Chapter 7

THE EFFECT OF A GOVERNMENT TARGET FOR THE PROCUREMENT OF INNOVATION: THE CASE OF THE UK'S SMALL BUSINESS RESEARCH INITIATIVE

Jillian Yeow, John Rigby, and Yanchao Li

INTRODUCTION

Public procurement of innovation (PPoI) has come to the forefront of the public procurement agenda in recent years, as a way to help foster market uptake of innovative products and services, increase the quality of public services and address major societal challenges, and support access to markets for small and medium-sized enterprises (Edler & Georghiou, 2007; European Union, 2014). Public sector procurement can significantly influence market dynamics and competition through its large purchasing power, in its production of scientific knowledge upstream and through creating new, forward looking markets downstream (Edler et al., 2012). Consequently, there has been extensive interest in the use of public procurement as an innovation policy tool and many countries have used public procurement to spur innovation (Edquist et al., 2015; Izsak & Edler, 2011; OECD, 2011).

Public procurement in the EU accounts for almost 20% of GDP (ICLEI, 2015); consequently, PPoI has a huge potential to deliver increased efficiencies and savings. In a time of decreasing public budgets, innovation can facilitate the delivery of vital infrastructure and services through better value for money. In the UK, public

---

* *Jillian Yeow, Ph.D., John Rigby, Ph.D., and Yanchao Li, Ph.D., are a Research Fellow, Senior Research Fellow, and Research Associate, respectively, in the Manchester Institute of Innovation Research, The University of Manchester. Dr. Yeow's research interests are in the fields of innovation management and policy, particularly the translation and adoption of technological and organisational innovation, and innovation in project-based contexts. Dr. Rigby's research interests include the whole policy cycle and methodological issues. Dr. Li's research interests lie in the design, implementation and evaluation of innovation policies, particularly public procurement of innovation and innovation policies.*

procurement accounts for approximately 16% of GDP and 35% of total public expenditure (Uyarra et al., 2013).

PPoI can support innovation processes through different modalities. An important differentiation here is that between pre-commercial procurement (PCP) and other forms of PPoI which take place after commercialization of new solutions (European Commission, 2006). Unlike commercial PPoI which often involves procurement of ready-to-use solutions/products, PCP involves the procurement of R&D services, which might or might not lead to a prototype (Rigby, 2016). In practice there are many concrete forms of implementing PCP, the archetype being the US Small Business Innovation Research (SBIR) programme followed by its European counterparts such as the UK Small Business Research Initiative (SBRI) and the Dutch SBIR programs (ibid.). It should be noted that for a period, the policy framework for the operation of PCP within the European Union established a formal separation between what could be developed under a PCP activity and what could then be purchased as a result of the PCP in terms of an actual market-ready product or service. In 2016 this picture is changing as a result of the introduction of a new legal framework for public procurement (European Parliament and the Council, 2014) that provides for a procurement under very specific conditions that covers all stages of the development of a product from initial feasibility study through prototyping to actual production. This so-called Innovation Partnerships procedure is in the process of introduction.

While the merits and challenges of PPoI to firms and the market has been widely debated and extensively researched, the practice of PPoI and its impact on the buying organization has been relatively underexplored with some notable exceptions. For example, Rothwell and Zegveld (1981) considered that procuring innovation requires a greater degree of in-house competence. Edler and Yeow (2016) looked at how capability and competence challenges in the buying organization could be overcome through intermediation whilst Yeow and Edler (2012) showed how managing innovation procurement as projects can address certain internal management shortcomings. It has also been found that the involvement of multiple stakeholders entailing all sorts of risks can sometimes impede innovative solutions (Tsipouri et al., 2009).

