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Concerning Support for SME's as Suppliers of Public Health Tech Innovation: Some Reflections and Case Evidence

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Abstract

Purpose The purpose of the article is to examine the role of public procurement as a means to stimulate innovation among Small and Medium Sized Enterprises (SME's).

Design/methodology/approach The paper combines a narrative literature review with a multiple case study of six innovation projects.

Findings The literature provides ambiguous support for the general claim that SME's should be more innovative than larger firms. Even if SME's can be innovative, this does not mean that all SME's are. The case study findings suggest that few of the challenges innovating SME's are facing would be ameliorated by developing public procurement of innovation policies specifically targeting SME promotion.

Research limitations/implications The analysis of the literature remains on aggregate levels. The included firms worked with health tech innovation.

Originality/value Unlike many studies and policy reports connecting ostensibly public procurement of innovation policies with SME promotion, this paper calls for a more critical view regarding policy development based on the SME construct.

Keywords: SME involvement, public procurement, innovation

1. Introduction

This paper concerns the connection between small and medium-sized firms (SMEs) as suppliers of innovative technology and public health authorities' utilisation of public procurement as an innovation-stimulating instrument. The interest in SME's is justified simply by the fact that they are an important category in most economies. 99% of firms in the non-financial business sector in the EU28 are SME's (European Union, 2014). SME's are considered the "backbone of the European economy" as this category of firms contribute to more than half of European GDP (Wessel Thomasson et al., 2014). They are also a category generally associated with innovation, job creation, sustainability and other commendable features. Public procurement then, has since the beginning of the 2000s been assigned the role of an innovation policy instrument. Initially in the EU - and subsequently in many parts of the world - public procurers have been urged to adopt more innovation-friendly and innovation-demanding practices in order to stimulate private sector innovation, ultimately to sustain competitive advantage.

It naturally follows that many countries have developed a policy interest for SME's and also a concern for involvement of SME's in public procurement (Zheng, Walker and Harland, 2006; Loader, 2013). Facilitating SME access to public procurement is also mentioned in the European action plan for implementing the European Strategy for the Baltic Sea Region (European Commission, 2010a). The new EU Procurement Directives have also been revised with the ambition to facilitate "...in particular the participation of small and medium-sized enterprises (SMEs) in public procurement" (OJ L, 2014).

A closer look at the evidence presumably available for underpinning this policy interest renders, however, a somewhat ambiguous outcome, in particular when searching for academic justification for public procurement of innovation policies explicitly targeting SME's. Freeman (2013, p. 9) notes that "it is far from obvious that SMEs as a group are in fact major contributors to economic growth." Recently, procurement law experts concluded that "the time for wholesale review of SME policies is ripe" (Nicholas and Fruhmann, 2015, p. 351). The situation appears to resemble what Gibb (2000) noted one and a half decade ago, when looking back on SME research conducted up to that point. He argued that the accumulated knowledge included a number of myths or commonly held beliefs established among academics and policymakers, which led to the development of support activities that lacked rigorous underpinning.

This paper examines a set of issues useful for furthering the discussion of public procurement policies as a means to stimulate SME's as suppliers for public health tech innovation - an exercise that to some extent echoes Gibb's observation. The generic research question addressed is formulated as follows: What are the justifications for developing public procurement of innovation policies for SME's? The approach is post-positivist in the sense that the ambition is to be "more cautious concerning strong and one-sided interpretations and restrained regarding the too extensive (or obsessive) use of (quantitative) data and methods" (Adam, 2013, p. 5). The argument brought forward here draws on a narrative literature review and case studies conducted in the context of the HealthPort project, described in more detail in the paper. The ambition is to "pull many pieces of information together into a readable format" presenting "a broad perspective on a topic" and "provoke thought" which is characteristics for a narrative literature review (Green et al., 2006, p. 103).

The paper begins with a brief introduction of the underlying principle of using public procurement as a means to stimulate innovation (section 2). Section 3 reviews literature that supports the general claim that different barriers inhibit SME involvement in public procurement. In an ideal world a natural subsequent step would be to establish to what extent public procurement of innovation with SME's as suppliers actually occurs. This study has failed to find studies on SMEs which distinguish between procurement of regular goods and services and procurement where some kind of innovative activity actually takes place. Existing surveys tend to settle for establishing SME involvement in public procurement in general or by distinguishing by sectors, or sub-categories of firm size (micro, small and medium-sized) within the SME category. This means that firms typically not associated with innovation such as the local fast-food shop are bundled together in the same category as any university spin-off, high-tech companies. What would be needed for our purposes here are studies that distinguish between SME's involvement in public procurement of off-the-shelf goods such as fuel, food or office supplies and public procurement from SME's which renders innovation e.g. new energy systems, new products or services. Due to the lack of appropriate data, section 4 therefore settles to use an overview of the current SME involvement in public

procurement in general as a starting point for discussing the connection between public procurement of innovation and SME involvement.

