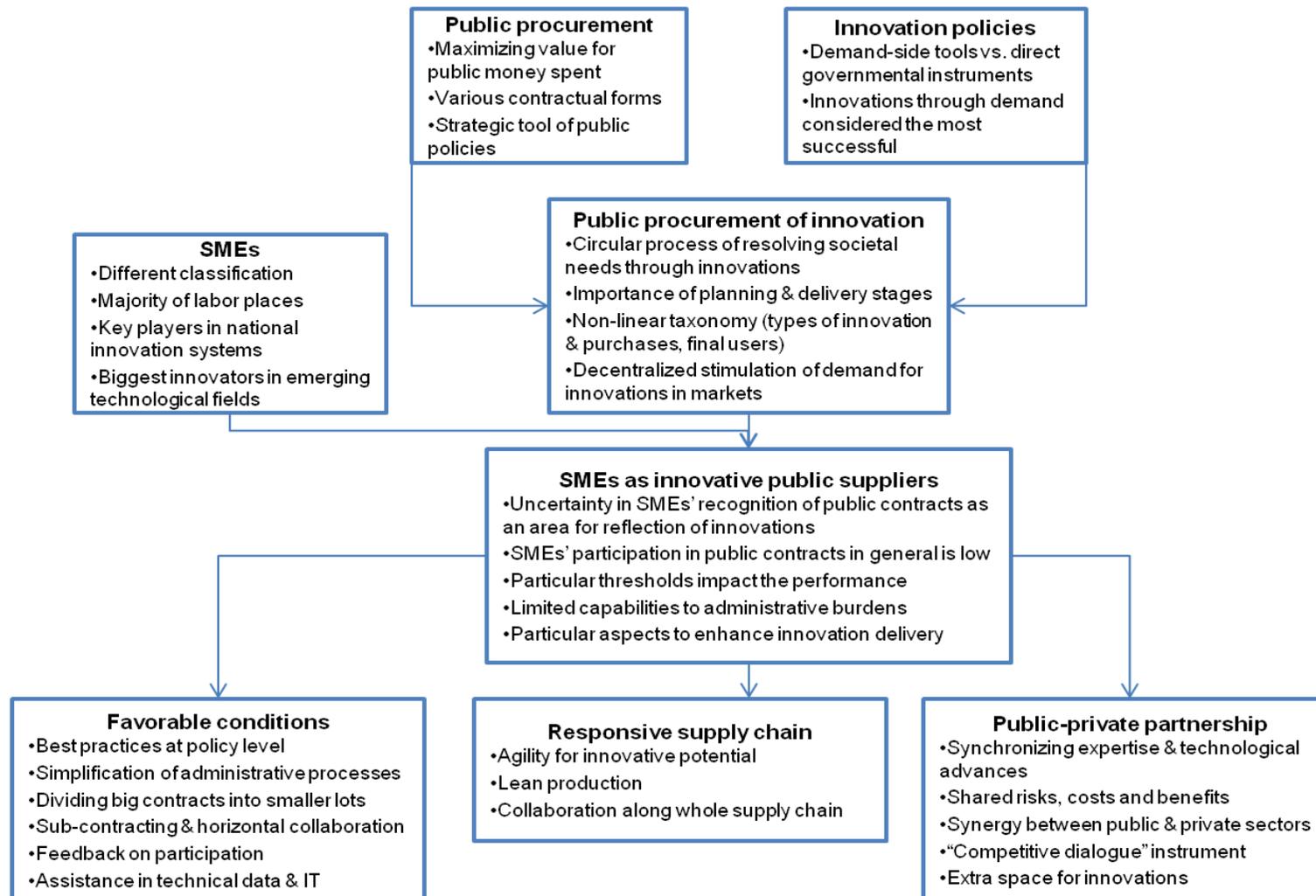


Figure 10. Analytical framework and summary of theoretical part

## 4 Research methodology

The aim of the present chapter is to present the systematization of carrying out the research and justify the procedures chosen. The comprehensive nature of the role of methodology in research is determined by the necessity of going beyond trivial outline of the methods involved (Rajasekar, Philominathan and Chinnathambi 2013, 5), since data collected and analyzed in specific methods has also to be interpreted coherently within certain boundaries. In other words, as, according to Saunders, Lewis and Thornhill (2009, 107), Guba and Lincoln (1994) noted, selecting on the methods of data collection plays secondary role, while determining the right philosophy which can be applied to the research is the cornerstone of an academic work.

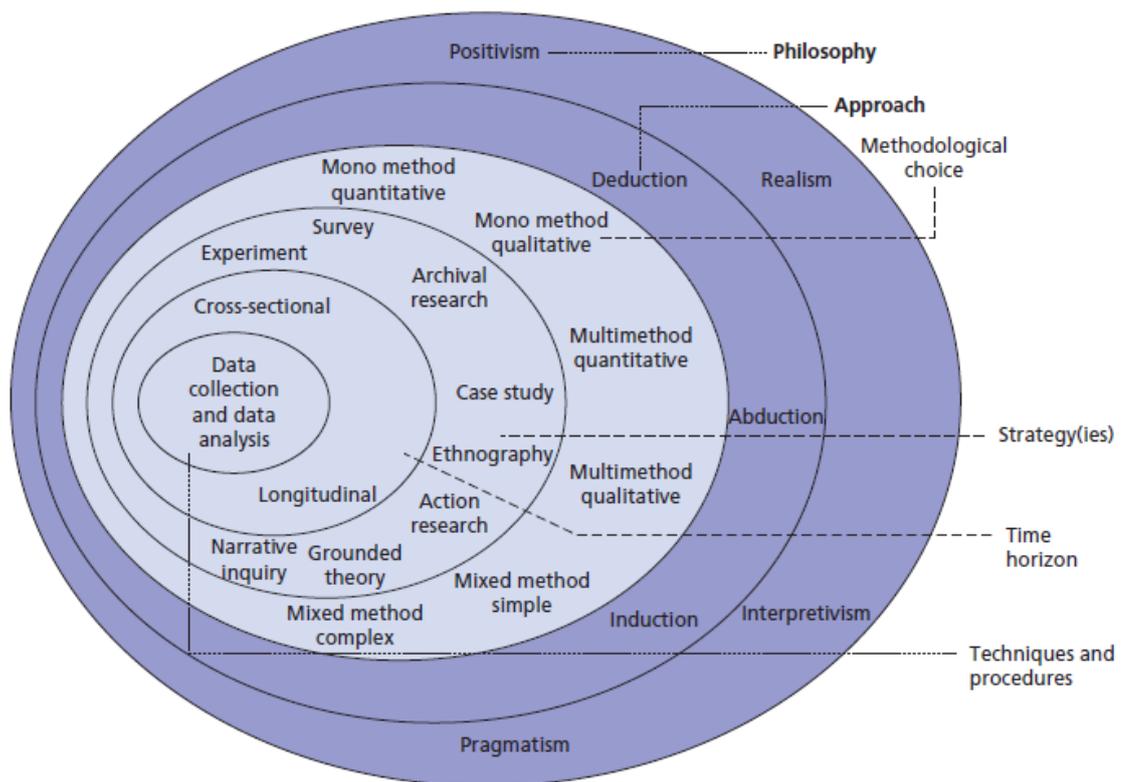


Figure 11. The research onion (Saunders et al. 2009, 108)

The figure 11 depicts the research onion, a tool describing the issues which are elemental to the selection of data collection and analysis methods. The classification presented above is preferred within the actual research, since it

provides author with unambiguous holistic model for the entire research process. As suggested, the outer layers cover the research philosophy and approach. Whereas these aspects are more relevant for the doctoral level studies and demand in-depth systematic analyses, the framework of master's thesis does not possess such requirements. Nevertheless, the research philosophy and approach are briefly discussed in order to keep the methodology systematic and to ensure higher validity and overall diversity of the present research. Accordingly, the current chapter starts from the abovementioned aspects of the methodology relevant to the present work, followed by the research methods and strategies, data collection and analysis techniques and approaches to assess the validity and reliability of the research. The overall methodological aspects related to the current thesis are presented in the nutshell within the table 6, whereas the following chapters are to describe each section in details.

*Table 6. Methodological selections.*

<b>Approach &amp; Design</b>	<b>Strategy</b>	<b>Data collection</b>	<b>Data analyses</b>
<ul style="list-style-type: none"> <li>• <b>Qualitative</b></li> <li>• <b>Exploratory</b></li> <li>• <b>Mixed deductive &amp; inductive</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Single-case study</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Topic-related secondary literature</b></li> <li>• <b>Tenders</b></li> <li>• <b>Interviews</b></li> <li>• <b>Surveys</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Interviews transcriptions and analyzing</b></li> <li>• <b>Tender documents evaluating</b></li> <li>• <b>Survey analyzing</b></li> </ul>

#### **4.1 Research philosophy, approach and design**

The starting point of, in principle, any research is the systematic analysis and proper evaluation of the philosophy that, subsequently, forms the overall research strategy. The importance of research philosophy in the context of a research grounds within the fact of reflection of author's main assumptions of the view of the

world. The aforementioned assumptions then set up the methods, which are involved in the research strategy (Saunders et al. 2009, 108). Similarly, Carr (2006, 422) argues that philosophy is referred to a form of a priori theoretical knowledge composing the methodology applied in the research. The methodology, at its turn, serves as the basis of holistic theoretical justification for the methods involved. As it has already been explained above, research philosophy is an aspect applicable for post-graduate level of research. However, in the actual thesis, brief description is presented in order to fully reflect author's apprehension of systematic methodology and further clarify the methodological choices.

For the enhanced results of the present work, the pragmatism is chosen as the research paradigm. As it has conventionally been known, the pragmatic viewpoint stands for the most prominent determinant of the philosophy to be selected is the research question (Saunders et al. 2009, 109; Ihuah and Eaton 2013, 937). At this point, inasmuch as the research question does not possess clearly whether positivism or interpretivism has to be applied and, generally, if singling out certain position, for instance, ontologically appear to be quixotic, the pragmatism should be utilized. In case particular approach is more appropriate than the other and is justified properly, a researcher is then able to choose the approaches and methods of data collection and analysis according to own value system, which is the core of pragmatism. As the result, the research questions are answered from multiple perspectives, whilst the value in the process of data interpretation is increased because of harmonized subjective and objective viewpoints of the researcher.

The choice of the research approach is determined by two dominant inquiries related to the state and use of theory: deduction and induction. Along with the overall role of theory, there is a number of certain other aspects that characterize the approach of the research according to Saunders et al. (2009, 124 – 126).

The deductive approach represents the process of development of theory and hypotheses and subsequent rigorous tests. Known also as “top-down” approach, it indicates the narrowing of general theories towards more specific observations in order to confirm the theory or identify the subjects to modifications. One of the most common applications of the aforementioned approach is the natural

sciences, in which the theory serves as the dominant source a priori knowledge (ibid).

There are, however, certain specificities related to the deductive approach that must be considered. Deductive researchers have to form the actual work on the basis of preceding research by specific measures and test if particular causal relationships among variables do exist (Ali and Birley 1999, 3 – 4). At such point, the researchers must keep objective and independent position and adhere to highly structured and precise methodology. Furthermore, Saunders et al. (2009, 125) suggest that the important feature of deductive approach is the possibility to measure the results quantitatively. Thus, any attempts of generalization of the results are dependent on enhanced validity of the work, which can be achieved by higher samples.

The inductive research approach, on its turn, outlines an opposite model – the “bottom up”. The approach involves certain degree of uncertainty and mainly used in the cases of absence or limited availability of theoretical knowledge to the extent that only the area of inquiry may be determined. Opposite to deduction, the theory follows the data analyzed. In other words, observations and the data derived are analyzed to produce the theory. The theory does not necessarily have to be new – however, it is still produced in an inductive way (ibid). As the methodology is not as strict as the one of the deduction is, the approach is more associated with the qualitative methods. Indeed, as the role of particular factors is crucial, the sample sizes tend to be small in order to fully consider the role of the context.

Nevertheless, the apportionment of the deductive and inductive choices does not possess the scrupulous line. Argued by Saunders et al. (ibid), it is not only feasible to blend the abovementioned approaches, but it is even beneficial. Similarly, Ali and Birley (1999, 2) indicate that since the main difference of the approaches is how they reflect the existing theoretical knowledge, the hybrid model, then, sets the first step as the development of theoretical scheme based on the constructs with the outcome of either adoption of the existing theory or alternative theory built.

The present research definitely has the signs of inductive approach. The sample size is restricted to an individual case study, in which the context plays essential

role. The academic knowledge is certainly limited and fragmented to the extent that no confident generalizations can be made. However, particular theoretical framework related to the overall performance of SMEs as the innovative public suppliers can be constructed. Namely, the areas of public procurement in general, innovative theory and role of small and medium sized enterprises in economies have attained scientific attention to the specific extent. Therefore, the starting assumption may be derived deductively, in which it is presumed that in the developed countries SMEs can principally be capable of performing innovative public orders because of working in highly competitive environment triggering to foster the R&D activities and less bureaucratic and more transparent public procurement system. However, aspects related to the innovativeness of gas turbines in public context have to be further analyzed in the inductive way. Hence, it may be concluded that the integrated approach is implemented.

Given the already identified methodological peculiarities and distinct characteristics of the present work, the research design is exploratory. According to the research methods notes of Harvard University (n.d., 1), explorations means primarily pinpointing the key issues and key variables in order to comprehend the feasibility of further deeper investigations and narrow the gap on which no or small knowledge has been accumulated so far considering the qualitative nature (Yin 2009, 9). It is specifically applicable to the current research, as the degree of uncertainty is high and the flexibility appears to be the core element in the pursuit of achieving better results, as exploring the phenomenon of attractiveness of public contracts for small gas turbines manufacturers certainly requires alterations from formal structures in contemplation of utilizing various tools required. The degree of flexibility provided by exploration also directs the researchers to be amenable to make changes and modifications in the research direction wherein the outcomes revealed direct to do so (Saunders et al. 2009, 139 – 140).

Taking into account the aforementioned factors relevant to the current paper, it may be stated that the research is qualitative. Coherent to the already established research philosophy and approach and the practical considerations behind the selection, the qualitative method matches the overall flexibility forming the framework. It, nevertheless, must be denoted here that the data collection involves

partially quantitative data, which is further analyzed qualitatively. The detailed explanations of the rationality are presented in the related chapter.

As it has been mentioned by Kananen (2013, 32), an essential question for the qualitative research that must be accounted throughout is “what is this phenomenon about?”, whilst the prevailing goal of such research is grasping the phenomenon deeper and interpreting it objectively rather than simply generalizing the results. Consequently, the research strategy discussed below is designed accordingly and keeps in a view the practical implications within the boundaries of the paradigm.

## **4.2 Research strategy**

The research strategy, as defined by Saunders et al. (2009, 600), represents “the general plan of how the researcher will go about answering the research questions”. That is, the process by which the research is executed influences the direction profoundly. Excerpting the proper strategy relevant for the research can be based on various aspects, such as research goals and questions, the saturation of theoretical knowledge available on the area of inquiry, author’s resources, etc (ibid). At the same time, Yin (2009, 4 – 5) emphasizes that whereas no universal formula exists, there are three main factors to be reviewed prior to strategy selection. They are as follows: type of research questions, level of researcher’s control over the events and the extent of focus on the existing and historical events. Inasmuch as the variety of partially overlapping strategies is recognized, the author has decided to utilize the hybrid one based on the case study research and extended by survey and secondary tendering documents in order to facilitate the results and overcome the myriad of obstacles related to case study research in supply management.