This paper looks at PPoI from the perspective of the buying organization. In particular, we examine how several UK government departments organize themselves to undertake PPoI activity, focusing on one particular aspect – the UK SBRI programme. We also investigate how the announcement of a target imposed on six UK government departments to increase their procurement of innovation through the SBRI influences their behaviour and attitude and any effects that might have. While much research has been done on the impact of PPoI on suppliers (in particular SMEs) (Edler et al., 2011; Georghiou et al., 2014; Uyarra et al., 2014) and the potential benefit to public authorities (and consequently, society) of increasing innovation procurement activities, less is known about *how* public organizations organize themselves to undertake PPoI and the effects on its internal organization (workings). It has been recognized that public organizations often face significant barriers and challenges to incorporate innovation in procurement and implement PPoI into their activities. Some have been more successful than others in changing practices and increasing their PPoI activity. Here, we look at some of the ways in which the SBRI process is undertaken and how different UK departments approached the requirement to use SBRI to increase their PPoI activity. We identify some of the challenges departments encountered, as well as the effects such requirements might bring about. We argue that there is a need for a clear understanding of the logic and benefits of the programme, dedicated resources and clear lines of responsibility to reap the benefits.

PUBLIC PROCUREMENT OF INNOVATION (PPoI)

A strict definition of public procurement of innovation (PPoI), or 'public technology procurement' as it was previously termed, is public agencies' purchase of not-yet-existing, innovative solutions which requires additional effort from suppliers (Edquist et al., 2000). This early definition, as noted by Uyarra (2016), has become too restrictive, particularly when innovation is denotes a broader range of activities. This paper adopts a broader definition as proposed by Yeow and Edler (2012), that PPoI is 'the commissioning and procuring of goods or services that are new to the purchasing organization and enable a novel service to citizens or enable a more efficient or effective delivery of that service' (p.490).

Justification of using public procurement to promote innovation primarily lies in the necessity of addressing information asymmetry between supply and demand sides (Edler & Georghiou, 2007). On the one hand, there is often unmet demand in the public sector driven by the changing needs of public infrastructures/services, and public buyers are not aware of what markets can offer in order to address this demand. On the other hand, because innovation is inherently a risky business, suppliers tend to be cautious in investing in R&D and innovation activities if they do not see clear signals of demand. Through PPoI public agencies can share risks, act as lead users to signal and articulate the unmet demand, and induce innovation through a 'pull' power (Uyarra & Flanagan, 2010). The unique leveraging power of public procurement could help realize the critical mass needed to create and enlarge markets for innovations and establish related supply chains.

PPoI can function in different ways depending on configurations of demand and maturity of technologies (See e.g. Hommen & Rolfstam, 2009 and Uyarra and Flanagan, 2010 for more detailed accounts of various forms of PPoI). Along the process of technology maturation, PPoI could support innovation through different stages of the innovation cycle, from idea development and feasibility study, to prototyping and commercialization, and to wider diffusion of innovative solutions. For PPoI that takes place prior to the commercialization stage, i.e. PCP, Rigby (2016) differentiates between an 'operational' mode of PCP where the public sector body conducts PCP for its own direct interests, and a 'policy' mode of PCP where the public body conducts PCP for a broader interest, as well as a hybrid mode of PCP which supports both operational and policy aims. Similarly, several authors have also differentiated between triggering and responding to innovation (needs), which may lead to different organizing of PPoI (Allman et al., 2011; Edler & Yeow, 2016; Miles et al., 2009). PCP can be useful in instances of triggering innovation and if used well can lead to a concrete procurement of innovation that transforms public services (Edler & Yeow, 2016; Yeow & Edler, 2012).

Compared with supply-side innovation policy instruments such as R&D subsidies and tax reduction, PPoI is believed to be able to achieve higher effectiveness in supporting business innovation under certain conditions. PPoI can generate immediate revenues for

beneficiaries and thus significantly incentivize suppliers by reducing uncertainty associated with R&D investment. In theory, PPoI can drive firms' innovation activities without extra spending beyond the procurement budget, which is particularly meaningful when the context is economically challenging. Public procurement is considered especially effective for smaller firms in regional areas under economic stress and in distributive and technological services (Aschhoff & Sofka, 2009). A more recent study in the European context has shown that PPoI has stronger positive impact on the probability of increase in total innovation expenditure than R&D grants (Guerzoni & Raiteri, 2015). Another advantage of PPoI is that the policy design can incorporate strategic goals of socio-economic development so as to embed a mission orientation (Edquist & Zabala-Iturriagagoitia, 2012). Moreover, as Edler and Georghiou (2007) noted, PPoI can serve as a cornerstone of a coordinated mix of instruments to systemically address policy problems. One early example in this regard is the EU Lead Market Initiative which is essentially a mix of PPoI policies, standardization, user subsidies and foresight (European Commission, 2007b).