The other strategy adopted to overcome the data problem was to explore to what extent the general increase of SME involvement in public procurement would give reasons to expect increased innovation. Thus, section 5 reviews literature that considers to what extent SME's are actually more innovative than larger firms and renders a rather inconclusive result. Generally there is no support for the claim that SME's should be more innovative than larger firms. Section 6 reports from a study of six innovative SME's located in the Baltic Sea Health region about their perception of barriers for the commercialisation of health tech innovations. Even if some participating firms did have some insights regarding the role of public procurement, other challenges such as barriers in relation to reaching the market, funding and complying with legal frameworks turned out more critical. Section 7 discusses the results and outlines some general conclusions.

2. Public procurement and innovation

Public procurement is the central sourcing mechanism evoked to directly secure items needed for the delivery of public services (Thai and Grimm, 2000). As such, it is not different from any other forms of (private) procurement (Caldwell and Bakker, 2009). Similar to what would happen in a firm setting, the public procurer forms a supplier relationship to satisfy a particular need. Most public procurement projects go through the following phases (van Weele, 2005): a tactical function/initial purchasing stage where the procurer develops specifications, selects suppliers and issues a contract followed by an operational stage where the contract execution is monitored and evaluated, i.e. where the procured item is delivered. Differences are found in the institutional set-up in which public procurement occurs. Public procurement is affected by public policy and legislative packages on different levels (Thai, 2009). Public procurement in EU Member states is regulated by national procurement law in turn implementing the European Directives on Public procurement. Rules for public procurement are designed to prevent fraud, maintain competition and thereby lower the prices public procurers have to pay (for elaboration of the similarities and differences with private procurement see Bovis, 2007). This means that any tender call must be published and made available to any competitors; award and selection criteria must be formulated in advance. Any bidders may also be required to substantiate any required competences and skills as well as economic soundness.

Through the policy development the last fifteen years the role of public procurement as an instrument for stimulating innovation has been increasingly emphasized and is today a well-established theme in the EU Horizon 2020 strategy, as well as in policy making on the global level (European Commission, 2010b; OECD, 2011; UNOPS, 2014), even if the degree of implementation of these policies varies between countries (Lember et al., 2014). The underlying idea is to encourage public procurers, instead of procuring items already available on the market, to stimulate innovation by developing tender calls with specifications which effectually require -- or at least allow -- the submission of innovative solutions. Public procurement of innovation can take place in different stages of technological maturity, for instance as applied research, feasibility studies, prototype development, but also as a vehicle for diffusion of technology which has reached a certain level of maturity (Rothwell and Zegveld, 1981); an observation justifying the recent development of pre-commercial procurement in the EU, where innovation is

achieved through procurement in phases with subsequently gained knowledge about the final solution ultimately leading to a commercial procurement (European Commission, 2007). At the mature end of the spectrum belongs consolidating procurement, i.e. where standards or label schemes are used to disallow products underperforming in relation to e.g. energy efficiency or environmental requirements (Hommen and Rolfstam, 2009). Sometimes the procured item qualifies as innovation only in the sense that it is new to the local context (Rolfstam et al., 2011).

Many authors have also corroborated the strategic role that different forms of public procurement can play as driver for innovation (e.g. Dalpé, DeBresson and Xiaoping, 1992; Gregersen, 1992; Fridlund, 1999; Palmberg, 2002; Berggren and Laestadius, 2003; Rothwell, 1984; Geroski, 1990; Aschhoff and Sofka, 2009; Eliasson, 2010; Guerzoni and Raiteri, 2015). Concerning the health market, it represents in most OECD countries around 10% of national gross domestic product in which the public sector contributes with 70-80 % of the total spending (OECD, 2013). Public health authorities are therefore important actors in the health innovation system, not only as adopters of supplier side innovation but also potentially as “intelligent” public procurers able to satisfy needs identified by patients and/ or health-care professionals (Omachonu and Einspruch, 2010). For suppliers of health tech innovation, this market becomes a locus for development of new knowledge, innovative products and subsequent competitive advantages. Herein prevails the strategic dimension which underscores the role of healthcare innovation as a means to generate competitive advantages, growth and employment. In this perspective, health tech suppliers and public health tech procurers become a venue for user-producer interaction and interactive learning (von Hippel; Lundvall, 1992), connectable to the general policy interest developed over the last decade which emphasises the role of public procurement as a means to stimulate innovation (Edler and Georghiou, 2007; Uyarra and Flanagan, 2010; Rolfstam, 2013; Lember et al., 2014).