Case study is one of the most widely utilized research strategies across different fields, such as political, social and business sciences, psychology, anthropology and many others (ibid). One of the most comprehensive definitions of it has been outlined by Yin (2009, 18) mentioning it as “*empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the*

*boundaries between phenomenon and context are not clearly evident*". The issue of context complexity and importance of specificity of external factors is also emphasized by Bryman (2012, 66), underlining them as the biggest drivers of in-depth analysis of a single case, which is, subsequently, associated with a certain setting that can be an organization or its distinct part, a person or an event.

Within the boundaries of the thesis, an evaluation of individual small company is undertaken in order to answer the research questions. At this point, the preconditions of selection case study are fully met. Firstly, the main research question and supporting sub-questions take the "how" form and seek to get multi-perspective answers from different supply chain angles. Secondly, the author does not have any control over the actions of the case company and stands outside to the case. Finally, the focus has been put onto the contemporary issues, which are highly relevant at the moment and whose prominence will certainly grow in the future.

Further source of confidence of choosing case study over other strategies comes from the fact that there are multiple evidences suggesting that case study research in SMEs context is specifically favored and leads to observations that would not have been otherwise achieved (Wedawatta, Ingirige and Amaratunga 2011). Grounded theory has also been considered good alternative to the case study due to various features of the present research. However, an emphasis of investigation has been put onto the context of the phenomenon, whilst the amount of existing literature allows testing the feasibility of its application rather than generation of solely new theory.

As it has been mentioned beforehand, the pragmatic research philosophy states that there is a possibility to choose the approaches and methods of data collection and analysis according to author's own value system. Since the area of inquiry goes beyond inner company's activities and encompasses the scope of a certain type of supply chain relationships, the complexity is increased and, thus, requires extra attention. According to Halinen and Törnroos (2005, 1285 – 1286), there is a notable lack of methodology knowledge related to business networks, which normally cover more than two actors, while the determinacy of networks is precarious due to their blurred nature. Taking advantage of flexibility provided by

the pragmatic paradigm, the intensive examination of the case company is extended by surveying the public procurement authorities and analyses of secondary tendering documents. The detailed description of the data collected and justifications along with the analysis techniques and procedures is presented in the following sub-chapters.

### **4.3 Data collection and analysis**

The empirical part of the thesis is based on several sources of both primary and secondary data. Since the approaches to data collection utilized in the present thesis are non-standard and not related solely to any concrete research strategy, the sequence of execution must be coherent and systematically designed. As stated by Sandelowski, Voils and Barroso (2006, 29), mixed research synthesis is the organized solution to issues generated by methodological diversity within and between qualitative and quantitative studies. One of the proposed designs applied in the research is the contingent design that structures the empirical part according to the results of each method or group of studies, id est the synthesis of one piece of research affect the preparation and execution of consequent parts. The categorization can be based either on research questions or other appropriate reasoning. In the actual study, the initial step is the interview and secondary data analysis of the case company aimed at enhancing the author's awareness of the state-of-the-art and areas to be further inquired. Subsequently, the secondary data related to tendering and description of similar public procurement is examined in order to obtain particular insights of tendering procedures and followed by the survey for public purchasers to test the knowledge gathered, expand it and identify the future perspective in the field.

#### **4.3.1 Case company**

Within the case studies, it is always recommended to utilize several sources of data in order to obtain valid and reliable outcomes which consider various dimensions, as indicated by scholars over time (Kähkönen 2011, 34). Interviews, defined as systematic way of communicating to people to collect data and obtain

knowledge (Kajornboon 2005), represent one of the most effective techniques of obtaining valuable empirical data; hence it is utilized dominantly within the research. As it has been further defined by Kajornboon (ibid), the classification of interviews mainly involves structured, semi-structured, unstructured and non-directive types of them.

Taking into account the fact that the case company is a small and young organization, having multiple interviews with different employees appears to be hardly possible. At this point, gathering primary data from the case company was conducted by e-mails with operational director and production manager and semi-structured interview with the production manager are approached. The interview's focus has been put on the organizational level rather than individual and encompassed the aspects of several departments and functions, and the existing theory has been used as the basis for questions, as indicated important by Kähkönen (2011, 34). The interview is semi-structured to an extent that the author has not attempted to test specific assumptions and prepared a list of key themes and topics to be covered related to organizational background, supply chain and technical specifications and innovative aspects of gas turbines. The supply chain perspective is specifically crucial, since the buyer's perception has also been evaluated in the form of primary and secondary data. The order of questions has not been defined in advance and varied according to the conversation's structure. Certain additional questions have risen as well during the interview according to the interviewee's responses and the necessity of objective interpretation of them.

Vital part of the analysis of interview results is the benchmarking of case company's product with the ones of the main competitors. The benchmarking process is one of the most essential practices undertaken by various organizations in pursuit of identification and continuous improvement of internal performance. The buzzword of benchmarking itself dates from 1970s, when Xerox Corporation being under significant market pressure approached testing own operation and practices to the competitors' ones (Elmuti and Kathawala 1997, 229). In other words, the fundamental idea behind is that there is no sense in reinventing the wheel when one can learn from the others. The more systematic definition of benchmarking outlines it as constant assessing, grasping and adapting of superior

practices of both inside and outside of organization in order to enhance the overall efficiency, total quality management and competitive advantage (Kelessidis 2000, 2; Yakovleva, Sarkis and Sloan 2012, 1298).

There are two fundamental points need to be considered while designing the metrics of benchmarking – the potential substitutes of current methods and related costs, risks and benefits (Kelessidis 2000, 2). However, the comparative metrics are organization-specific and must be adjusted to internal needs and peculiarities. The benchmarking involved retrieving the secondary data in the form of technical specifications lists and turbines catalogues of the case company provided in the e-mail and of the competitors available from the official web pages. The choice of secondary data is justified by the fact of relying on original and genuine sources which are fully applicable to the current thesis. The selection of companies is systematic: Company A has been selected because of production manager's indication on it as the main and, probably, the only rival in the sector of small-scaled gas turbines. Moreover, Company A is the small-sized organization, which is especially relevant given the main research question. The choice of Companies B, C and D has been made because of their leading positions in the global production of gas turbines. These organizations are, nevertheless, the large ones, thus the considerations of it can be seen explicitly. At the same time, the power output in kW is the crucial metric, and the selection of turbines for comparison is dependent primarily on it in order to have relatively similar-sized products, whilst the rest metrics are determined according to the interview. More detailed explanations are presented in the related part of the research.

#### **4.3.2 Innovative aspects and organization of gas turbines-related public contracts**

As it has already been mentioned before, the nature of public purchases involve at least a supplier and a procuring organization. The scope has been put onto the context of Finland; therefore, evaluation of purchaser's perception is the linchpin of the empirical part of the thesis. The theoretical knowledge of SMEs innovative public procurement is generally limited, whereas the amplification of the context of gas turbines in particular country imposes the necessity in author's own empirical

investigations. For these purposes, the observations obtained through secondary analyses of tendering documentation are coupled by primary data in the form of survey.

Secondary data used in determining the key variables related to the public procurement of gas turbines has been derived from two notable instances and possesses certain structural differences. Firstly, the full set of tendering documentation related to the procurement of gas turbine fuel governor by Gasum Oy, a Finnish state-owned company, including project description, call for tender, instruction for application, and scoring and selection criteria have been extracted from the company's website. Secondly, a report by University of Eastern Finland reviewing procurement process of small-scaled CHP (combined heat and power) in the case of Mekrijärvi Research Station, a part of the University, have been selected.

There are a lot of varying advantages and disadvantages that secondary analysis implies. Using data that has already been collected for other purposes can significantly save resources and rearrange the time that would otherwise be wasted for the process of primary data obtainment to the actual analysis, whereas the quality of the secondary can be extremely high (Bryman 2012, 312 – 313). Yet, a researcher can lack the control over the sample selection and collection methods, whilst the validity and reliability of data can be under a question (Sørensen, Sabroe and Olsen 1996, 435).

Reliability and validity of the secondary sources involved can be confirmed, since the documents are retrieved from official web pages of related authorities. Tendering documentation of Gasum Oy is a kind of raw secondary data to an extent that no prior analyses have been made that could distort the researcher by subjective assumptions and hypotheses. The applicability of the aforementioned documentation can, however, be partially doubted. The procurement process embraces the fuel governor systems for already working gas turbines, whereas the case company focuses on manufacturing small-scaled gas turbines. Nevertheless, the products are certainly interrelated, specifically in the light of fact derived from the interview, in which case company's production manager pinpointed intentions to extend the product line to various spare parts for gas turbines in the future. At

this point, the focus within the scope of the tendering documentation is put on the organization of procurement process from the SMEs' perspective and on the feasibility of bidding for such type of public contracts for them. Keeping in mind the justified delimitations is crucial at this point for the secondary analysis.

Case of Mekrijärvi Research Station is, on the other hand, is presented in the form of report describing the public procurement of CHP along with the rationalities behind that and the results. The choice of undertaking this study has been influenced dominantly by the matching the key variables. Small-scaled CHP is one of the most promising markets for gas turbines, and the selected report describes the overall procurement process from preliminary market research to the latest installations. Additional value and relevance come from the point of different energy generation technologies involved besides the gas combustion. Moreover, the Finland's contextual factors can also be examined. Inasmuch as the original tendering documentation is published in Finnish and no longer available, the form of case study report is accepted appropriate and reliable with particular delimitations. An emphasis is put essentially on the description of procurement process and technical specifications in order to minimize bias. Results and recommendations provided by the authors of the report are also considered with the higher degree of criticism.

The questionnaire is described by Brace (2008, 4) as the medium of conversation between two parties in general and, in the context of research, between the researcher and the subject. The main goal is to provide a standardized interview to a certain amount of respondents who are asked the questions in exactly the same way. It would definitely be beneficial to conduct individual interviews with public procurers within the current thesis; however, due to limited resources, the survey appears to be a relevant substitute.

The mixed-type survey has been prepared with the Google Drive engine and sent in March 2017 to overall 20 public procurers and procurement departments of public organizations, such as city administrations and state organizations. Five replies have been received in total. Given the low sample and the qualitative nature of the research, the results are analyzed qualitatively, even though the data produced is quantitative, as the aim of the survey is to get specific insights related

to the practices and opinions of public purchasers in Finland. The questionnaire consists of four sections related to respondents' expertise, utilization of PPI, involvement to gas turbines procurement and practices related to SMEs. The types of questions asked are multiple choice, checkboxes, linear scale and grid. Some of the questions have "other" boxes in case none of the proposed answers satisfies respondents, whereas various specific questions on which recipients might not be able to answer objectively are voluntary.

## **5 Analyses of the results**

### **5.1 Case company interview**

#### **5.1.1 Background questions**

The starting point of the interview was apropos of the better understanding of the company's overall picture and key parameters that would affect the forthcoming questions. Whereas it is important, in general, in almost every case study, the relevance is even higher when the case company is small and young, as well as the information related to the company available in the open sources is limited.

To begin with, the first questions encompassed the size and organizational structure of the company. Accordingly, the company has the headquarters in Lappeenranta, Finland, with the offices in the UK and Germany, with the overall seventeen employees. Qualifying as a small-sized company, it is also relatively young, as the foundation date is 2013.

Unsurprisingly, now the case company's transactions list is not extensive. The current production activities are focused on the prototype development. As defined by the production manager, fully operational prototype had recently been assembled and tested with the cooperation of local university. Based on the test results and feedback received, the prototype's design is being developed and further upgraded to the next level. More concretely, nearly 70 per cent of the prototype's construction is going to be revised and updated. The manufacturing is taking place in the factory in Lappeenranta, and the first units will be produced there. However, in the observable future the manufacturing will also be performed globally by other external partners when the demand is high and dispersed internationally. The company recognizes such model as a way to expand to markets with high entry costs, such as the ones of USA and Russia. Presently the case company has received four orders, and the first deliveries will be performed in the end of 2017.

As it may be derived, the company has not yet bidden for the public contracts. Particularly, the production manager emphasized that no considerations had been taken yet, which is though clearly explainable by the company's overall start-up

nature. Nevertheless, the overview of clients and suppliers relationships presented beyond is anticipated to outline certain patterns, which must be accounted for public procurement contracts fulfillment.

### **5.1.2 Supply chain**

The scope of the interview questions related to the organization's supply chain encompassed the main customers and first tier suppliers. As it has already been mentioned above, there are no state-owned agencies among the company's clients. According to the production manager, currently the orders have been received mainly from the medium-sized enterprises, while in the nearest future the big organizations are expected to become the buyers of the gas turbines as well. With the increased quantities of orders, the production size will be intensified gradually to meet all of the clients' demands without compromising the quality factors and with small lead times.

The point of supplying the large companies was emphasized particularly during the interview, since the main barriers small- and medium-sized face with large private clients and public bodies are generally analogous. The production manager takes the large sizes of orders from larger companies into account and, accordingly, the case company has the capabilities for bigger manufacturing volumes, whereas all of the employees are highly experienced in the field of energy production to be able to manage it. In the context of public procurement, possible separation of contracts into smaller lots, the phenomenon commonly acknowledged as the helpful support tool for better SMEs' access to public procurement, was accepted by the interviewee as the highly valuable approach that would allow the company to overcome the myriad of limited resources and to possibly contemplate the strategy of bidding for state orders. As the products fall into public procurement in the utilities sector, the EU regulations are higher flexible than those of other sectors. Framework agreements can be set up to eight years on the basis of objectivity and transparency while purchasers are allowed to either award contract to one company or outline several contracts to small businesses with the overall higher thresholds (European commission 2016c). Such legislative

support can become a strong steppingstone for a case company's further state orders activities.

Since the number of possible applications of gas turbines is enormously large, there might be a need in totally different approaches. For example, gas turbines are dominantly used as the supplements of backup energy supply for renewable energy engines, such as windmills or solar panels (Richter 2010, 155). Whereas there are different reasons behind the fact, the preliminary collaboration between the producers of the aforementioned goods with the further joint bidding for a public contract appears to be highly coherent and economical. The case company's production manager stressed particularly the relevance and benefits of such practice to be used in public procurement. Moreover, the variety of renewable energy companies and already established contacts with them are anticipated to advance such horizontal collaboration by the interviewee. As the result, different benefits as mutually shared risks, substantial cost savings and joint expertise and innovation capabilities were agreed during the interview.

The second option for smaller enterprises to mitigate the burdens of bidding process and big contract sizes that was examined is the sub-contracting. Inasmuch as the case company is aiming at working with at least medium-sized organizations, the construction of collaborative relationships will definitely enhance the chances to be invited for sub-contracting works by those larger companies if they are to perform contracts for public buyers. The line drawn above is specifically important in the mean that the sub-contracting selection process is not conducted by the public procurement bodies; hence the well-established partnerships with the private clients may be especially vital. The interviewee's opinion regarding the topic was mainly positive, yet it was pragmatically mentioned that such options must be carefully examined prior to any concrete decisions.

Another crucial aspect that was discussed is the information flow and communication channels across the supply chain used by the company. As stated by the production manager, no sophisticated supply chain systems are in the use at the moment. All of the communications with customers and suppliers are done via e-mails and phone calls. It was also additionally mentioned that the company is moving towards the implementation of enterprise resource planning (ERP)

software. The current use of more simple tools is justified by the overall situation of pre-series production and, as defined by the operational director of the case company, by the fact that the organizational procurement activities are restricted to the sourcing of the components and services for the manufacturing of the turbines.