PPoI is not necessarily the result of policy interventions and can take place in a bottom-up fashion driven by the unmet needs of public authorities, as shown, for example, in the various case studies in Edler et al. (2005). However, successful conduct of PPoI cases in a bottom-up way is a challenging endeavour requiring various factors including but not limited to strong practitioner capabilities and institutional capacity. Public procurers, often constrained by the cost-saving agenda and legal inflexibility, can be too risk averse to orient their activities towards innovation. In this context, public intervention is believed necessary to provide the incentives and resources, and to support the building of skills needed to carry out PPoI. As classified by Georghiou et al. (2014), four broad categories of public interventions have been evident in practice. The first category is policies aimed at setting up friendly framework conditions, including adjusting procurement regulations to accommodate the goal of promoting innovation e.g. amendments of the European procurement directives in 2005. The second category is policies aimed at improving organization and capabilities, including networking and training schemes for public procurers e.g. the European Commission Lead Market Initiative networks of contracting authorities. The third category is policies aimed at identifying, specifying and signalling

demand, including the development of special procedures to allow interactive learning between suppliers and users such as the use of competitive dialogues for projects involving highly uncertain technologies. The fourth category is policies aimed at incentivizing innovative solutions, including instruments to provide insurance for procurers and suppliers e.g. the Forward Commitment Procurement scheme in the UK (Uyarra et al., 2014). The existing PPoI policy schemes have mostly been on a voluntary basis, although in some contexts e.g. in the Korean New Technology Purchasing Assurance Program, mandatory procurement targets to support SMEs have been set for public agencies (OECD, 2011).

There is some limited evidence on the conduct of PPoI and the barriers perceived and/or experienced by stakeholders. For instance, a number of reviews have identified a variety of shortcomings in the actual conduct of PPoI (Aschhoff & Sofka, 2009; Bonaccorsi et al., 2012; Lember et al., 2007; Uyarra, 2010, 2016). More recently a large-scale survey (Uyarra et al., 2014) highlighted a lack of organizational capabilities of all kinds and counter-productive incentive and organizational structures as some of the reasons for the lack of uptake. To a greater detail Yeow and Edler (2012) and Edler and Yeow (2016) offer some insights as to how public buyers have attempted to overcome some of the challenges of PPoI, both internally and through intermediation respectively. However, there has been very limited understanding developed regarding how public bodies organize themselves to respond to deliberate policy initiatives to promote PPoI. This understanding is crucial in order to open up the black box of policy implementation to promote PPoI.

OPPORTUNITIES AND CHALLENGES OF PPoI FOR ORGANIZATIONS

In times of austerity, public bodies are increasingly expected to do more with less (Uyarra, 2010). Theoretically, PPoI requires no extra public spending on R&D beyond the normal procurement budget; it can generate immediate sales to firms to boost economy, and can address societal goals and generate positive externalities – all these make a strong case from policymakers' perspective. A core argument by policymakers to promote PPoI has been the policy instrument's advantage of financing business innovation on the one hand and fulfilling public sector's needs with innovative solutions on the other. For instance, Innovate UK has addressed explicitly its consideration

of upgrading the SBRI programme through its statement [that] '…SBRI encourages public sector organizations to take the lead customer role helping to develop and de-risk innovative solutions for which it might be the potential future customer.' (Innovate UK, 2015).

Public bodies, rather than suppliers, are in fact the core target group that PPoI-related policy interventions seek to directly influence. Unlike the target group of suppliers which often gets analysed in an in-depth way according to their demographic features (e.g. sizes, turnover and locations as conducted by Aschhoff & Sofka, 2009; Guerzoni & Raiteri, 2015; Uyarra et al., 2014), the target group of public bodies is rather neglected by the existing literature. This group could be diverse in terms of organizational characteristics, levels of governance and technical expertise. The existing policies targeting this group, as summarized by Georghiou et al. (2014), include those aimed to change the mind-set of public bodies towards supporting innovation, those aimed to build the capabilities and expertise needed in order to cope with technological and organizational risks associated with PPoI, and those aimed to create the institutional capacity including procedural flexibility for public procurers to carry out PPoI. Indeed, the Procurement of Innovation Platform point out that the implementation of PPoI can differ in terms of scope, ambition or budget; consequently, the extent to which a public body organizes themselves to undertake PPoI will vary depending on the size of the authority, the right political/high-level support, knowledge and experience in PPoI, and the availability of innovation products and services that the organization needs (ICLEI, 2015).