3. Barriers to SME involvement in public procurement

Given the policy interest it is noteworthy that there appears to be many barriers that reduce the possibilities for SME’s participation in public procurement¹. An extensive literature review by Loader (2013), provides a list of twenty-three barriers faced by SME’s organised into three main categories, barriers that relates to public policy; to the procurement process and those relating to SME’s specifically. In the first category are issues such as conflicting procurement objectives and cultural barriers such as risk-averse attitudes among public procurers. The second category includes uncertainty regarding the technical aspects of public procurement, such as lack of knowledge on procedures and challenges regarding the requirement to demonstrate a track record, or negative consequences of (too large) contract volumes. In the third category we find issues regarding to what extent SME’s have resources, skills and attitudes that would make them prone to participate in public procurement processes (ibid, 2013). Similar points have been made elsewhere: Karjalainen and Kempainen (2008) found the lack of legal expertise and lack of administrative resources to be such a barrier. These authors also found that SME’s using electronic order and invoice systems would be more likely to get involved in state level procurement than those which don

¹ It is not the purpose here to evaluate to what extent any barriers affect exclusively SMEs. Rolfstam et al., 2011 and Eyarra et al., 2014 suggest barriers to involvement in public procurement can be perceived also by larger firms.

not. Walker et al. (2008) mention an array of barriers related to SME's and sustainable procurement. Some SME's fail to adopt their market strategies for the public sector. SME's might also be seen as inducing larger risks for the procurers.

Based on stakeholder consultation, the European Commission listed an array of barriers for SME participation in public procurement (European Commission, 2008), which are consistent with findings in the academic literature (as cited above, see also Wessel Thomassen et al., 2014). The findings suggest that due to lack of resources an array of sometimes related problems occur. SMEs experience difficulties in obtaining information about tender calls: in general they don't have sufficient time to prepare bids and they lack knowledge about tender procedures. The cost of preparing the tenders was also seen as disproportionately high, giving advantages to larger enterprises with resources available to cope with the excessive administrative burden. Another issue of disproportionality concerned qualification levels, certification requirements; requirements for financial guarantees stated in tender calls, which were perceived as excessive. Tender calls with too big contracts and excessively long payment timeframes would also reduce SME proneness to participate in public tenders. A final type of barriers were related to international participation in public procurement, where discrimination against foreign tenderers and challenges in relation to finding cooperation partners abroad were seen as barriers. (European Commission, 2008.) For the European Commission the outcome of the consultation exercise was clear: "This leads to the conclusion that there is a need to develop a more SME-friendly approach to public procurement among contracting authorities by promoting the possibilities offered by the Public Procurement Directives to facilitate access by SMEs to public procurement opportunities, and by making known the relevant best practices in Member States" (European Commission, 2008, p. 5).

It is not the purpose here to evaluate to what extent any barriers affect exclusively SMEs. The question remains, however, to what extent there are other ways of interpreting these findings and whether other policy implications can be deduced. Rolfstam et al., (2011) and Eyarra et al., (2014) find barriers to involvement in public procurement affecting also larger firms. Assuming one ascribes to the view that public procurement should be a disinterested process designed to safeguard that the most competitive supplier – i.e. the one best able to supply according to the specified need – is selected. Any firm or consortium of firms with adequate capacity regardless of size would then be considered a potential awardee of public contracts. Any other principle applied would lead to insufficient use of public money as well as aggravation among firms who realise they are excluded due to secondary policies, rather than judged inferior after objective application of award criteria. It is plausible that a subset of SME's which submit bids without being awarded contracts are unsuccessful for the same reason big firms fail; that they in one way or another submit an inferior bid. The ambition should of course always be to remove unnecessary bureaucracy. One could then argue that a non-optimal situation might be when a certain category of firms becomes penalized for the sake of policy, forcing procurers to make less rational award decisions. In that sense there is a trade-off between rational competitive decisions and those affected by any secondary policies. It could be argued that if such deviation is allowed, policy makers should be aware of the implications. A central question in this debate is to what extent SME's are actually disfavoured, a question which, as will be discussed in the subsequent section, is not easily answered in a straightforward manner.

4. SME involvement

According to the official European definition are SME's "enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million" (European Commission, 2003, Article 2). Although definitions of SME that are used in different surveys might vary, the general outcome is that the SME share of the public procurement market is proportionally lower than larger firms (Nicholas and Fruhmann, 2014). Studying the UK context, Loader (2013) makes the same point; although a public contract may offer economic stability and prestige, relatively few SME's bid for public contracts. The interest for SME participation in public procurement can be seen in recent comparative surveys conducted on the EU level, and also on national levels (Vincze, et al., 2010; Konkurrence- og Forbrugerstyrelsen, 2013; see also Loader, 2012 for a review of such studies in UK and the US). Common themes in these studies are attempts to establish to what extent SMEs are involved in bidding as well as winning public contracts. Often the findings are viewed in the light of the relative importance of SME's for the total economy. For tender calls published in Tenders Electronic Daily (TED) database, i.e. those tender calls above the threshold values as stipulated by the European Directives on Public procurement, the proportion of SME's directly awarded a contract was 60% (years 2006-2008) which is similar to estimates for 2005 (61%) (Vincze, et al., 2010). Estimates for the years 2009-2011 suggest the SME involvement for public procurement contracts over the threshold values was 56%. Estimates provided by the Danish Competition and Consumer Agency on SME participation in Denmark suggests a similar level: Danish SME's participates in 2/3 of Danish tender calls and win half of the tender calls. This should be compared with the private turnover, where SME's contributes with 1/3 of the total turnover (Konkurrence- og Forbrugerstyrelsen, 2013).