The case organization shows a good example of harvesting the benefits of a virtual enterprise by relying on sub-assemblies, machining partners and over fifty various suppliers. With the offices located in different countries, the thrust on the external resources is the core of company's responsiveness of the supply chain. The production materials and services are sourced from the market and afterwards used for the assembling activities on the production site. The importance of such flexibility is especially recognized by the interviewee as the vital part of constant development of highly innovative products. Additionally, the maintenance assistance and remote monitoring the company provides are to supplement the overall portfolio.

Subsequently, the management of the upstream of the supply chain is on the emerging stage presently. The interviewee noticed that there are no explicit and comprehensive requirements or guide books outlined for these purposes, whilst the contemporary managing the suppliers is shaped prevalingly by the two following factors: technical specifications, which are the key parameter given the complexity of products and manufacturing process, and quality and sustainability, as it may be seen in the figure 12.

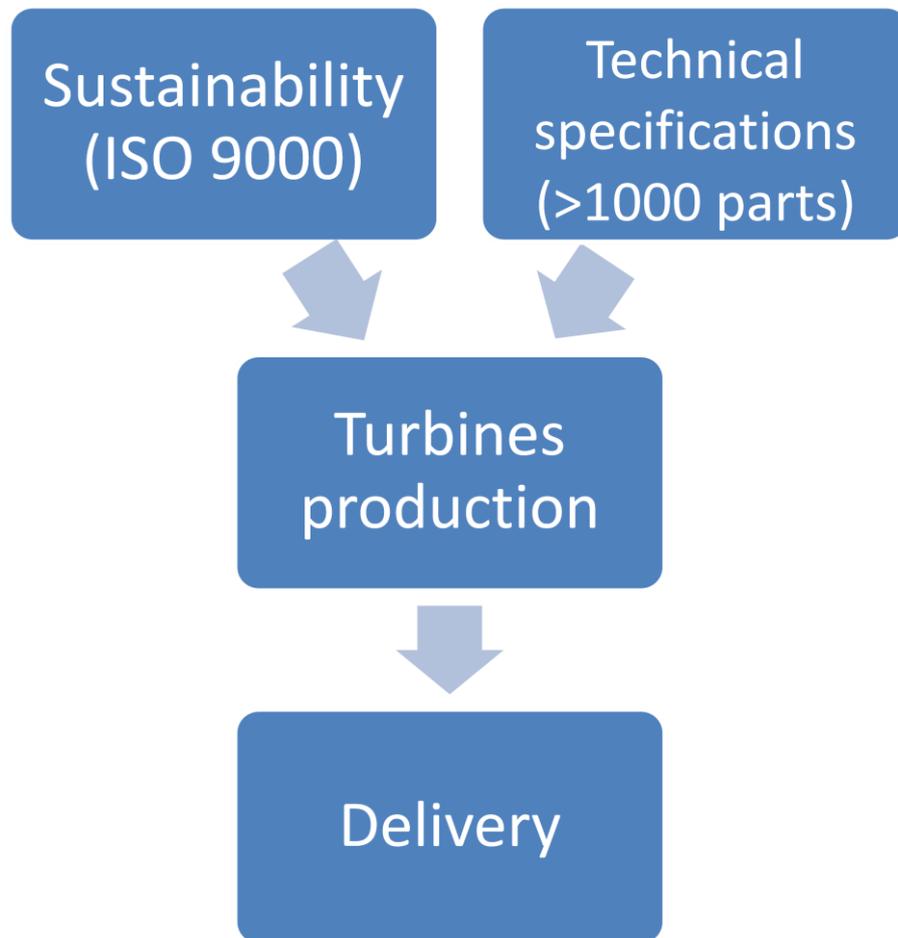


Figure 12. The process of case company's manufacturing in the nutshell

Meticulously, sustainability issues generally involve the environmental considerations, since the environmental performance is crucial for the gas turbines. No strict assessment measures are depicted internally, but the interviewee stated that the company is working on the policies. Accordingly, the forthcoming evaluations and suppliers selections will mandatorily involve at least ISO 9000 standards. Whereas ISO 9000 standards do not represent sustainability indicators precisely, it is argued by the interviewee to be an evitable basis representing the overall quality. It is pointedly consistent in the light of the current tendencies of a great number of companies incorporating sustainability as one of their primary objectives and expecting the business partners across the supply chains to correspond to certain sustainability standards, especially when the same demand comes from the downstream.

The importance of technical specifications was emphasized by the case company's production manager from the innovative perspective. The company's main activities are focused on the updating and innovating the prototypes and the first machines based on the results of the first commercial implementations. As it was specified, the overall production comprises more than one thousand various spare parts, and certain requirements to any of them is high. Thus, potential suppliers must be able to fully meet and satisfy all of the conditions in order to harmonize with the ongoing processes smoothly. However, the enlargement of the suppliers' base will only take place after the first deliveries are done, while the manufacturing will use the products and services of the suppliers involved into the prototype development. Namely, it is expected that sixty per cent of actual suppliers will remain.

The prominence of the parameters described above logically leads to the organizational approach to R&D and the key features of the gas turbines manufactured by the case company from innovative point of view, which are discussed in the subsequent part of the interview.

### **5.1.3 Innovativeness in gas turbines**

Significant part of the interview was related to the gas turbines produced by the case company and the structure of the innovative processes undergoing. In spite of the small size and virtual nature of the organization, there is distinct R&D department, which is coherent to the company's goal of manufacturing the most efficient gas turbines in the world. Furthermore, as it has already been mentioned, the emphasis has been put onto the R&D activities at the current moment with the visible outcomes, such as the various awards and merits in different cleantech and energy forums.

The main areas of innovation of the gas turbines were discussed with the interviewee and ensuingly applied for the analyses of the company's products. Consistent with the conventional views (Unger and Herzog 1998, 19 – 20; Overton 2014), the essential innovative aspects are the greenhouse gases emissions,

efficiency, design flexibility and the overall life cycle and maintenance.

Unsurprisingly, the company focuses on all of the points above.

Since all of the turbines are designed according to the customers' demands and requirements, the flexibility on the general level is very high. The possible applications of the products encompass the areas in which the demand for innovative solutions is at its highest. For instance, cogeneration, or combined heat and power (CHP) on the small scale, is mentioned by the production manager as relatively new and fruitful market requiring new solutions. As it may be seen in the figure 13, Finland is one of the most intensive countries in the CHP production responsible for 33.8 per cent of gross electricity generation. Given the increasing popularity of small-scale CHP, the company's products are expected to find the niche, whereas an insight from the picture X not being a part of the interview is presented below in order to verify the feasibility of company's vision. Nevertheless, the implementation may also be found in simple- and combined-cycled power plants, refrigeration and other industrial and commercial purposes.

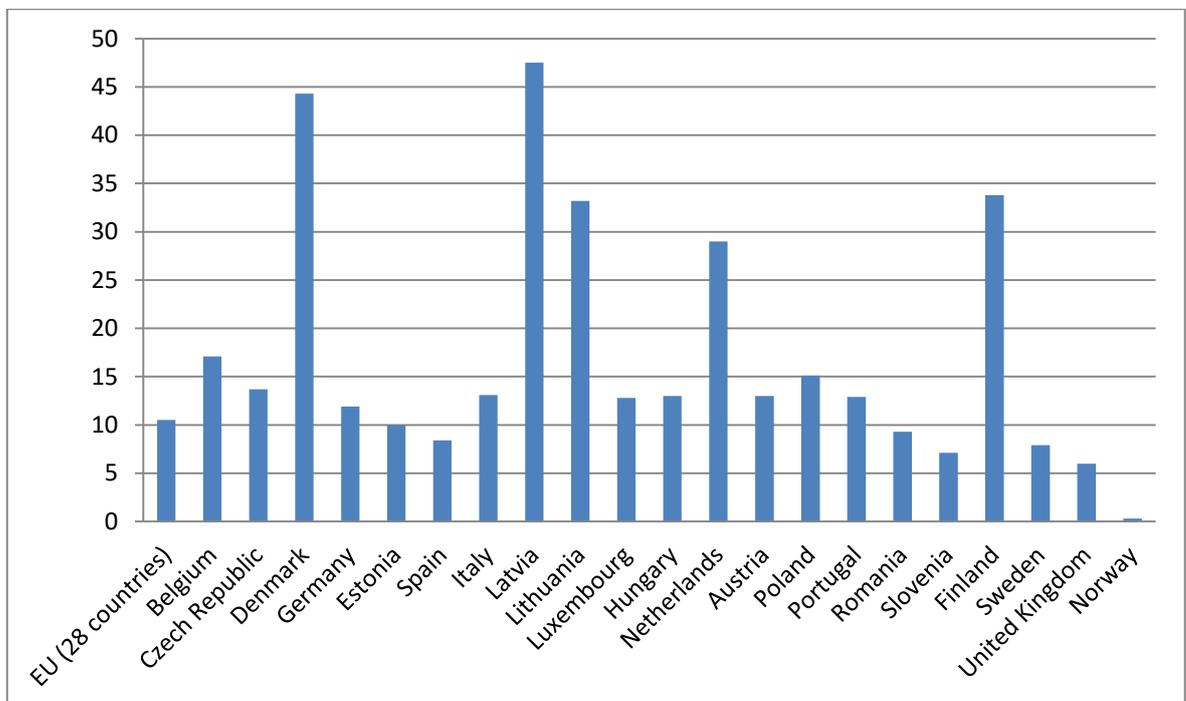


Figure 13. CHP generation as the % of gross electricity generation (author's own creation based on Eurostat 2017).

The wide applicability has been achieved because of several key innovations. The lead point of the extensive R&D work is the modular design bringing extra agility to the range of aspects. Along with the options of integration into different sectors, the retrofitting is argued to be the fundamental driver of the innovating the current technologies of gas turbines. In other words, new units may be integrated into the existing systems and infrastructure and paralleled without any additional modifications, which is especially relevant from the contemporary point of view. Similarly, the production manager clearly stressed the dominance of the upgrading ability enhanced by modularity demanded by customers.

Inevitable part of the case company's innovative agenda is formed by the life cycle evaluation. Inasmuch as the relevance and prominence of this approach in the context of PPI has been determined in the theoretical part, the interviewee confirmed the pattern. Accordingly, the systematic approach has led to the minimum life cycle time of gas turbines of fifteen automated years. The overall cost of ownership has also been decreased considerably because of the use of active magnetic bearings, exempting the necessity in the lubrication and related maintenance meaning smaller down times.

Even though the gradual upgrades of the turbines may increase the life time significantly, there is still a point after which the further ordinary use of the product is not possible. At this point, the interviewee stated that the company plans to interfere with the products after the end of the life cycles by implementing the reverse logistics. As such practice has been widely implemented in the framework of green supply chain management (GSCM) concept, treatment of disassembled parts and reused materials is the decisive step ahead that can undoubtedly stimulate the entire supply chain to adjust own capacities and design in response to the emerging sustainability needs as the part of innovative strategies.

Finally, the main specifications of the prototype for the first deliveries were described during the interview. The electrical output of the gas turbine is 400kW with the efficiency at 40.2 per cent, making these small turbines one of the most efficient in the market. The environmental performance's key indicator of the energy engines operating at combustion of gaseous fuels is the NO<sub>x</sub> emissions in mg/Nm<sup>3</sup>, and the amount of the emissions resulting from the case company's

prototype is less than 20 when the turbine operates on the natural gas. However, liquid fuels, biogas, biodiesel and various synthetic gases may be used as well as natural gas.

#### **5.1.4 Summary & benchmarking**

The present section is aimed to underline the main conjunction points of the interview with the case company. The summary starts from the comparative benchmarking of the main technical specifications of the case company's prototype and similar products of other dominant manufacturers, which may be seen in the table 7.

Table 7. Comparative benchmarking of gas turbine manufacturers.

	<b>Case Company</b>	<b>Company A (SME)</b>	<b>Company B (MNE)</b>	<b>Company C (MNE)</b>	<b>Company D (MNE)</b>
<b>Power output</b>	400 kW	600 kW	4000 kW	600 kW	3900 kW
<b>Efficiency</b>	40.2%	33%	29.7%	19.4%	29.1%
<b>NOx emissions</b>	<20 mg/m <sup>3</sup>	N/A	≤ 25 ppmvd	50 ppm	N/A
<b>Lubrication</b>	No; active magnetic bearings used	No; air bearing used	Needed	Needed	Needed
<b>Modularity &amp; retrofit</b>	Yes	Yes	N/A	No	Yes
<b>Compatibility with liquid fuels</b>	Yes	Yes	Yes	Yes	Yes
<b>Compatibility with bio- and synthetic fuels</b>	Yes	Yes	On request	No	N/A

Prior to any analyses, it must be acknowledged that the power output is key parameter that is positively correlated the efficiency and emissions produced. Within the cases of larger companies B, C and D the minimal power output machines have been presented, giving interesting results. Firstly, larger companies hardly produce small-scaled units, and the starting electrical output of auxiliary devices may begin at mega Watts. Inasmuch as the biggest clients

appear to seek for massive industrial solutions, smaller procurers may be challenged significantly. Secondly, arising from the aforementioned fact, the large manufacturers put the focus of R&D onto the biggest machines exceeding the ratings of 100 MW and getting the efficiencies slightly above 40 per cent.

On the contrary, only smaller companies recognize the importance of small-scaled production and, hence, have the full capabilities to take the niche. However, the main interest and curiosity come from the technical specifications of SMEs' units that allow outperforming the ones of the bigger companies' notably. The efficiencies are indeed large, which is especially crucial and has not been reached by big producers.

The service issues are also in the agenda, as the cease of lubrication necessity and shift towards air- and magnetic bearings is significant innovation that might increase the overall lifetime and simplify the maintenance. From the smaller customers' perceptions, which might lack the technical expertise and, hence, be incapable of maintaining the turbines by themselves, the innovations within such dimensions recognized by SMEs and coupled by possibility of remote monitoring and support, as mentioned by the interviewee, are certainly beneficial.

Particular patterns of similarity may be observed in the compatibility with other types of fuels. Liquid fuels, such as kerosene and diesel oils can be principally used in any gas turbine reviewed. However, the applicability of biogas, biodiesel and other different unconventional fuels varies. Whereas small-scale off-shelf turbines of the case company and company A can already be used for such purposes, the turbines of larger companies are either incompatible or require additional modifications by manufacturers on request. Generally, the pertinence of non-standard fuels is dependent on the degree of flexibility of the design of a turbine and, especially, modularity of a combustion chamber.

Yet, the modularity, in general, and the retrofit options are the crucial determinants of the long-term sustainability and life cycle of gas turbines, since they allow integrating the engines into the existing and even outdated machineries smoothly and their gradual update, easier repair and parallel of several devices to synchronize the power outputs. As it may be observed, both small and large

companies recognize the prominence and growing value of these factors, whereas, however, smaller companies tend more to prioritize and explicitly outline them. Larger companies, unsurprisingly, put the focus on the flagman products and, thus, the smallest turbines might be incomparable in the means of flexibility.

## **5.2 Results from the tenders**

### **5.2.1 Preparation for tenders**

At the outset, it can be noted that no social problems have been expressed explicitly as the dominant source of the procurement. Instead, it might be stated that latent incorporations of social needs may be faced in the general descriptions of projects. For example, Mekrijärvi Research Station is particularly indicated as the inevitable part of University of Eastern Finland that supports and facilitates the ecological research and education, as well as provides various facilities valuable to local people. As there are increasing needs in electricity and heating, combined heat and power system is recognized as the highly valuable solution with respect to different dimensions.