The key benefits that PPoI could offer public organizations include higher efficiency/productivity and improved services/infrastructure which enable better performance in the functions those public organizations undertake. An example of achieving the benefit of higher productivity through PPoI has been documented in Caloghirou et al. (2016), whereby a Greek local authority through its purchasing power was able to offer improved and more efficient services to the public, which then generated potential opportunities for wider communities of users and suppliers. Other evidence of improved public services with benefits for the wider society includes those analysed in Meerveld et al. (2015) regarding the forward commitment procurement (FCP) approach in the UK context. For instance, the adoption of biodynamic technologies by the Rotherham NHS

Foundation Trust led to considerable savings in terms of energy consumption and maintenance costs; in the case of zero-waste (i.e. fully recyclable) mattresses by the HM Prison Service, new solutions prevented landfill of retired products and hence achieved better environmental friendliness. The case of a closed loop recycled paper initiative in UK government ensured the safe and secure disposal of confidential documents whilst saving money for departments (through procurement) and achieving wider sustainability objectives (Yeow et al., 2015). From a wider perspective, as innovation has become increasingly of a systemic nature engaging different stakeholders, PPoI could offer immediate learning opportunities for departments that have not been traditionally involved in science and technology to become innovative, and contribute to a better functioning innovation system and furthermore to a more competitive economy.

PPoI poses a range of challenges at all levels; as Edler and Yeow (2016) point out "procurement is a complex market transaction with a high level of functional demands and risks involved that necessitate a broad range of capabilities" (pp. 415). Adding the innovation dimension makes the challenge even greater – markets for innovation are, by definition, not established; different functions within public organizations produce different expectations and incentives to demand innovation, not to mention the high learning and adaptation costs within buying organizations. These, along with other factors, often lead public organizations to become overwhelmed. They lack crucial capabilities, are poor at linking up complementary skills and interest both internally and externally.

There is some literature in the PPoI arena that has identified conducive factors of the buying organization that can facilitate PPoI (Edler et al., 2005; Edquist et al., 2000; Izsak & Edler, 2011; Rolfstam, 2013; Rolfstam et al., 2009; Tsipouri et al., 2009; Yeow et al., 2015). Nonetheless, to establish those enabling factors poses severe challenges for the buying organization. Generally, the most important challenges for PPoI from an organizational perspective as identified by Edler and Yeow (2016) are related to:

1. Understanding and assessing the market and its opportunities, both in terms of what is already offered and in terms of what the market could deliver if asked for by the public buyer (Edler et al., 2005);

2. Being able to understand one's need(s) and the functional improvements possible through innovation (Edler & Gee, 2013);
3. Establishing incentive structures that reflect the risk–reward distribution, to ensure that those organizational units that bear the risk also share some of the efficiency or reputational gains associated with innovation. Additionally, PPoI needs capabilities and procedures to overcome risk aversion through risk management approaches (Tsipouri et al., 2009; Wilkinson et al., 2005);
4. Being able to implement the innovation and change organizational procedures, routines and capacities needed to do so (Kyratsis et al., 2010; Rolfstam et al., 2009; Rye & Kimberly, 2007).

Literature has highlighted the challenge of innovation-related skills in procurement functions; for example, procurer competence has been identified as a possible concern when procuring innovative solutions. Authors have pointed to the possible discrepancy between the capabilities held by procurers and the skills required for procuring innovative solutions (Tassabehji & Moorhouse, 2008; Yeow & Edler, 2012) as the procurement of innovation requires a greater degree of in-house competence (Rothwell & Zegveld, 1981). Commercial skills across UK central government have been found to be very inconsistent (Green, 2010). Procurement of innovation requires different skills from normal procurement, and expertise from a wide range of functions, including and not limited to innovation necessarily. As a result, it has been recognised that PPoI is not and cannot be the responsibility of only the procurement or innovation department, but rather requires a co-operation of both types of skills (and sometimes even beyond) to achieve the potential of PPoI.