Recent estimates for Baltic Sea region countries reveal some country-specific differences (Table 1), which probably reflect the share of SME's in relation to bigger firms in the specific country (European Commission, 2008). A general – and not surprising – tendency is that SME involvement is larger for contract values below threshold values². If one looks at contracts with a value below the threshold values, the SME share appears to be quite substantial, reaching, in the extreme case of Latvia, 90% of the total contract value awarded to SME's.

Estimation of SMEs' share of contract value awarded		
Country	Above threshold %	Below threshold (%)
Germany	48	75
Denmark	36	65
Estonia	24	51
Finland	29	57
Lithuania	30	59
Latvia	74	90
Poland	25	53
Sweden	19	44
Total EU 27	29	58

Table 1. Estimations of SME share of contract value awarded, years 2009-2011 (Wessel Thomassen et al., 2014).

The issue regarding SME involvement in public procurement triggers a set of sub-questions, such as what kind of involvement is envisaged and what effects are measured. It appears that the notion of involvement is frequently used as a synonym for being a contract owner, i.e. that the entity counted as 'involved' is also the contract owner, while involvement regulated

² Threshold values are those values which determine whether a contract should be awarded following the EU Directives. Depending on what is procured thresholds range from EUR 134000 to EUR 5186000.

through sub-contracting is disregarded. This might be problematic as awarding a contract to a large firm might still involve SME's as sub-contractors as well as other suppliers not named as sub-contractors in the specific project. In other words, even if the contractor is a large firm, this may not necessarily exclude participation of SME's, as SME's may still be involved through other arrangements.

Another issue of concern is whether there is such thing as an optimal SME share in public procurement. Any claim made from the data reviewed above suggesting that SME involvement in public procurement is too low seem to rely on the assumption that involvement in public procurement should mirror different firm categories' importance in general: If 98% of firms are SME's this should be reflected in SME involvement in public procurement. However, one could also argue that public procurement is not a "fair" process in that sense, but rather one that relies on rational decisions both in terms of how procurement projects are setup and how submitted bids are evaluated. The SME underrepresentation might be explained by for instance that certain contract require financial strength, experience and other capacities to larger extent held by larger firms.

One central issue here is the relevance for promoting SME involvement with the purpose of rendering more innovation. A dedicated SME policy could be justified if evidence were available that demonstrates that SME involvement in public procurement would actually render more innovative solutions than public procurement conducted according to current practice. This reveals another complex issue which may not be easily solved: one could argue that public procurement organised in an adequate way to render or stimulate innovation would lead to the award of the contract to the most innovative bid, regardless of the size of the supplier. In that perspective the entire debate becomes pointless. The strategy chosen here is to address this issue on a generic level, i.e. try to establish whether or not SME's are more innovative than larger firms. If it could be established that SME's are more innovative than larger firms, stimulating SME involvement in public procurement could then be justified from an innovation policy rationale. However, as will be discussed below, this is not the case.

5. SME and Innovation

Concerning whether or not SME's are more innovative than large firms, the evidence, in spite of what is sometimes claimed, is rather inconclusive. Symeonidis summarizes hypotheses proposed in the literature as to why larger firms would be more innovative: R&D typically involve large fixed costs, which can only be covered if sales are sufficiently large; There are scale and scope economies in the production of innovations (i.e. advantages more easily exploited by larger firms; large diversified firms are in a better position to exploit unforeseen innovations; large firms can undertake many projects at any one time and hence spread R&D risks; large firms have better access to external finance; firms with greater market power are better able to finance R&D from own inputs; firms with greater market power can more easily appropriate the returns from innovation and hence have better incentives to innovate (Symeonidis, 1996). The same author also summarizes counterarguments, i.e. why larger firms would be less efficient innovators. Less managerial control and bureaucracy associated with larger firms would decrease returns of scale; the absence of competition, i.e. in monopolistic situations, may lead to innovation inertia (ibid, 1996). In comparison, it is well established that incumbent firms typically tend to be less innovative in situations where there is a technology shift. In that sense appears size to be related to innovation inertia at some point. However, firm size *per se* appears not to be a central explanation variable in these situations. The underlying nature of the problems faced by incumbent firms in relation to

technology shifts appears not because they have ceased being innovative, but rather because they fail to be innovative in the disruptive technology (Christensen and Bower, 1996).