Within the cases observed the stage prior to the invitation to tendering plays essential role in the entire procurement process. Whereas the scopes and volumes of contracts and, thus, organizational capabilities involved vary, the importance of the relevant groundwork is comparable to a certain extent.

First of all, the consultations are utilized as the beneficial tool for the further design, even though the implementation is different. In the case of Mekrijärvi Research Station's small-scale CHP procurement, the preliminary market consultation was conducted by surveying the potential suppliers according to the maximum heat requirements in the winter period and the proprietary knowledge. Such approach is specifically logical in the light of the fact that the technical parameters of the tender do not indicate any concrete type of engine to be supplied, but rather the power output and other specifications. The initial survey has resulted in several technologies considered by the purchasing organization that might be involved into the CHP system. Namely, the list encompasses organic

rankine cycle (ORC) turbines, gasifier piston engines, hot air- and gas turbines, as all of the aforementioned technologies allow converting the heat produced into the energy. Additionally, two experts in small-scale CHP and local heat district have been consulted in order to draw apparent requirements and aspects of maximum electricity power that might be required considering the major external factors.

Meanwhile, larger procuring organizations appear to choose more systematic tools in obtaining the external knowledge and expertise. Gasum Oy, a Finnish state-owned organization operating in natural gas and biogas sector and offering solutions for energy production, transportation, industrial and household applications, gets the engineering and project service consultations from Neste Jacobs Oy, expert company in clean and high technologies, within the boundaries of five-years framework agreement signed in 2016 (Neste Jacobs 2016). Such example of taking advantage of a peculiar form of a public-private partnership (PPP) is certainly sympathetic path of in the means of achieving transparency and better product development. From the suppliers' perspective, it might also be a trigger that would stimulate the intensification of innovations in the higher integrated market. Expectations of higher requirements and opportunities to new strategic alliances with the companies in the aforementioned types of PPPs can particularly enhance the performance of public tenders and participation of smaller companies in them in the pursuit of achieving the high-hanging fruits that can only be achieved by going beyond minimum technical specifications.

It may, nevertheless, be argued that the previously mentioned form of partnership is rather the outsourcing of non-core activities to external expert company that has more capabilities in specific area of tasks. However, the nature of public contracts involving innovations is not linear, and the variety of different combinations of approaches to obtain market knowledge is only limited to the company's determinants and competences. It is especially coherent given an absence of unified and all-inclusive interpretations of public-private partnerships.

### **5.2.2 Tendering procedure design**

The cases reviewed represent two different types of public procurement procedures implemented by purchasing agencies. Mekrijärvi Research Station in spite of preliminary suppliers research and contacts has preferred the open procedure, id est any interested company could leave the tender. For such purpose, the buyers published invitation to tender in HILMA, Finland's procurement resource by the Ministry of Employment and Economy. Obeying the national and the EU legislation has been conducted, since the invitation to tender in Finnish, one of the official languages of the EU, was opened 49 days prior to the submission day, while the European legislation mandates that the minimum time suppliers must have to submit a tender is 35 days from the publication of notice (European Union 2017). However, the important prerequisite for companies interested is the personal visit and inspection of the research station's site. The point has been particularly emphasized from the perspective of the retrofit, as the new system must be integrated into the already established infrastructure and structure. Meanwhile, it has been argued that the general peculiarities and distinct aspects of the research station's power plant play enormous role in the decision making process, since there are certain limitations and challenges possible providers might face, hence, is it especially important that the tenders submitted consider all of the requirements.

Slightly dissimilar approach has been chosen by Gasum Oy. As it may be derived from the call for tender, the procedure is restricted to five pre-selected candidates in the case there are more than five applicants. The initial contract notice and invitation to tender are published 21 days prior to the request to participation with 37 days from the selection of the candidates to the final submission of tenders, including opening and closing days. The EU legislation on the public procurement declares that the time limit to request willingness to participate from providers is 37 days, whereas pre-selected candidates are to have at least 40 days to submit the tenders, or 36 days in the case prior notification is outlined (ibid). The selection criteria for the restricted procedure are presented in the table 8.

Table 8. Restricted procedure candidates selection criteria.

Criteria	Weight value
Supplier has performed and obtained references from similar deliveries within last ten years	40 %
<ol style="list-style-type: none"> <li>1. One reference – 1 point</li> <li>2. Two references – 2 points</li> <li>3. Three or more references – 3 points</li> </ol>	
Candidate's successful experience in production of FG systems	20 %
<ol style="list-style-type: none"> <li>1. Less than three years – 0 points</li> <li>2. From three to five years – 1 point</li> <li>3. From five to ten years – 2 points</li> <li>4. More than ten years – 3 points</li> </ol>	
Spare parts availability and delivery time	20 %
<ol style="list-style-type: none"> <li>1. Delivery within more than three days – 0 points</li> <li>2. Delivery in three days – 1 point</li> <li>3. Delivery in two days – 2 points</li> <li>4. Delivery in one day – 3 points</li> </ol>	
Guaranteed life cycle with the minimum of 15 years	20%
<ol style="list-style-type: none"> <li>1. At least 15 years – 1 point</li> <li>2. At least 20 years – 2 points</li> <li>3. At least 25 years – 3 points</li> </ol>	

Furthermore, it is indicated that while the present subject for tendering is particular compressor station, candidates can optionally include in the tender matters regarding supply of identical gas turbines fuel governor to another compressor station, which might possibly be referenced no earlier than in three years. However, the procurement unit does not take any obligations related to the purchasing of the optional FG systems.

### 5.2.3 Tender documentation

The degree of volumes of the required documentation to be submitted in the tender is different and possesses contradictory implications. Since Gasum Oy runs

the restricted procurement procedure, the certificates candidates ought to present are divided within the following three stages: willingness to participate application, tender and purchase order.

In the selection phase, suppliers have to submit electronically the buyer's pre-defined forms, in which confirmation to participate, references to previous deliveries and the selection criteria documents are filled and described. At the same time, the dominant aspects related to candidates' business indicators, financial status and other relevant information have to be provided through the ESPD. In addition, the free-formed reports in which candidates guarantee and outline the availability of support and spare part services and depict the assurance that the life time of FG systems is at least fifteen years.

Once a company is nominated to leave the tender, the documentation to be presented encompasses the tender letter, pricing form, technical description, preliminary quality- and implementation plan, timetable of installations, descriptive information of the key personnel to be involved and preliminary list of sub-suppliers and sub-contractors, description of the support and development services, price list of recommended spare parts required within four years of constant operation and minor administrative and reimbursement papers. The final seller is, finally, obliged to submit specific technical drawings and diagrams related to the implementation of products.

In the case of Mekrijärvi Research Station, the description is given on the overall performance of tendering candidates regarding the documentation. Whereas the legal and financial data, supply solution and other attachments are determined as crucial, the procurers emphasize that in the particular case given, the most important point is submitting the tender in general. Specifically, even if it is not fully matching to the technical specifications, formally compliant tender that is only partially corresponds to purchase requirements can be a determinant of opening negotiation process if no tenders adhere to the invitation. The recommendation stems from the fact the contract has been awarded to the company whose offer is not fully technically obedient and that would probably not win the contract under more competitive circumstances. The aforementioned recommendation is, moreover, in line with the ones given by Gasum Oy suggesting to submit only the

required documents and to obey all the formal rules, while any extra or additional attachments not related to the concrete tender are not favored at any point.

#### **5.2.4 Evaluation criteria**

The contract-awarding principle utilized by both purchasing agencies is based on the EMAT. Such choice is consistent and entirely logical, as the procurement of sophisticated technologies involved cannot be based solely on the price factor. Moreover, in the case of small-scaled CHP, the complication is even more amplified by the fact that the estimations have also to be done among several different types of engines which might be involved. The ratios of price to quality factors vary notably.

In the foregoing instance, the value of price and quality factors is almost equal. Out of total 40 points, 20 points are referred to total price, 16 points can be obtained by fulfillment of technical aspects, and the maximum of 4 points are given for costs of maintenance. As it has been further described, the technical specifications comprise the possibility of retrofitting the engine procured into current outdated systems, technology used in electricity generation, efficiency, automated cleaning and feasibility of use wood pellets as fuel. The latter one is particularly indicated as the essential factor.

The tenders of pre-selected candidates for the FG systems are evaluated by examinations of several sets of different principles. The quality factors weight for the 65 per cent of the final ranking and divided into four groups: functionality (30 per cent), technology of the system (15 per cent), organization of the project (10 per cent) and support and maintenance (10 per cent). The price considerations include the separate total prices of delivery to both compressor stations (15 per cent each) and the service prices for the three years (5 per cent).

Prominent conjunction point extracted from the observations above lies within the fact that in both cases life cycle evaluation is utilized and, thus, the financial aspects differentiate the direct purchasing and the service costs. It is especially valuable in the gas turbines industry, in which the life time of units is expected to

last for decades and, hence, the importance of proper service and maintenance is at its highest.

### 5.3 Results from the survey

The following sub-chapters are presented according to the classification of questions implemented in the survey and aimed at analyzing the results alongside recognizing of patterns.

#### 5.3.1 Background information

All of the questions of this section are mandatory and focused on comprehending the extent to which respondents are familiar to and experienced in aspects related to gas turbines and innovativeness in the context of public contracts. Since the sample group includes public procurers only, questions related to job functions, tasks and areas of procurement have been considered unrequired. Similarly, any questions concerning the personal information have been omitted.

Altogether, five persons have participated in the survey. To begin with, only one respondent has certain experience in the procurement of gas turbines, whilst others neither have been involved to procurement of gas engines nor to any other energy machines, as it can be seen in the figure 14.

Have you been involved into procurement of gas turbines? (5 responses)

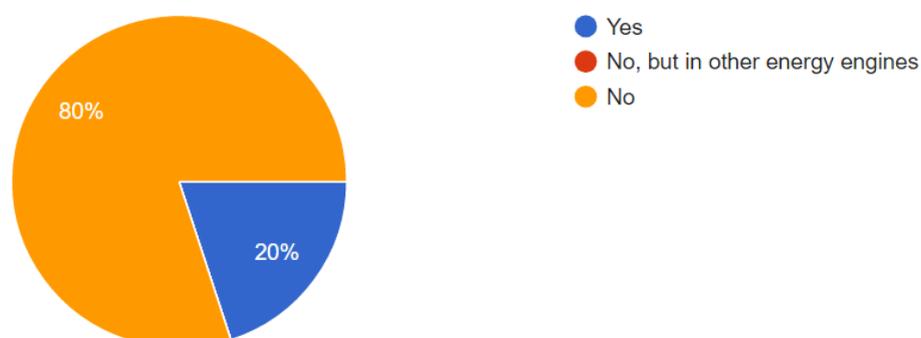


Figure 14. Respondents' expertise in procurement of energy engines

More surprising and interesting outcomes are faced in the next questions. As it has been expected by the researcher, the majority of respondents would be at least familiar to the concept of public procurement of innovation. The preconditions for such expectations stem from the overall state of development of public procurement as distinct discipline and practical recognition of its contemporary issues. However, only one person has indicated an acquaintance of the aforementioned term (figure 15). It might yet be partially the result of the variety of different overlapping terms and concepts describing the role of innovations in public procurement.

Are you familiar with the concept of Public Procurement of Innovation (PPI)?  
(5 responses)

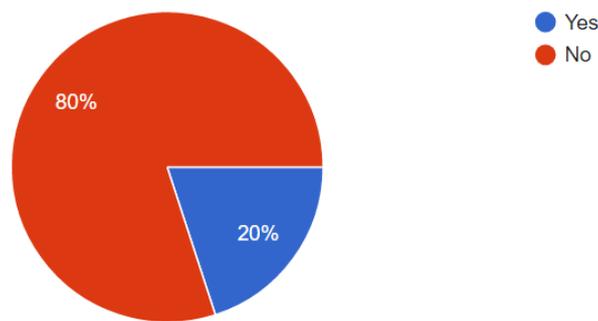


Figure 15. Respondents' awareness of PPI

Nevertheless, when asked about the degree of integration of innovative aspects into ordinary procurement practices, all of the survey participants have expressed that innovations are partly incorporated, as it may be derived from the figure 16. This result is especially appealing and can be surprising not only to the researcher, but to the respondents as well, considering their unawareness of PPI from academic viewpoint.

Are innovative aspects integrated into your procurement processes?  
(5 responses)

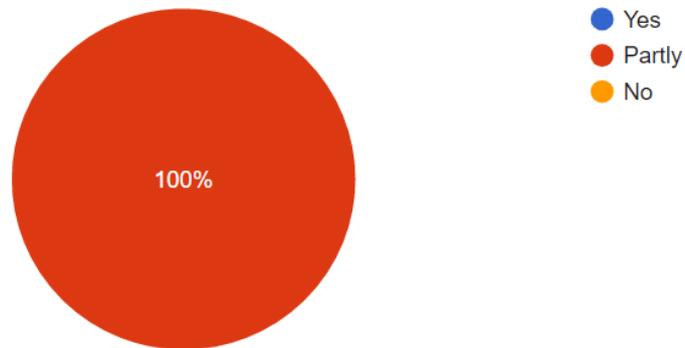


Figure 16. Degree of innovative aspects in procurement practices

### 5.3.2 Utilization of PPI

Current section's goal is to investigate deeper the appearance and organization of innovative issues in public procurement along with determinacy of tools and techniques that are in the use. Additionally, respondents have been asked to evaluate the benefits of PPI. None of the questions are mandatory and participants were informed to skip any question they are unable to answer. Nevertheless, all of the questions have attained answers from each respondent.

Firstly, all of the questionnaire participants have responded that a typical innovative procurement process involves purchasing of products or services that are already or nearly in the market involving continuous improvement process, meaning the incremental innovations, whilst disruptive innovations have not been sought to take place in public contracts, which can be seen in the figure 17.

"Other" open box has also remained empty

### How would you characterize your ordinary innovative procurement process?

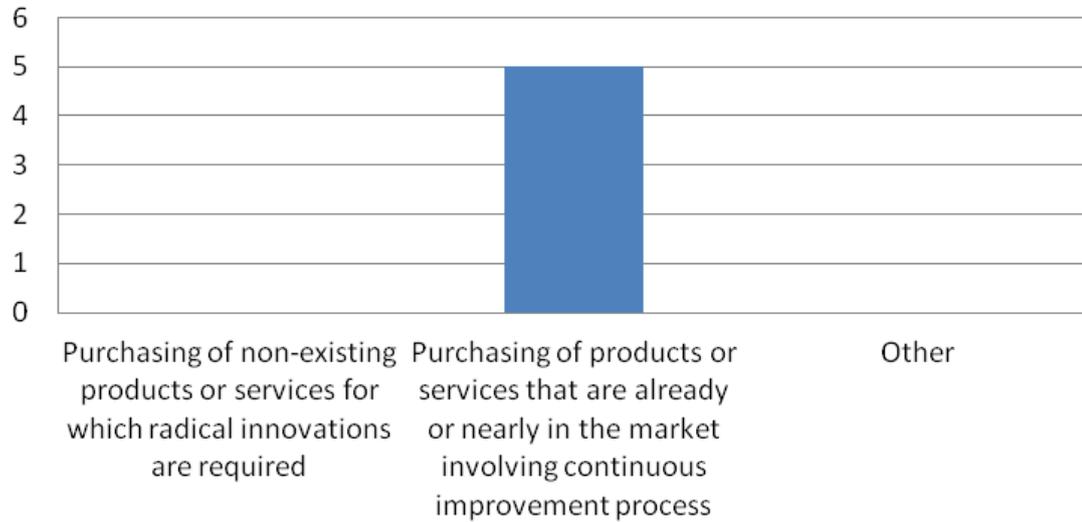


Figure 17. Type of innovations procured

According to the conventional scientific knowledge on the PPI, the end-user of innovations developed through the public contracts is one of the key dimensions influencing the overall design and features of purchasing process. Therefore, the respondents have been asked to indicate the final parties who ordinarily benefit the technologies cherished. 80 per cent of survey participants have indicated society as the dominant enjoyer of products and serviced developed, which is adherent to the main goal of the PPI in solving different social problems and challenges and enhancing infrastructure and general distribution of public services. Market is recognized as the beneficiary of innovative public procurement by 60 per cent of respondents, whilst 40 per cent have pinpointed purchasing agency itself as the final customer of technologies procured. Yet, none of participants consider any third parties the heirs (see figure 18).