THE UK SBRI PROGRAMME

The UK SBRI programme is a PCP programme developed based on the US SBIR programme. The origins of this approach to public procurement of innovation are in attempts by the US government to support small business and widen access to government procurement budgets. In the late 1990s the UK and then the European Union sought to imitate this approach, noting that it had a number of apparent advantages (Rigby, 2016). The UK developed its

own scheme and the EU followed this up by devising a framework for PCP that adopted the general principles of R&D service procurement but which ensured compliance with the EU's Treaty Principle of equal treatment and by avoiding state aid, sought to encourage competition (European Commission, 2007a). As time has gone on, EU Member States have themselves moved to develop their own national schemes and the UK has been joined by the Netherlands, and the government of Flanders in Belgium. The European Commission conducted a review of the state of development of the policies in Member States in 2011 and found that in nearly all countries of the EU, steps had been taken to prepare for PCP and in three countries there were schemes that were operating (European Commission, 2011).

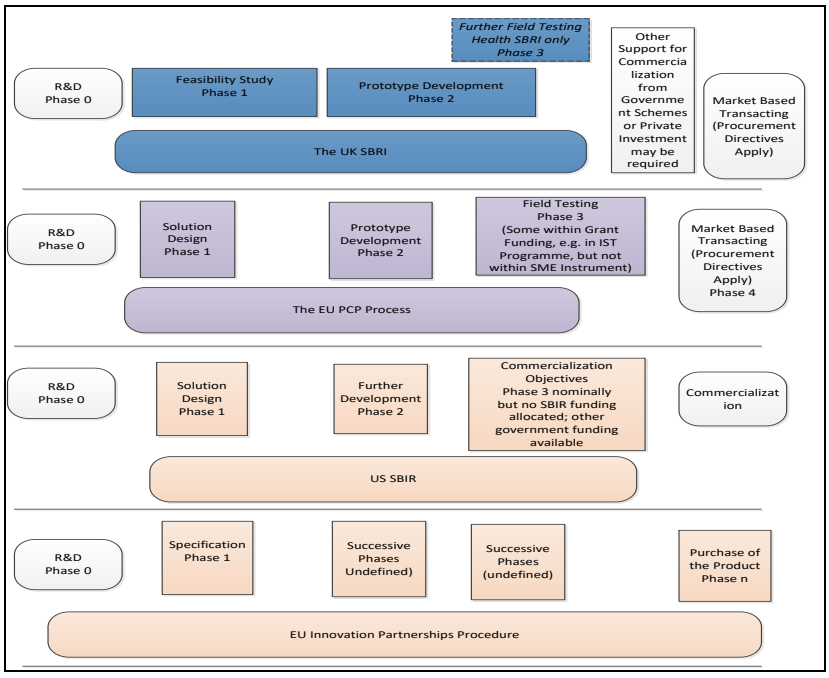
PCP may be conducted to serve the needs of government, where an operational need has been specified, or it may be conducted to deal with a general policy problem where the public or a private sector organization might be the ultimate user of the product or service delivered. Other choices for policy makers and the users of the policy include the following: should PCP be used or another of the options available through the directives, some of which allow for considerable scope in specifying innovation? Should procurement be conducted at the EU level, through EU initiatives of which there are a number, attempting to work cross-border in terms of specification and sourcing? Should Member States compel contracting authorities to use a specific programme or should they allow any organization to go it alone? What is the best way to build capacity to operate the process, nationally or locally? Should contracting authorities be required, as has been the case in the US since its inception to meet a target for the use of PCP, and if targets are set, how should they be monitored? There is therefore considerable scope in how PCP may be used, developed and supported.

The SBRI programme uses a two-stage competitive process whereby firms seek to demonstrate the scientific, technical and commercial feasibility of their product or service idea at the first stage, and develop a prototype in the second stage. The SBRI is used by UK government departments to engage with industry to define and meet (a) government's operational requirements (challenges) and/or (b) the need for more general innovations to address specific policy problems. In the latter case, the government will not itself be a

purchaser of the innovation however, if left to itself, the market might not be expected to deliver solutions. It is expected that at the end of the SBRI process, innovations have been developed to the point where volume production is the next step and market competition can take place.