The ambiguity prevails also if one considers quantitative research on the relation between firm size and innovation. In a survey conducted on UK firms' innovative activities over the years 1945 to 1983 Pavitt et al. (1987) found the size distribution of innovative firms to be U-shaped, i.e. suggesting smaller firms (between 500 and 1000 employees) and larger firms to be the most innovation intensive. Medium-sized firms (between 2000-999 employees) had below average innovation intensity. Variances were however found for specific sectors. In mining and defence for instance, most innovations were conducted by large firms (50000 employees). Smaller firms were relatively more innovation intensive in the service, R&D and instrument sector (ibid, 1987). Such sector differences were also reported by Acs and Audretsch drawing on US data recorded for 1982 (Acs and Audretsch, 1988). In contrast to the study by Pavitt et al., (1987) Acs and Audretsch did however not find variation related to firm size. Instead, they found that "there does not appear to be a great difference in the "quality" and significance of the innovations between large and small firms. However, the extent of innovative activity does not necessarily correspond to the market values of the innovations. It is conceivable that larger firms may tend to focus on innovations with a higher market value" (Acs and Audretsch, 1988, p. 681). Later, Cohen and Klepper found the relation between the size of the business unit and R&D effort stronger than the overall size of the (multi-product) firm. Also, in industries where innovations are saleable in disembodied form (through e.g. licensing) and/ or when there are better possibilities for growth due to innovation the importance of size is reduced (Cohen and Klepper, 1996).

It appears then as if the general assertion that SME's should be more innovative than larger firms is controversial, if viewed in the light of available literature. One could argue that this in turn reduces the justification for policies based on that general assertion. Pavitt et al (1987) concluded that "our findings do not point to easy or obvious prescriptions for the policy-maker. Given the high variance in the size distribution of innovating firms both within and between sectors, grand generalisations are often likely to be wrong, and grand policies often likely to be inappropriate. It is tempting to conclude that, under such circumstances, diversity and pluralism should be the only objectives of policy (Pavitt et al., 1987, p. 314)".

6. Public procurement and small innovative firms

The points outlined above imply that the SME notion is a too crude construct if used as a device for targeting particularly innovative firms and also that a categorical prescription of SMEs as more innovative than larger firms fails to find underpinning in the literature. A tentative conclusion is then that a policy set-up to increase SME involvement in public procurement might not necessarily render more innovation and should in that sense be considered insufficient as an innovation policy. One unresolved question that remains concerns the role of public procurement for those SME's which actually are innovative; it could be argued that the existence of these screening problems does not necessarily discredit the general idea of supporting SME's as a means to stimulate innovation. Maybe the problem would be settled by applying a more fine-tuned selection mechanism? Rather than examining any such options, the attention here turns towards inquiring about the conditions for a subset of innovative SME's that would presumably be targets for procurement policies aiming to stimulate innovation; small innovative health tech firms.

The empirical material reported here was collected in the context of the Baltic Sea Health Region HealthPort project that ran from 2012 and 2014, and was co-funded by the European Development Fund. The overall aim with the project was to facilitate ‘business acceleration’ by providing support, training and bringing together innovative SMEs and health care organisations to strengthen the Baltic Sea Region health economy. One topic addressed by the project concerned how public procurement could facilitate SME access to the health care market. This was an intervening project where participating firms were offered a support scheme consisting of EUR 10.000 to be spent on activities aimed at facilitating the commercialisation of the respective potential innovations each firm had submitted to the project.

6.1 Case selection and method

The selected firms were treated as individual cases following a case study methodology (Yin, 1994). Before proceeding to the data collection stage a case study protocol was developed. The case study protocol summarized important aspects of the project, such as purpose, practical procedures and interview questions. As data were to be collected by a team of investigators, the case study protocol filled two purposes: to provide a guide for the data collection and to maintain reliability. Prior to data collection, a workshop was held with the case study team, where the case study protocol was discussed. The workshop was set up to establish a mutual understanding of the purpose with the project and procedures to follow throughout the data collection stage.

The principle selection criteria applied were as follows: a. Selected candidates were either in project phase (i.e. not incorporated/ established as a firm) or SMEs in the life-science sector; b. They were involved in product innovation in cooperation with hospitals; c. willing to present their case, as well as interact with the HealthPort project. Other selection criteria came directly from the specific set-up of the HealthPort project. The ambition was to achieve technological variance, i.e. to select firms engaged in different technology areas. Another issue concerned the time-line of the projects. Cases were selected based on the probability of measuring progress during the study period. Further criteria concerned to what extent the selected firms would benefit from the support offered by the HealthPort project. A final criteria concerned the judgement of the potential for the BSR Bioregion and to what extent support to the candidate would contribute to the development of a better health care market in the BSR Bioregion.

For each case two main events of data collection and interaction were organised. All initial meetings were conducted as physical meetings. In four of the cases the second meetings were conducted either as telephone meetings or video conference (SKYPE, Teamviewer). The meetings were recorded and transcribed. Summaries of the interviews were sent out to respondents to allow for comments and corrections. Additional communication occurred through email and telephone over the project duration. The purpose with the first meeting was to collect data as specified in the case study protocol and identify and agree on needs to be supported by the HealthPort project. The main purpose of the second meeting was to evaluate the effects of activities supported by the HealthPort project. The time between the first meeting and second meeting was 4-7 months (Table 2).