## Who is the final user of the technologies procured?

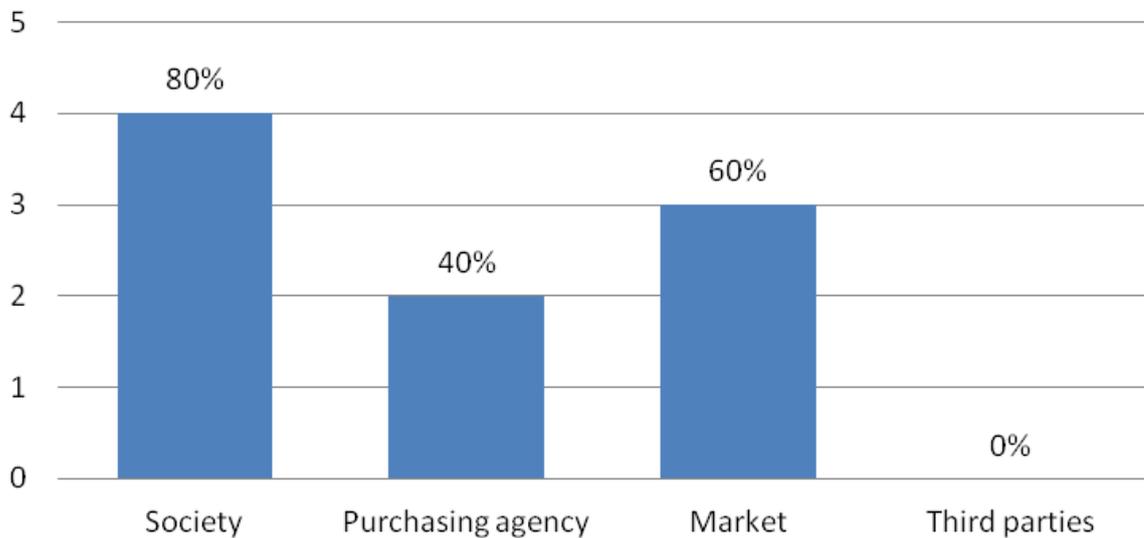


Figure 18. End-users of the developments

Subsequently, innovativeness in relation to the cost factors has been the subject of inquiry. As the figure 19 depicts, all of the participants acknowledge it as nearly equal to financial aspects with the moderate appearance. Given the already identified state of incorporation of innovativeness into public contracts, the results are consistent, even though it could be expected that cutting-edge elements would take very minor role according to the low awareness of the PPI.

How is innovativeness outlined in your tenders? (5 responses)

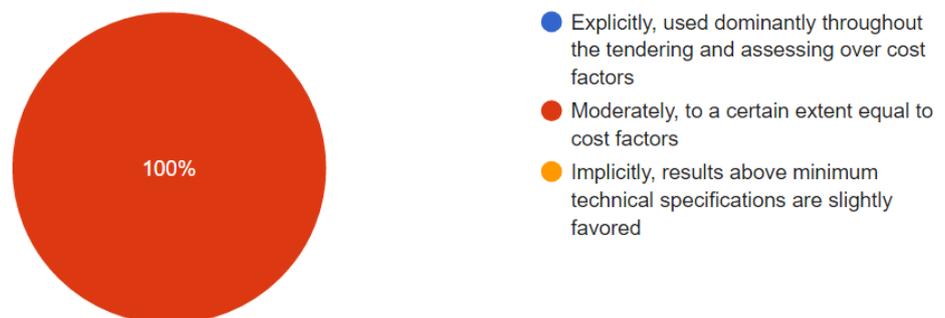


Figure 19. Innovative- to cost considerations relation

By the reason of diverse nature of the toolbox used by innovators in public procurement underscored by specificity of the PPI it is important to get practically new insights on more profound level, considering the theoretically determined inability of presenting the bottom line of techniques applied within the PPI shortly and, at the same time, comprehensively. Lack of adherence may especially be reflected on the comparative basis, as the tools utilized in one industry can hardly be applied in the other.

According to the figure 20, respondents' interest is equally distributed among life cycle evaluation, EMAT and flexibility as supporting approaches in designing and executing innovative public tenders with 80 per cent in each. Such results are harmonious with the conventional theory recognizing them as vital determinants of the PPI, as its non-linear and rigorous structure requires certain space for possible reconstructions along with proper value identification by differentiation and evaluation of total purchase and maintenance costs.

Preliminary market consultation is indicated only by 40 per cent of respondents, whilst exclusion criteria are applied only by one participant. Market consultations by public purchasers represent peculiar procedures demanding distinct efforts and capabilities alongside cautious implementation to keep it within the boundaries of regulations and fair competition. As assumed by the researcher, according to already derived patterns it can require particular form of the public-private partnership or some other form of collaboration between two parties. Low rate of responses in the use of exclusion criteria can, at the same, be possibly explained by the of a unified and predefined procurement forms, for example ESPD, in which general exclusion criteria are initially integrated, hence there is no need in further going deeply into it unless very special assets take place. The fact that none of the participants have used prior notifications of intentions is consistent with the matter that innovativeness is expressed moderately and mainly involves incremental innovations, whereas prior notifications are prevalingly utilized in the disruptive technologies development, where notable time intervals are engaged.

## Which innovative aspects and techniques are in your use?

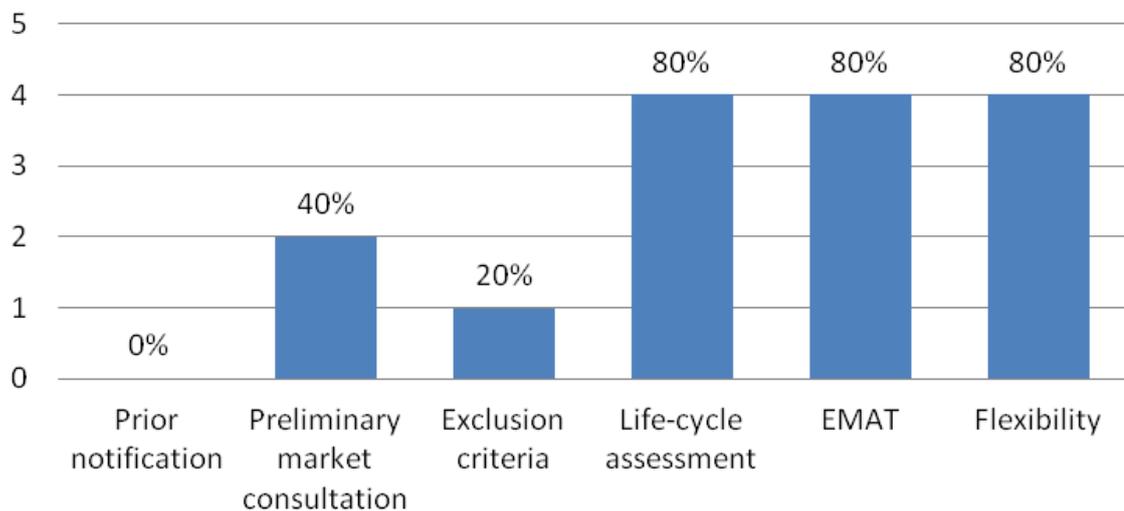


Figure 20. Innovative tools used

The latter part of the section is focused on gathering participants' evaluation of importance of different benefits innovative public procurement possesses on the scale from 1 (irrelevant at all) to 5 (very important). The first subject of assessment is the solutions to social challenges provided by the PPI, and the results suggest that 80 per cent of respondents consider this benefit important, while one respondent has indicated the highest prominence of the aforementioned benefit (figure 21).

Solutions to societal problems and challenges (5 responses)

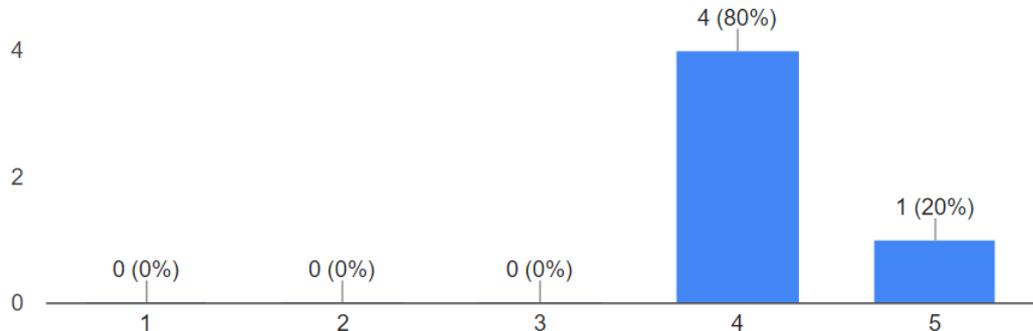


Figure 21. Importance of social problems solution through PPI

Symmetrical graphics can be seen regarding better infrastructure obtained by enhanced products and services publically procured. The questionnaire participants recognize it as especially valuable gratuity of incorporating the innovativeness into procurement of public goods (see figure 22).

Better infrastructure through developed products and services (5 responses)

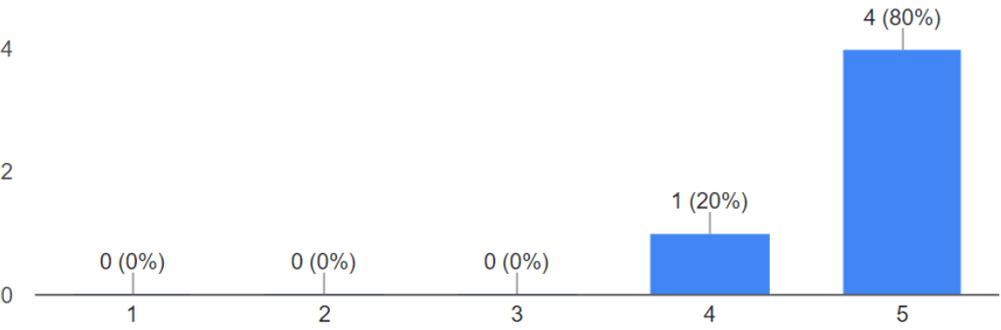


Figure 22. Importance of better infrastructure through PPI

Higher market interaction and intensified competition is also emphasized as notably decisive benefit to be obtained with 60 per cent of replies assigned to the highest scale, which can be seen in the figure 23. Moreover, as it has been discovered within the previous parts of the thesis, one possibility principally

relevant to smaller organizations is the joint bidding for contracts in the form of horizontal collaboration. In other words, companies have to interact between one another more actively towards collaborative relationships.

### Higher market interaction (5 responses)

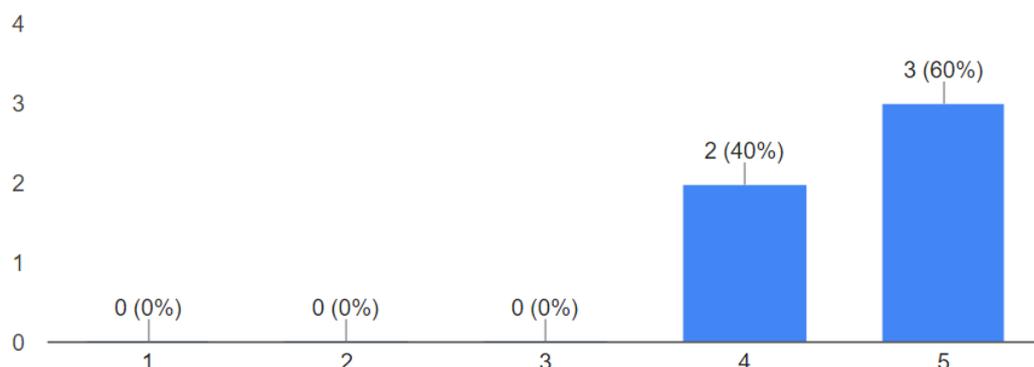


Figure 23. Importance of higher market interaction

Consequently, more equal distribution of responses may be derived from the figure 24. When asked about the stimulation of R&D by triggering innovations in public contracts, one purchaser has indicated it as moderately important feature of the PPI, whilst the importance scaled by 4 and 5 marks have attained two replies each. As it has already been determined in the theoretical section related to the benefits of the PPI, public procurement of innovation may truly intensify the competitiveness of markets, even though this aspect is partially neglected by contemporary academic sources.

## Stimulation of R&D (5 responses)

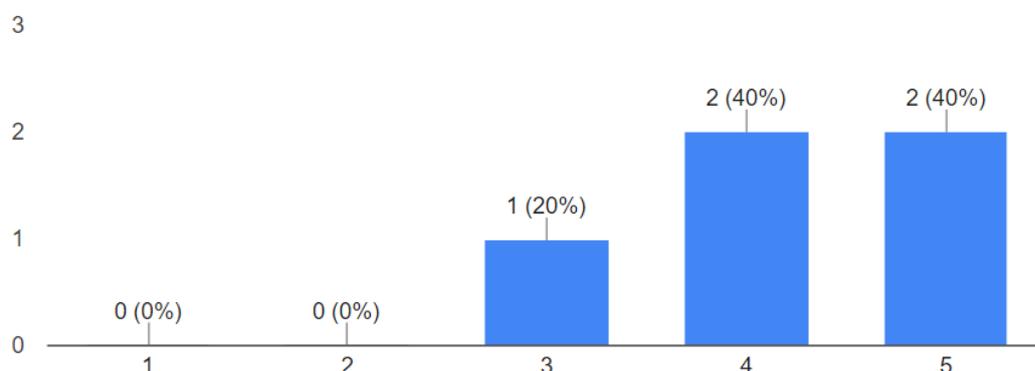


Figure 24. Importance of R&D stimulation

Boost of local economies and creation of new job places has attained distribution of replies nearly similar to the R&D stimulation's one, as figure 25 depicts. Only one person has pinpointed it as a very important benefit of innovative public procurement, whereas scales of 3 and 4 have equally gathered two marks each. The modern scholar sources emphasize that creation of work places and overall industries development may specifically be enhanced by simplifying public procurement process and creating the favorable conditions for smaller companies in economically challenged regional markets in which SMEs, the core players in national innovation systems, play the dominant roles, hence analogous links will be built in the forthcoming analyses.