Case no.	Initial meeting (date, type)	Evaluation meeting (date, type)
1	4 April visit	23 August visit
2	19 April visit	27 August Teamviewer conference

3	30 January 2013 visit	26 September Skype conference
4	1 February 2013 visit	13 August Skype conference
5	11 April 2013 visit	27 August 2013 skype conference
6	20 February 2013 visit	26 August 2013 visit

Table 2. Main events of data collection in the six cases

6.2. Case study findings

Included in the cases were firms established or about to be established in the Baltic Sea area. Included entities were registered in Estonia, Denmark (two cases), Finland, Germany and Sweden. Technologies represented were IT/ software development, telemedicine, health tech appliances and drugs. Each case and their respective innovations are displayed in Table 3 and described above.

Case no.	Innovation	Benefit
1	Cloud-based IT system for patient management	Enable better services for patients, faster and adequate decisions, long term analysis.
2	Personalized diabetes treatment system	Due to increased control making patients able to live more 'normal' lives. Reduce number of emergency responses due to increased control
3	Intelligent container for transporting organic samples	Increased efficiency for laboratories due to automated process. Reduced number of ruined samples in transport due to improved safety.
4	Angiogenesis inhibitor, which starves tumours by cutting off their blood supply	More efficient treatment leading to improved patient satisfaction.
5	Tele medicine solution	Provision of distributed healthcare in remote areas at a reduced cost.
6	Catheter with impregnated anti-microbial protection	Catheter can be in place for prolonged times, rendering fewer infections, reducing number of catheters that needs to be used.

Table 3. Description of the six cases.

Case 1. The firm was established 2007. The innovation project concerned a cloud-based IT system for assisting health care professionals dealing with patients suffering from multiple sclerosis (MS). Technical development started 2011. The aim of the system was to provide relevant information faster that would facilitate and speed up doctors' decisions. A central feature of the design was usability, for instance, the system was set up to avoid double entering of data. The system also included some analytical services enabling comparison between the individual patient and non-personal data on other patients stored in the system's data-base. During 2013, the firm scheduled to implement and test their technology at five major hospitals on their domestic market. Subsequently the firm envisaged to identify and exploit international markets.

Case 2. This case consisted of a product that relied on decades of research on diabetes conducted by a research institute. The system was designed to allow monitoring and took into consideration factors that influence blood sugar levels, ultimately resulting in an increased personalization of diabetes treatment. The aim is to be able to better control diabetes, enabling patients to live more 'normal' lives and save a lot of the emergency procedures associated with lack of or failing diabetes control. The foreseen subsequent development step for the system was a portable service, which would reduce the need for the patients to visit treatment centers. A test version of the system is in operation. It is envisaged to diffuse the system, initially by gaining acceptance from clinicians on the domestic market, and subsequently to exploit international markets.

Case 3. The firm was established in 2006 and worked with software development for automated logistics solutions many times as a sub supplier to larger companies. The project considered here concerns the development of an intelligent transport box used for transport of organic samples to and from laboratories. Over the duration of the Healthport project the product was not finished or ready for actual trials. The developers envisaged that the transport box would increase efficiency at laboratories, because of the higher level of automation that would enable safer transport of samples and therefore reduce the risk that samples are ruined during transport.

Case 4. This case concerned a commercial project (i.e. an organisation not established as a firm) administrated by a holding company in turn owned by a university. The project also benefited from close collaboration with a research firm. The firm who owned the project was established in 2011. The idea was based on more than 10 years of research in this field. The firm was transnational in the sense that the owners come from two different countries. The research was mainly conducted in one of the countries, while the management and commercial operations were based in the other. The product under development was an angiogenesis inhibitor, a drug designed to starve tumors by cutting off blood supply. Expected benefits would be a more efficient treatment and better patient satisfaction. The drug had gone through initial studies and demonstrated positive effects, and the project was therefore perceived as very promising.

Case 5. Established in 2004, the firm worked with IT infrastructure and telemedicine. The firm had already introduced some products on their domestic market. As the firm perceived their home market too small it had begun to explore international markets with products already commercialized in their home country. The product portfolio ranged between products that patients were able to use on their own to services where a unit, such as a bus, was taken to the patients in remote areas. There were also products enabling communication between physicians. More products and services that extend the current services are in development. The main objective was to get the patient a better and faster service, which is currently either denied them, or at best is very expensive. In this manner, the patient will either be in contact with health care personnel over an IT solution, or basic health care services are taken to patients in mobile units, and the net result will be a better service at a cheaper price. The solutions are relevant in all countries where part of the population live in remote areas of the country.

Case 6. The firm was founded in 2006 working initially with service provision in the life science industry. The firm's focus has shifted towards getting a first successful product on the market. The innovation considered here concerns the development of a catheter with impregnated anti-microbial protection. The problem with existing catheter coatings is that they are fragile and short lived. The novelty of the catheter in question is that it uses an impregnated anti-microbial protection, based on impregnation of active components. This creates a drug depot and a transport route to the surface of the catheter that allows for a self-regenerative surface. This means that the catheter can be in place for a prolonged period of time, which in turn reduces the number of catheters that need to be used. The solution also renders fewer infections.