### Creation of work places (5 responses)

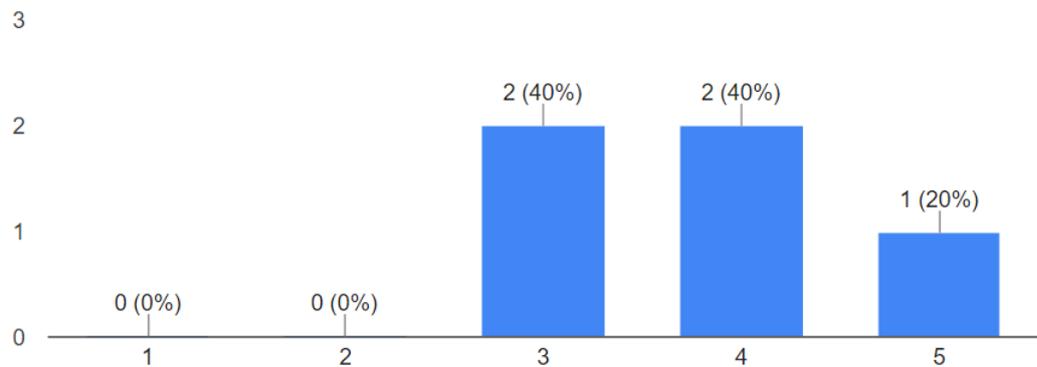


Figure 25. Importance of work place creation

Finally, the use of public procurement as the innovative policy instrument is known for smoother and more transparent transactions and, thus, the increased confidence. Preeminent cost savings are achieved, while both parties mutually share risks. Comparable viewpoints are shared by the respondents, with 60 and 40 per cent of the replies standing for important and very important answers respectively (see figure 26).

### Reduced costs and jointly shared risks (5 responses)

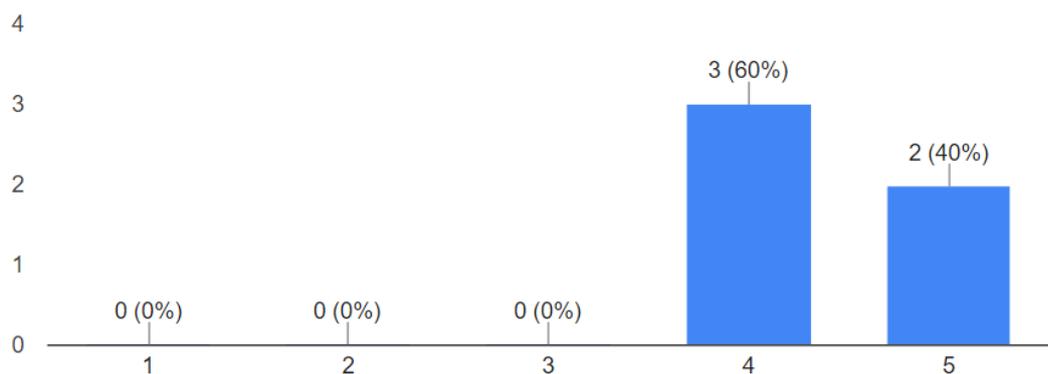


Figure 26. Importance of costs reduction and joint risks mitigation

### **5.3.3 Gas turbines**

The purpose of the actual part of the survey is to examine the applications of gas turbines procured by respondents and to evaluate the innovative significance of the main indicators on the scale of 1 – 5, that is identical to the one described earlier in the previous section. Questions are also voluntary and participants were instructed to skip questions in case they are inexperienced in the field.

Since only one person has indicated the experience in gas engines procurement in the first part of the survey, the question related to the sphere of application has received, unsurprisingly, only one reply representing the CHP. Other answer options encompass simple- and combined-cycle power plants, industrial solutions, renewable energy systems and passenger vehicles.

Other questions have attained four responses each, meaning that in spite of absence of gas turbines and other energy engines in the procurement lists respondents are still aware and interested in the subject. All of four participants have stated that the public demand for gas turbines will definitely grow, as illustrated in the figure 27. It is an important evidence of public recognition of clean energy potential of gas combustion technology to the extent of already determined phenomenon of wide applicability of gas turbines as the environmental-friendly electricity production engines because of very minor CO<sub>2</sub> emissions, especially as auxiliary devices of backup electricity supply for renewable energy systems (Richter 2010, 155).

## What is your opinion on the public demand for gas turbines in the future?

(4 responses)

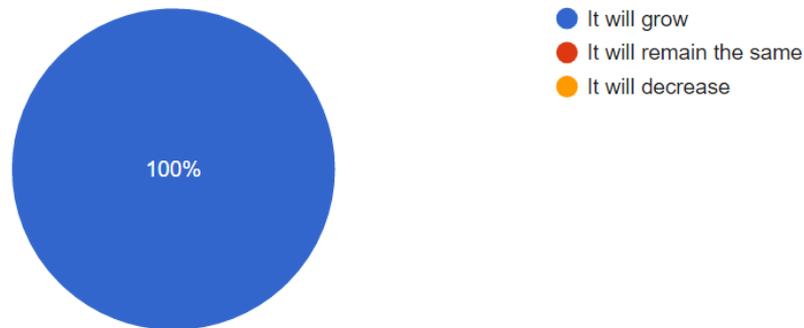


Figure 27. Public demand change for gas turbines

The following part of the section covers evaluation of innovative importance of certain aspects of gas turbines. Predictably, all respondents have stressed electrical efficiency as very important (see figure 28). Adherent to the preceding findings, the efficiency is the cornerstone of energy generation influencing the majority of other factors and features.

## Efficiency (4 responses)

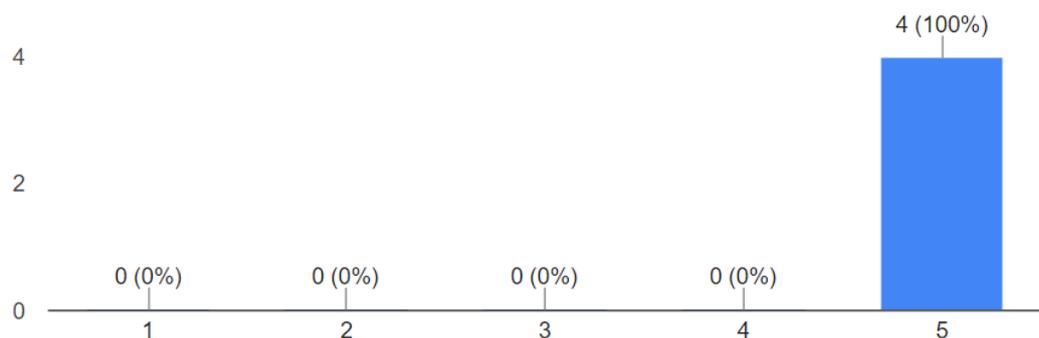


Figure 28. Importance of innovations in gas turbines' efficiency

Environmental performance is aggregately represented as the greenhouse gas emissions. Typically, they are calculated in the equivalent of CO<sub>2</sub>, whilst the EU regulations in the case of gas turbines focus on NO<sub>x</sub> emissions. In order to avoid any confusion, the aforementioned characteristics have been omitted. As the

result, innovations in emissions are identified as very important by 75% of participants, while one person has indicated the significance at one index less, which might be seen in the figure 29.

### Greenhouse gas emissions (4 responses)

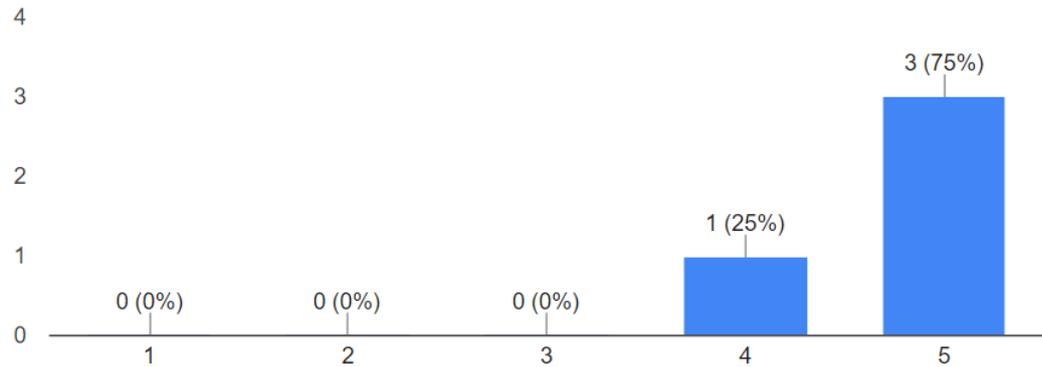


Figure 29. Importance of innovations in gas turbines' GHG emissions

One person has reported that opportunity to run a turbine on some other compositions of natural gas or on other types of fuels is very important, whereas other respondents have found it slightly less important, as it may be derived from the figure 30.

### Flexibility to various natural gas compositions and other fuels (4 responses)

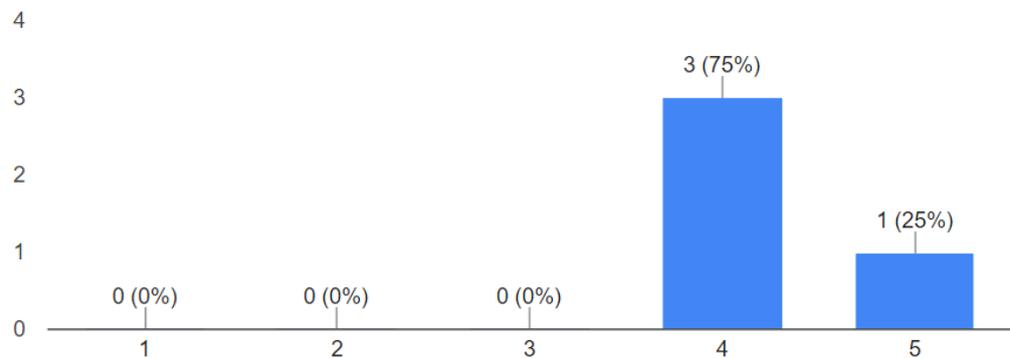


Figure 30. Importance of flexibility to different types of fuels

The concerns regarding flexibility are even higher when it comes to the design allowing gradual upgrade and retrofitting into existing plants and systems without any major modifications, suggested by figure 31. Accordingly, innovations of such feature are stressed by 75 per cent of respondents as highly important.

#### Flexible design for upgrade and integration (4 responses)

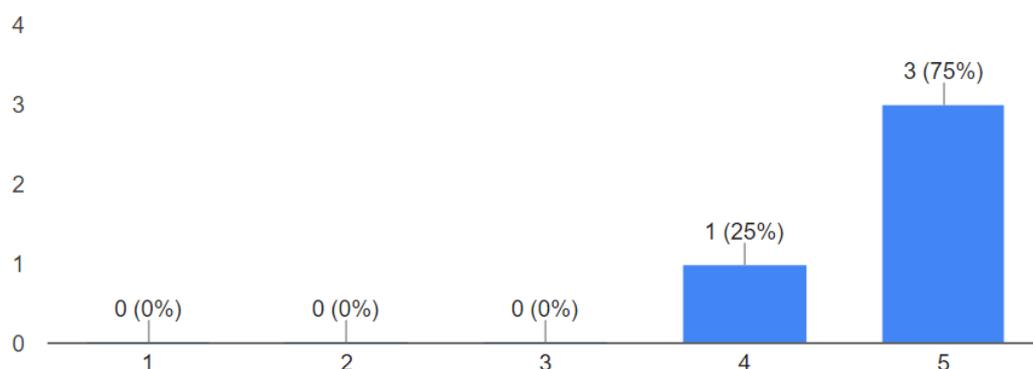


Figure 31. Importance of gas turbines' flexible and modular design

Totally identical distribution of replies is faced in the assessment of prominence of guaranteed life cycle. Unsurprisingly, the period of time a product is able to work is, perhaps, of the most significant characteristics of almost any products in different sectors and purposes. Moreover, the previously described flexible design and life cycle are correlated aspects, since modular design allowing partial development; upgrade and repair can directly affect the amount of time a turbine can be used.

Finally, the point of innovating the maintenance process depicts equally shared responses for the two highest scales (see figure 32). Facilitated and automated maintenance of turbines means smaller down times coupled by decreased variable costs. As life cycle evaluation has been utilized by the part of respondents, the pattern identified is coherent.

## Maintenance (4 responses)

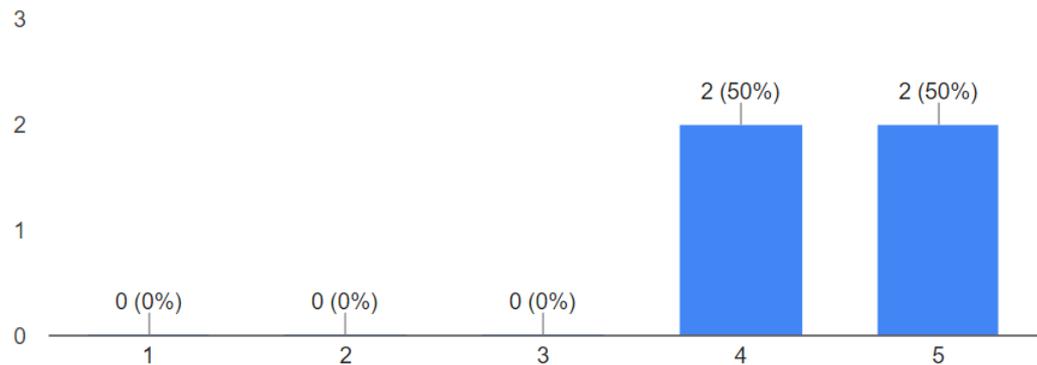


Figure 32. Importance of innovations in maintenance

### 5.3.4 SMEs

The latest section subsumes the involvement of small and medium enterprises within the procurement practices of survey participants. The objective is to acquire sagaciousness of shares of SMEs bidding for public contracts, the main barriers that hinder the successful performance and tools respondent undertake in order to support small companies.

Logically, the first question embraces the proportion that SMEs take among all of the bidding organizations. Figure 33 epitomizes that 80 per cent of participants have indicated the share SMEs account for is from one fifth to half of all the companies participating. If compared with numbers retrieved from academic sources, the results are certainly appealing and possess the positive tendency, as the majority of small organizations prefer not to submit the tenders in cases they do not find an opportunity to compete feasible.

What is the proportion of SMEs among all of the bidders? (5 responses)

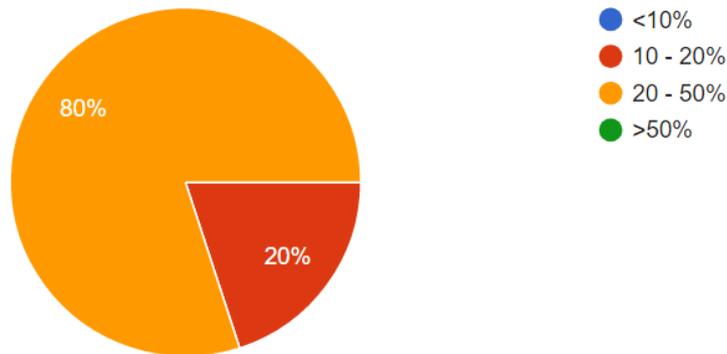


Figure 33. Share of SMEs among all bidders

As further deepening into the questions related to smaller companies, the results of contracts won by SMEs are indeed intriguing and outline food for thought. Forasmuch as the fact that the proportions of contracts awarded to SMEs do not exceed 10 per cent marked by four respondents is fully comprehensible and rational, one reply shows that SMEs win from 20 up to 50 per cent of all of the public contracts (see figure 34). However, given the absence of any specificity, no concrete and confident hypotheses on the factors behind the phenomenon can be made.

What is the proportion of contracts awarded to SMEs? (5 responses)

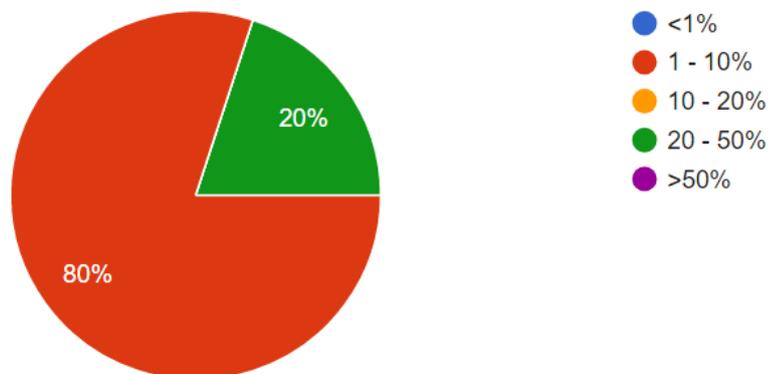


Figure 34. Share of public contracts won by SMEs

Identification of the essential issues that stand in the way of embellished integration of SMEs into public procurement in the primary form is principally vital considering that the main barriers and challenges of SMEs towards enhanced access to public contracts remain similar to those identified over 20 years ago, as described previously in the current thesis. As figure 35 suggests, large size and value of contracts is determined as the obstacle hindering access of smaller organization to public orders by 80 per cent of the respondents. 60 per cent of them have equally indicated limited resources of companies and administrative burden of tendering process, but none of participants recognize inadequate access to information and selection criteria involved as the impediments.

## What are the biggest obstacles SMEs face?

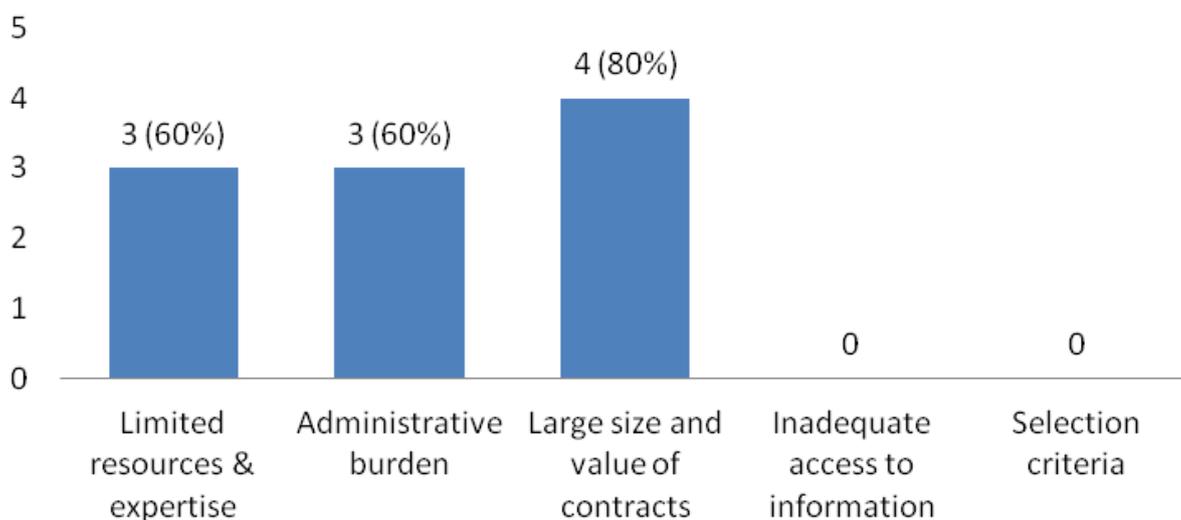


Figure 35. Dominant challenges SMEs face in public orders

The very last question is presented in a form of grid requiring mandatory replies in each row, as it can be seen in the figure 36. The main intention behind such construction is to grasp which measures have already been undertaken, which of them are being implemented in the forthcoming five years and which have not yet been considered. The dominant focus of respondents has been put onto techniques that allow overcoming of bureaucracy and organizational issues of

tendering process. Dividing contracts into lots, the practice widely accepted as exceptionally valuable practice, has expectedly already been used by 80 per cent of the respondents, while one of them is going to deploy it within future five years. For comparable reasons, the same amount of purchasers accepts joint bids by several horizontally collaborated companies. In order to avoid administrative burden, candidates can submit only the summary of relevant information, and the nominated company has to further provide the purchasing agency with the full package of documentation. At the moment, two respondents have already undertaken the approach, whereas other three will integrate it into design of tendering within next five years.

Fostering sub-contracting and joint fulfillment of technical data represent identical atypical distribution, in which one respondent has stated that such options have been at disposal, but other participant have indicated that there approaches have not been considered. None of the purchasers has been involved into the assistance in adoption of IT systems, but four of them will initiate it during the five years' period of time. Given the forthcoming shift to e-procurement in Finland, such aspirations are entirely adherent. Ultimately, feedback on performance to every participating company has already been implemented by all of the purchasers asked.

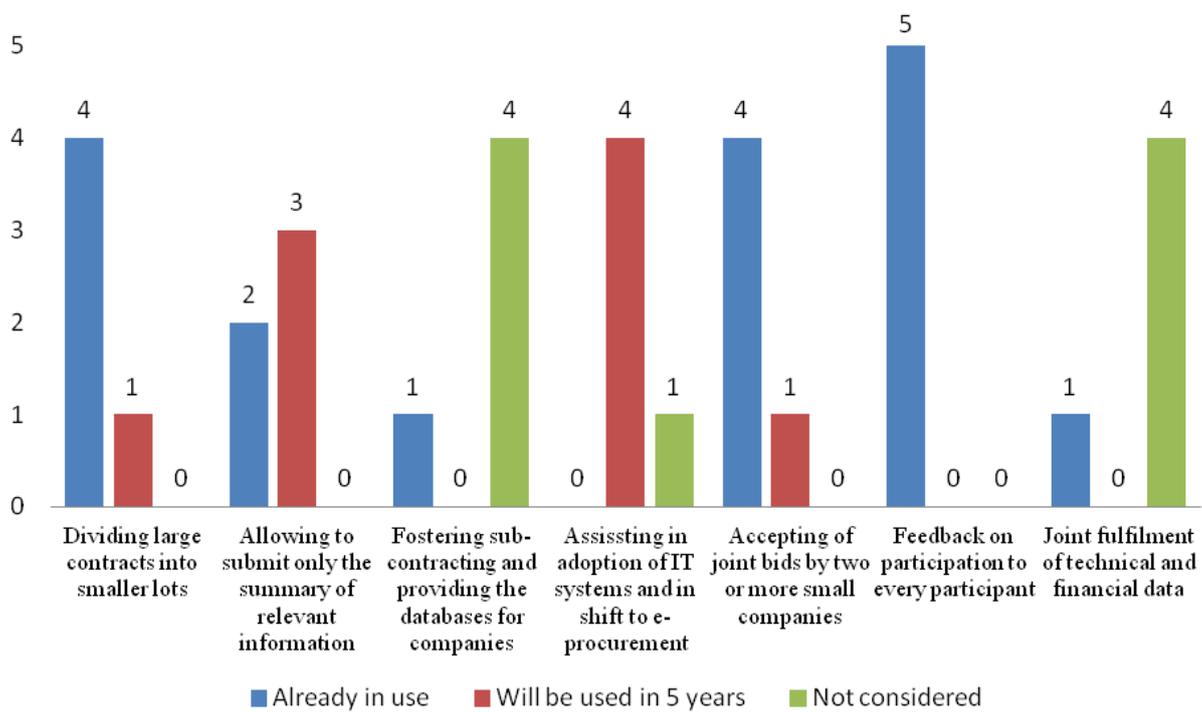


Figure 36. State of implementation of support approaches in public procurement

## **6 Discussion**

The present research has been conducted in the form of an extensive and detailed examination of the overall appearance of public sector as an appealing and feasible customer for smaller companies from the point of innovations delivery to the market. The uniqueness of the work stems from the focus of investigations that has been put onto an assessment of different relevant academic sources to identify the state-of-art and the major trends of public procurement for innovations and the degree of involvement of SMEs into competing for public contracts coupled by empirical observations related to the aforementioned phenomena scoped to gas turbines in the context of Finland in order to derive patterns and new insights of how a small gas turbine manufacturer should consider bidding for public contracts.

### **6.1 Summary of the findings**

The theoretical section, in spite of specific limitations and fragmentations, has resulted in the evidences of the wide applicability of public procurement with its high shares of GDP involved as a fruitful innovative policy tool, to a certain extent more beneficial than direct R&D investments (Edler and Georghiou 2007, 949 - 950). Similarly, there are at least two dominant aspects suggesting the high reciprocity of innovative public contracts and SMEs that can be identified. Firstly, small and medium sized enterprises are recognized as one of the biggest sources of innovations, especially in the emerging technological fields, in which they are able to outperform larger enterprises, as it has been indicated by Frietsch et al. (2013). Secondly, SMEs are one of the biggest beneficiaries of benefits the PPI possesses, since the stimulation of development in the economically challenged markets in which small companies play the fundamental roles can foster the companies impressively (Aschhoff and Sofka 2008, 16; Lember et al 2014, 17; Raiteri 2015, 4).

Whereas there are certain academic traces to approaches and techniques aimed at facilitating an access to state orders for smaller companies, the specificity of external factors are not covered. Therefore, empirical part of the present thesis

was focused on gathering the knowledge with the scope of gas turbines industry in the context of Finland. Taking into account these characteristics, the research combined deductive and inductive approaches in the contemplation of enhancing the desired outcomes.

In general, empirical findings are in the consonance with main assumptions and prevailing theoretical premises. In the emerging field of cleantech energy, a small and young company delivers innovations of considerably higher degree than the ones achieved by larger multinational companies. Yet, no deliberations nor attempts to bid for public contracts have been undertaken, similar to the point of Loader and Norton (2015, 2). Consequent empirical analyses do confirm the main barriers and obstacles SMEs face in a process of bidding and the dominant tools and approaches purchasing agencies undertake to assist smaller companies.

The facts presented in the study depict certain confirmation to points of Caldwell et al. (2005, 315) and Edquist et al. (2015, 68) indicating that in R&D intensive countries recognizing the prominence of innovative policies environment and markets are stimulated to such an extent that companies tend to bolster their innovative capabilities to be able to be competitive even if there is no actual evidence of corresponding demand. As it can be observed in the actual example, the off-shelf prototype gas turbine of small and young start-up company represents notably enhanced and innovated product even in comparison with the industry's leaders. As the phenomenon takes place in Finland, one of the most R&D intensive countries, that serves as the model for innovative policies implemented (Georghiou, Toivanen and Ylä-Anttila 2003, 63), the link is even stronger. Moreover, the insights derived from the interview also validate theoretical insights and the researcher's assumption that responsive supply chains are significant determinants of an organizational innovativeness, because the case company shows elements of a virtual enterprise relying prevalingly on the external resources allowing being flexible and respond to the changes in market demands fast with small lead times.

However, slightly unexpected outcomes have also been obtained. For instance, low familiarity of state purchasers to the concept of PPI with the partially integrated innovative aspects to daily operations suggest evidences of more blurred

boundaries between public procurement and public procurement of innovation as the separate concepts from the practical perception, referencing to a rigour-relevance gap common to a management research.

Additionally, given the results gained within the present thesis, the author of the research proposes the “semi-public procurement” concept. In the view of words by Vilppo and Sikanen (n.d., 14), in Finland the Act on Public Contracts regulates that private companies receiving public subsidies, for example from TEKES, making more than 50 per cent of funding must perform procurement with the value over 30 000 Euro in the full accordance with the regulations of public procurement. In other words, “semi-public procurement” embraces a transition option for companies to supply private consumers as the public agencies. Since such considerations have not yet been indicated in contemporary scholar sources, it may make a notable contribution to the theory.

## **6.2 Answers to the research questions**

The main research question outlined within was as follows: ***“How can a small gas turbine company reflect innovative capabilities in public contracts?”***.

Three sub-questions were designed in order to fully unveil and holistically answer the main research question. The first support question was: *“What are the innovative aspects of gas turbines and how are they reflected by SMEs in comparison with large manufacturers?”*. Initial identification of the indicators representing the degree of advancement of the technology of gas combustion was done through reviewing academic and public sources along with the gas turbine manufacturers’ prospects. However, as the goal was to grasp the results comprehensively rather than trivially outline them, an interview with the case company’s production manager was undertaken to get new insight and further test them in the survey aimed at experienced public purchasers.

The outcomes obtained are indeed interesting and partially unexpected. The essential innovative aspects are, subsequently, the greenhouse gases emissions, efficiency, design flexibility and the overall life cycle and maintenance. As all of

them are interrelated, none can be compromised for the sake of the other, which is supported by the distribution of replies in the questionnaire covering the two highest indexes in the scale of importance. However, efficiency is mainly being looked at primarily, and all respondents have indicated it as the most important aspect to the innovations. This is certainly unsurprising, as it serves as the main sign of what amount of fuel burnt is transformed into effective energy.

Furthermore, natural gas is to the date the most energy efficient fossil fuel; hence, the demands for higher efficiencies are even higher. Efficiency of the case company's gas turbine is 40.2 per cent, and the main curiosity comes from the comparative benchmarking depicting significantly lower ratios that large multinational enterprises can offer. Efficiencies tend to be positively correlated with the power output, and at this point not all of bigger manufacturers have small-scale gas turbines. For instance, the minimal power output of Company B's products is 4000 kW, which is ten times more than the one of the case company's turbine. Whilst the efficiencies might be expected to be at least comparable, in fact, efficiency of smallest Company B's product is only 29.7 per cent, whereas its biggest machines exceeding the ratings of 100 MW represent efficiencies slightly above 40 per cent. Company C, another MNE, has a small-scale turbine of 600kW, whose efficiency is only 19.4 per cent. At the same time, Company A, which is an SME and indicated in the interview as the biggest competitor has achieved an efficiency of 33 per cent with similar small-scale engine.

Similar patterns may be observed with the other indicators as well, in which smaller companies outperform their larger rivals. Both of SMEs represent significantly eased maintenance with the ceased necessity of lubrication by the use of air- and magnetic bearings, which is definitely an important advantage. Almost all turbines may be gradually developed or upgraded with the help of modular design and retrofitted into the existing systems, and all emission indexes are consistent with the norms and power volumes. Compatibility with liquid fuels is in the technical specifications of every turbine that has been looked at, while possibility to run the engines on bio- and synthetic fuels is presented mainly by smaller manufacturers.

The second research question was: “*How is innovativeness considered and outlined in the public contracts?*”. In consonance with the principles of contingent design for research synthesis, the first step of getting the answers involved analyses of secondary public tendering and tendering documentary related to gas turbines followed by surveying public procurers. The categorization was made in the furtherance of improved systematization. Accordingly, the commencing stage in the form of gathering the market knowledge and expertise plays fundamental role and influence the overall consequent procurement process. The forms it may take vary and depend on volumes of contracts and organizational capabilities – within the documentary observed, preliminary market consultation, dialogues with industry-specific experts and public-private partnership have been determined, which is coherent with the findings of Semple (2014, 19). At the same time, only 40 per cent of questionnaire respondents have indicated the use of preliminary market consultation in the purchasing practices. It may be argued that this technique appears prevalingly implicitly and has certain space for further improvement towards wider applicability. Additionally, none of respondents has used prior notifications of intention, and similar observations are found within the secondary documentation implying that invitations to tendering have been published on the basis of time regulations by EU law rather than by innovative considerations.