6.3. Barriers perceived by the firms

Five main barriers were identified by the firms. These are discussed in the following.

Encountering regulations

Case 1, which dealt with an IT solution handling patient data, reported perceived challenges in relations to the integrity regulations. In order to market the system on the domestic market, the firm had to interact with the national health authorities and the agency regulating management of personal data in order to be able to prove compliance with what the firm perceived as a very strict law. For case 4, concerning the development of an angiogenesis inhibitor, this meant the rules and regulations necessary to comply with in connection with test and trials. The firm perceived that the amount of regulations made it difficult and expensive for a project to get to the latter stages of trials, and that this discourages a lot of potential successful projects from trying altogether. It was suggested that the rules could be softened without patient safety being at risk. Case 5, which involved tele-medicine solutions, also demonstrate similar viewpoints regarding strict regulatory guidelines: like case 1, the firm perceived data protection rules as a barrier to the ambition to integrate data from different countries. Another legal challenge was whether the products offered should be considered as software technology or a medical device, as this decision determines which laws applies. The case also reported about legal uncertainty regarding less known foreign markets.

Different types of market barriers

For the firm in case 2, one important barrier concerned what might be labelled diffusion barriers. Due to the setup of the particular health-system, the company had to convince both responsible physicians and patients about the benefits of the innovation. Barriers identified by the firm studied in case 1 concerned their ambition to exploit international markets. The firm reported a need to gather information to secure that the right markets were targeted. Another barrier related to “national pride”, i.e. the tendency to favor solutions developed by a domestic firm rather than a foreign firm. The firm in case 2 perceived it as hard to bring the innovation to market and to adapt the system to different health systems in different countries. Also, case 5 reported challenges due to differences in regulations across different international markets. A particular product-specific issue concerned the use of the solutions in a cross-border setting, requiring patient data to cross national borders.

Negotiating oligarchical markets

Case 1 reported a technical challenge related to integrating the new system with existing technology supplied by incumbent firms. Although the situation appears to be changing, what for this firm has been an oligarchical domestic market has in the past prevented entries of new suppliers of health-tech. A similar view was found also in case 3, which reflects a concern regarding the chances of a small firm to compete with larger firms. The firm perceived the tendency that larger firms “block out” smaller firms from the market as a significant barrier.

Funding

The project in case 1 received funding from a national innovation agency. The process of obtaining funding meant engaging in activities that for the firm, in retrospect, appear as side projects not central to the development of the innovation *per se*. After funding was secured, the focus shifted to making the system work. The funding from the national innovation agency was perceived as a critical success factor for the newly started firm, which did not

have any other references. The fact that the firm received funding was perceived as a way of legitimising the firm in the market. One challenge reported by the firm in case 4 was to find a major investor that could finance the further development of the drug. Hitherto it had been fairly easy to get access to smaller amounts of money, below 10.000€. There was some funding available in one of the countries available primarily for domestic firms. The fact that the firm was based in two countries excluded this opportunity for funding that would have been available had the firm been established as a completely domestic firm in that country. The firm managed to get funding from the innovation support agencies in the other country. The firm reported, however, allocating funding of magnitudes between 50.000€ or 100.000€, perceived as necessary for the further development, was very difficult to fulfill.

Interaction with public customers

The main challenges reported by the firm in Case 2 concerned getting the product on the market, which was a matter determined by how the health care was financed. In that country, insurance companies are the main funding source of health care, and patients and doctors expect insurance companies to pay for a service of the kind provided by the firm. This means that doctors have to be convinced of the relevance of the system. This is potentially difficult because it means that doctors are not solely in charge of the diagnosis and treatment of the patient. For the firm, it was perceived an advantage that they were part of a recognized organization with long experience in diabetes, which raises credibility amongst peers and make it more likely to be accepted by the doctors.

An important issue in Case 3 was that the firm lacked understanding of how the public sector is organized and what perhaps could be labelled cultural aspects necessary to identify business opportunities; i.e. issues such as relational and political elements at work inside the health care organizations; how the decision making process works and who influences this process. For Case 4, on the other hand, the firm did not perceive interaction as problematic. They felt that their location in a business park connected to a hospital played an important role to facilitate the interaction. Case 6 reported an interesting work-around solution of problems potentially encountered on European markets. The firm made the decision to focus on the US market because of legal constraints imposed on health providers to deal with bacterial related illness and epidemics at hospitals. According to the firm, this is not the case in other countries. The perception was reported that in the US, they generally think in socioeconomics and benefits on a more holistic and societal level when looking at acquiring innovative products. This strengthens the business case for products that can achieve those goals better than existing products.