Furthermore, there are no traces of defining any societal challenges that might be resolved by particular public contract. The EMAT criteria are applied within the both cases observed and emphasized by 80 per cent of respondents, which is logical to European Commission’s (2014, 29) notice that the core of the PPI is appropriate evaluation of quality factors. However, ratios of quality to cost factors do vary. Similarly, guaranteed life cycle evaluation stressed by Edler et al (2005, 2) is implemented in the mode of differentiation between direct purchasing and maintenance costs and utilized by the majority of survey respondents. The flexibility of procurement process is, however, more controversial in the means of appearance, as it was crucial and valuable for supplier selection in one case whereas in the other the level of strictness is high and no evidences of possible adjustments are available.

The most important apprehension, nevertheless, comes from the fact that none of the secondary documentation have direct references to innovations in general, while the respondents' answers add even more uncertainty, because only one participant has marked the familiarity of the concept of PPI, whereas all of them have indicated partial incorporation of innovative aspects into own daily work. In other words, there is no straightforward division of innovative and regular contracts. Instead, modernity emerges in the forms of technical specifications, requirements and evaluation criteria motivating candidates to have strong ongoing R&D agenda. This is, perhaps, one of the most prevailing managerial implications of the present work from supplier's perception.

The ultimate research sub-question was: "*What are the main obstacles in access to public contracts and how small suppliers are expected to mitigate them?*". Theoretical section is quite saturated at this matter and represents different issues SMEs face that remain similar to those determined more than twenty years ago. According to the results of the thesis, large size and value of contract, limited organization capabilities and administrative burden of tendering process are recognized as the dominant obstacles smaller organizations have to overcome towards facilitated access to state orders, whilst inadequate access to information and selection criteria are not considered by Finnish purchasers. It is coherent in the light of insights observed in the tendering documentation, as invitations have been published in HILMA, procurement publication channel maintained by Finnish Ministry of Employment and Economy, and in Tenders Electronic Daily (TED), the centralized European channel acknowledged in the theoretical section, yet the lack of awareness and motivation identified in the interview suggest other point of view.

As the survey visualizes, at the moment following approaches have different state of implementation by purchasing agencies. Feedback on participation to all of the candidates, widely accepted as enormously helpful practice for SMEs, is given by all respondents, whilst almost all of them presently divide larger contracts into smaller lots and accept joint bids of two or more companies, while the rest will implement analogous techniques in the period of five years. As assumed, the gas turbines-related contracts might specifically be influenced, since the turbines are being widely applied as auxiliary devices of backup electricity supply for renewable

energy systems and other combinations. Similar argumentation has been faced by the case company's production manager mentioning highly feasible benefits of the horizontal collaboration. Working as the sub-contractors may possibly be another option of eased access to appropriate sizes of public contracts. Even though the majority of survey respondents have not considered assistance in facilitating the aforementioned aspect, it should still be at least acknowledged by SMEs aimed at overcoming the myriad of administrative challenges public procurement possesses. Furthermore, the obstacle related to being excluded from proper information flow mentioned by Karjalainen and Kemppainen (2008, 232) can be improved by more active application of IT systems, given the willingness of public procurers to support smaller companies, especially taking into account the forthcoming shift to e-procurement in Finland.

Finally, the synthesis of answers to all of the support research questions is to present the comprehensive response to the main question of the present research. There are no right or wrong roadmaps for small companies pursuing working with the clients from the public sector and delivering innovations through these channels. As it has been determined in the context of gas combustion energy generators in Finland, the main point to start with is simply the identification of orders whose fulfillment demands certain extent of suppliers' innovativeness, since evidences suggest that no R&D related labels take place, even though some of orders do favor the results well above minimal technical specifications. Second dimension covers the choice of entry mode to the extent that direct bidding, sub-contracting and joint bids imply specific benefits. The dependence is based mainly on the sizes of orders, tendering procedure type and the overall nature of it. With the small-scale gas turbines, CHP is truly appealing and promising market, in which SMEs may take the niche confidently by outperforming larger competitors. Within the framework of the actual thesis, the case company can, in principle, become highly competitive innovative supplier of public contracts. That is, the technical characteristics of its products are impressive and well above the ones the competitors possess and customers require. Furthermore, flexibility in the modular design and various types of turbine implementation is a significant advantage. The case of Mekrijärvi Research Station's tender favoring these

aspects represents the circumstances in which the case company can fully unveil its benefits and, hence, fulfill the tender requirements, especially since the volume and nature of purchase eliminate excessive administrative burdens SMEs may hardly operate with. At this point, the coherence to survey results is explicitly visible, as the purchasers recognize the prominence of communication throughout the procurement process from preliminary market consultation and facilities visit to feedbacks given to participants. Moreover, as it has already been indicated, the main implication for prospective suppliers is submitting the application in spite of any possible challenges in relation to documentation, as such aspects can be resolved afterwards. In other words, if the case company had bid for the preceding tender, it would have had high chances of winning the order. Operating in the utilities sector is supported by its flexible regulations aiming at bolstering the process and simplifying the burdens for both sides.

Meanwhile, an example of Gasum's tender depicts a format of public purchase in which a small company cannot be competitive in isolation. Firstly, the restricted procedure with several pre-selected candidates outlines strict legal and administrative requirements, which may be a significant barrier for SMEs. Secondly, the volumes of orders and the overall sizes of contracts may require joint capabilities of various companies. Even though there are survey evidences of procurers' willingness to divide larger contracts into smaller lots, SMEs still have to be prepared for the demands of "everything at once". However, limited abilities of implementing only particular parts of contracts, in which smaller companies can doubtlessly expose their innovative potential, can be still valuable in the forms of sub-contracting and horizontal collaboration by joint applications of several organizations. Inasmuch as the latter option has been specifically emphasized by the case company and survey respondents, they have not outlined readiness to step in and foster the sub-contracting within the own purchases and organize certain organizational database, e.g. the one developed within the Trans Adriatic Pipeline project (Tap 2017).

The abovementioned aspects must be the starting point for the case company in order to bolster its presence in the public market. The communication has to be transparent and focused onto two categories – firms operating in similar and

adjacent field (for instance, solar panels manufacturers), whose products are interrelated, in order to obtain different entry modes, and public purchasing agencies and organizations towards public-private partnerships. Its prominence in innovative public procurement has been determined crucially in the initial stage of preliminary market consultation. Along with the supportive points of Semple (2014, 19), tender of Mekrijärvi Research Station has also reflected the importance of advantage procurers take by working closely with prospective suppliers. The public-private partnership, hence, represents the logical ultimate stage of tight and efficient communication between state-owned purchasing agencies and market towards synchronizing the efforts and capacities.

### **6.3 Reliability and validity of the research**

Ensuring reliability and validity is an inevitable part of an academic research and, in spite of particular differences, are used in both qualitative and quantitative researches (Golafshani 2003, 597). Since the present thesis has been conducted qualitatively to comprehend a phenomenon in context-specific settings, justification for the reliability and validity are to be made according to their appearance in qualitative research. Nevertheless, the fact that data collection has partially involved quantitative methods is considered as well.

The term of reliability stands for consistency, credibility and repeatability over time (Greener 2008, 37). Namely, the author defines it in the means of designing research to be auditable, meaning that an outside reader is able to obtain similar results under the same methods. At the same time, Saunders and Rojon (2014, 7) make a distinction among reliability of sample selection, data collection and data analysis). With the sample size, the dominant suggestion from scholars is related to the data saturation. The data should be collected until the saturation is reached by the means of lack of new value from additional data (ibid, 7). This is, however, a controversial topic, as the sample size number is more accurate for quantitative studies. Specifically, purpose of qualitative studies differs from one of quantitative research, hence, even small sample sizes can still be successfully used for making generalizations (Soy 1997). Therefore, non-probability sampling technique

known as purposive sampling is used when particular subject of interest is chosen according to high level of knowledge and expertise (Tongco 2007, 147).

Meanwhile, the justification of choice of non-probability sample does also contribute to validity of research (Saunders and Rojon 2014, 5), whereas Greener (2008, 37 – 38) defines three pillars of a business research be valid: a lay person may effectively identify rationality behind the methods of researching the questions, which is principally important in surveys; the methods chosen measure what they really are supposed to measure, and the causality of different factors.

The choice of the case company is justified by the overall evolving stage of small-scale gas turbines industry. The amount of companies producing gas turbines is generally limited and mainly the focus is put onto larger industrial solutions. Specifically, the market overview did not reveal any competing companies in Finland, the country whose context has been used throughout the research. Notwithstanding these aspects, the case company appears to be in possession of the most appropriate operational knowledge and expertise. The level of innovativeness of its products is also at the highest level, even in comparison with the industry's dominant players. Secondary data in the forms of tendering documentation was obtained from the official sources and covered detailed overview of completed and ongoing public purchases in Finland. Hence, the relevance of the cases is valuable in evaluation of the company's capabilities of reflecting the innovativeness in the public field. The selection of respondents for the survey was also done purposively by contacting purchasing departments and managers of public agencies of Finland, such as regional and cities' administrations, state-owned companies, etc.

The reliability of data collection and analyses should be basically evaluated according to the detailed explanation of the process (Saunders and Rojon 2014, 7). As it has already been mentioned, the contingent design that structures the empirical part according to the results of each method or group of studies, id est the synthesis of one piece of research affect the preparation and execution of consequent parts, was chosen in the present thesis. Hence, ensuring the correct order of data collection and analyses was crucial. Firstly, an interview was conducted with the case company's production manager along with the e-mail

communication with the operational director. Since the organization is very small, it was not possible to enlarge the sample size by interviewing other workers. The interview was recorded and transcribed accurately to ensure the correctness. The results were afterwards used in choosing and analyzing the tendering documentation to evaluate case company's capabilities. Consequently, all of the outcomes available at the moment were utilized in designing the survey aimed at professional public purchasers in Finland. The questionnaire was designed methodologically and delivered to respondents' official e-mails with the covering letter describing the present thesis research. The confidentiality matters were also considered, at the survey was fully anonymous. The structure contained both mandatory and voluntary questions. On the overall, data collection methods, process and analysis stages were described in details within the methodological stage, thus increasing the transparency, reliability and validity of the research. If the study were undertaken under identically similar circumstances, the results would be comparable. However, it must be considered that the replication of circumstances may not be feasible, especially after certain amount of years, since the external factors, legislation and the tendencies of businesses, public procurement and innovative policies can differ.

#### **6.4 Limitations and suggestions for further research**

In the current research, an emphasis was put onto researching the distinct case of a small company that is only on the stage of growing and entering the market. Since the company has not yet participated nor considered the opportunity of participation in public contracts, the main results of the work represent the organizational capabilities as innovative public supplier and the concrete steps the company has to undertake in order to overcome the biggest barriers.

To begin with, there are certain theoretical limitations which have already been determined. The overall academic knowledge in public procurement in general is somewhat limited, whereas the literature on the public procurement of innovation is especially diminished and fragmented to individual case studies. The absence of generally accepted universal conceptual frameworks and bias towards purchaser's

perspective makes it especially challenging to utilize the theoretical implications solely. Furthermore, the geographical divergences in classification of small and medium enterprises tangle the scope of the work.

Enlargement of the sample size or choice of other research methods would not unconditionally alter the final results. The outcomes satisfy initial assumptions and contemporary academic opinions, whereas unexpected and surprising aspects arisen can be judiciously interpreted, taking into account the externalities. Nevertheless, having multiple-case research involving companies, with whom the case company might collaborate horizontally or become a sub-contractor, would undoubtedly make the results stronger and more diverse towards future investigations.

The generalization of the results of the research may principally be applied to analogous context at least in the scope of developed European countries. For instance, Finland's market tendencies and national regulations have impacted the case company in a mean of entering the market with already highly developed and sustainable product. The turbines' efficiency, flexibility and life cycle are already on the level comparable to the ones of turbines produced by larger manufacturers. Additionally, the higher shares of renewable energy involved and the overall shift to cleaner technologies creates higher demand for gas turbines, whose greenhouse gas emissions are low and which are mainly used as the complementary tools for renewable energy units. At this point, it is assumed that the company will be able to compete successfully in public contracts on local level and that the success factors can be isolated for further implications in similar context, for example in the UK or Germany. However, they may hardly be used in the fully different circumstances of developing countries. Furthermore, the specificity of the industry has also contributed significantly. For these purposes, examinations of similar phenomenon in other markets or industries appear to be attractive research option to outline the key differences.

Another option of additional research using the actual outcomes is either involving more sophisticated quantitative research methods with higher samples or enlarging the work to multiple-case cross-industry study to evaluate peculiarities of different small companies aiming at flourishing the innovative potential through the

public demand. Identification of common patterns and key differences alongside various anomalies appear to be an anticipated goal of such intensification of research based on the results of the present thesis.

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# Appendices

## Appendix 1. Questions used in public procurement survey

\* – Mandatory questions

### Section 1. Innovative public procurement of gas turbines.

1.1 Have you been involved into procurement of gas turbines?\* (Multiple choice)

- Yes
- No, but in other energy engines
- No

1.2 Are you familiar with the concept of Public Procurement of Innovation (PPI)?\* (Multiple choice)

- Yes
- No

1.3 Are innovative aspects integrated into your procurement processes?\* (Multiple choice)

- Yes
- Partly
- No

### Section 2. Utilization of PPI. (Skip unrequired questions if innovative aspects are not included into your purchasing processes at all).

2.1 How would you characterize your ordinary innovative procurement process? (Checkboxes)

- Purchasing of non-existing products or services for which radical innovations are required
- Purchasing of products or services that are already or nearly in the market involving continuous improvement process
- Other (open question)

2.2 Who is the final user of the technologies procured? (Checkboxes)

- Society
- Purchasing agency
- Market
- Third parties

2.3 How is innovativeness outlined in your tenders? (Multiple choice)

- Explicitly, used dominantly throughout the tendering and assessing over cost factors
- Moderately, to a certain extent equal to cost factors
- Implicitly, results above minimum technical specifications are slightly favored

2.4 Which innovative aspects and techniques are in your use? (Checkboxes)

- Prior notifications of intention
- Preliminary market consultation
- Exclusion criteria
- Life cycle assessment
- Economically Most Advantageous Tender (EMAT)
- Flexibility

2.5 Evaluate the following benefits of the PPI. (Linear scale)

1    2    3    4    5

Irrelevant at all Very important

- Solutions to societal problems and challenges
- Better infrastructure through developed products and services
- Stimulation of R&D
- Higher market interaction
- Reduced costs and jointly shared risks
- Creation of work places



4.1 What is the proportion of SMEs among all of the bidders?\* (Multiple choice)

- <10%
- 10 - 20%
- 20 - 50%
- >50%

4.2 What is the proportion of contracts awarded to SMEs?\* (Multiple choice)

- <1%
- 1 - 10%
- 10 - 20%
- 20 - 50%
- >50%

4.3 What are the biggest obstacles SMEs face?\* (Checkboxes)

- Limited resources & expertise
- Administrative burden of bidding process
- Large size and value of contracts
- Inadequate access to information
- Selection criteria

4.4 Please, select appropriate answers on the following support approaches for SMEs.\* (Multiple choice grid)

Rows	Columns
Dividing large contracts into smaller lots	Already in use
Allowing to submit only the summary of relevant information in the bid	Will be used in 5 years
Fostering sub-contracting and providing the databases for companies	Not considered
Assisting in adoption of IT systems and in shifting to e-procurement	
Accepting of joint bids by two or more small companies	
Feedback on participation to every competitor	
Joint fulfillment of technical and financial data	