6.4 Conclusions from the cases

An analysis of the interviews reveals an array of problems and issues that are somewhat dependent on the specific case, such as securing venture capital, uncertainty regarding regulations, how to adequately choose a business model, uncertainty regarding foreign markets, issues on validation studies and finding relevant partners. Concerning IPR, the firms engaged in innovation in the medical sciences (cases 2, 4, 6) were about to file patents and/or already had secured patents protecting the underlying technology. Firms drawing on ICT (cases 1, 3, 5), did not find this a central issue, although one of these firms as a result of the interaction with the project considered to look into the possibilities of patenting

For most cases public procurement was not a central issue. It is noteworthy that the firms in Case 1, Case 2, Case 4 and Case 6 did not report any experience as a contract owner awarded through a public tender process. In Case 3 the firm reported negative perceptions of public procurement, even if the firm (similar to Cases 1 and 2) had no previous experiences as contract owners. However, the firms did have experience as a member of a consortium. Getting involved with a consortium was also the preferred strategy for future engagements as a supplier to public agencies. The only firm that reported having experience from acting as a contractor in public procurement was the one included in Case 5. They also stated that they have the necessary competences to participate in public procurement.

For the six cases presented here some tentative conclusions can be made: most of the issues encountered and perceived as barriers for innovation were not directly linked to the domain of public procurement. One exception concerns the challenge associated with SME's competing with incumbent firms on oligarchical markets. There is always a risk that an award decision in favour of a certain standard or technological trajectory will work to exclude any emerging alternatives. It is beyond the scope of this paper to discuss how to balance the need for exploiting the benefits from standards dictated by dominant suppliers against excluding competitive alternatives. For the present discussion, it suffices to note that this problem is probably not solved by a generic SME policy, but rather, innovation policy leading to management practices that affect how contracts are set-up, and the extent to which these moderate the negative effects from dominating suppliers in situations which would otherwise impede innovation.

These conclusions have implications for the general emphasis on involving SME's in public procurement seen in recent policy making. At least for firms similar to the ones included here, it appears unlikely that generic efforts to increase SME involvement in public procurement will be able to negotiate the barriers to commercialisation that these types of innovative firms encounter.

7. Discussion

At the first glance, using public procurement of innovation policies that target SME's perceived as an innovative appears appealing. However, this paper presents evidence that raises doubt about the extent to which a generic approach would actually increase and/or enable innovation. Following the literature discussed here, there are certainly barriers for SME participation in public procurement. Some unsettled issues remain: whether or not barriers should be dealt with with any particular firm category in mind, or if this should be done in consideration for any potential bidder. Any divergence from a competitive tender process, for the sake of policy, might cause less rational contract award decisions. This paper scrutinizes statistics on SME involvement in public procurement, which establish that the share of SME's involvement in public procurement is lower than would be expected if the importance of SME's for the economy as a whole is taken into account. However, the available data only point towards tentative conclusions, and any there is no evidence that such 'fairness' is actually a sound expectation. The paper refers also to some studies that consider role of firm size in relation to innovation which render ambiguous outcomes. Although some of the studies drawn on were able to identify differences among specific sectors, the general claim that smaller firms would be more innovative than larger firms is not supported. Finally, the case study of these six small, innovative health-tech firms reported here, suggest that most of the innovation barriers these firms encountered would not be solved by public procurement policy aimed at promoting SME involvement.

Even if innovative categories of SME's could be identified and made distinct from those which are not, such distinction would not automatically determine which specific actions to take. Policy makers would still need to figure out what category of SME should become the target of public procurement of innovation policies. Among some options to consider would be identifying SMEs with previously-established track record of successful innovation; or those judged to have innovation potential, or potential as a job-creator, or any other criteria (c.f. Gibb, 2000). What goes for any policy measure is however the requirement of additionality, i.e. that the envisaged effects of a policy measure would not materialise unless the measure were implemented. Following that view, the application of public procurement of innovation would be justifiable if it could negotiate a situation where the market is not otherwise able to deliver innovation. Public procurement of innovation seen as a process requiring more resources than off-the-shelf procurement, evoked in a situation where the market is already capable of supplying innovation or suffering from problems cannot be resolved by public procurement policies, could be seen as a waste of public resources. Formulated in a more generic way, one could wonder whether any category of firm should be promoted because it is already innovative, or should it be promoted rather because it is underperforming in terms of innovation?

It should perhaps be noted that this paper neither asserts that SME involvement in public procurement is a bad thing, nor claims that SME's should not be able to contribute with innovative solutions. For the sake of innovation promotion, the SME category, i.e. the bundling together of all kinds of firms, seems less useful as a target group. One could argue that the solution is to be found on more endogenous levels (Rolfstam, 2013). If public procurers and technology managers within the public health sector develop innovation-friendly practices that promote innovative firms regardless of size, this might help to connect to other innovative SMEs. Such an approach would be a way of 'transposing' policy formulated on the EU level, to the level of hospital procurement decision makers – a process that moves from policies aimed at promoting SME's in general, to innovation policies implemented in endogenous practice that promote innovative firms.

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