The UK SBRI was introduced in 2001 and has been in its current incarnation since its relaunch in 2009 when Innovate UK (then as the Technology Strategy Board) took responsibility for it. SBRI is predominately funded by the government department or public sector organization which has a challenge and is looking for an innovative solution. In addition to managing the scheme, Innovate UK is also an important financial contributor to it, providing funding where it is responsible for the formulation of challenges that address key public policy objectives, but also co-funding challenges that are led by, or which involve, combinations of departments. Figure 1 provides a comparison of the UK SBRI Process in relation to the US SBIR, the EU PCP Process and the new EU Innovation Partnership Procedure.

FIGURE 1
UK approach to PCP Compared with the EU and US



CASE STUDY BACKGROUND AND METHODOLOGY

In the 2013 Budget, the Government announced that it would substantially expand SBRI among six key departments, thereby increasing the value of contracts awarded through this route from £40m in 2012-13 to over £100m in 2013-14 and to over £200m in 2014-15. The 2013-14 amount represented 0.25% of procurement budgets. The aim of the target was to increase utilization of the programme "across all departments", and was one of two approaches taken to use the programme to support SMEs.[1] The table below lays out the target departments and spend respectively.

TABLE 1
Target Departments and Their Respective Target Spend for 2013-14

Department	Target spend for 2013-2014 (in £ Millions)
Ministry of Defence	50
NHS (Heath)	30
Department for Transport	7
Home Office	7
Department for Energy and Climate Change	3
Department for Food and Rural Affairs	3

The authors were part of a study team commissioned by Innovate UK to conduct an evaluation of the SBRI Programme focusing on three aspects: (1) Use of the programme by departments and other public bodies and thereby understand the effect of the announcement of new departmental targets announced in the 2013 Spending Review; (2) Thorough review of the SBRI process by which the programme realises its mission and achieves its impacts; and (3) A detailed review of the impacts achieved by the programme. This paper focuses on the review of the programme from the perspective of the departments, in particular exploring the SBRI process in departments and the effect of new departmental targets on the organization of SBRI within departments.

This paper utilizes a case study methodology to present the findings of the study. According to Yin (1994, p.23), a case study is "an empirical enquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between

phenomenon and context are not clearly evident; and *multiple sources of evidence* are used". The case study approach allows organizational phenomena to be examined in actual situations, and its usefulness is "its ability to deal with a full variety of evidence – documents, artefacts, interviews and observations" (Yin, 1994, p.20). In case study methodology, one or a few entities are focused on and studied intensely. These include core events, processes and outcomes within specific contextual boundaries (i.e. the case) (Creswell, 1994), and can include both qualitative and quantitative approaches (Yin, 1994). In this study, we focus on how departments organize themselves to undertake SBRI and the effect the announcement of a target spend has on the organizing of SBRI.

As part of the study, semi-structured interviews were conducted with key individuals in 12 government departments and user agencies – 6 target[2] and 6 non-target, as well as firms and Innovate UK. This paper mainly draws on the interviews, some statistical data from an analysis of individual SBRI competitions as well as some desk research. The competitions analysed in the study covered the period from October 2008 to July 2014 in 17 departments. The semi-structured interview guide broadly covered the following:

- Role of the Programme in the procurement of innovation
- Management of the SBRI process, including engagement with industry
- Issues relating to route to market
- Effects of the targets set
- Overall impacts of the SBRI programme

We note the special case of MoD in this paper; its inclusion in our analysis is partial partly because we do not have direct interview data. Thus in terms of examining the way SBRI is organized within MoD, our interpretation is limited to the quantitative data and prior knowledge of the scheme and its operation. We do not feel that this causes any bias to the results; our intention in the study was to include departments which were prepared to use both policy and operational competitions and who might experience the organizational challenge of deciding between such competitions. The authors felt that MoD's use of SBRI might not be representative of the way in which the broad range of government departments experience and operate the

scheme. More precisely, the MoD is a very heavy user of the operational side of the scheme and while some other departments appear to show sole use of either the policy or the operational competitions, In MoD, the emphasis is very strongly on the operational side with 76 such competitions and no policy procurements. Furthermore, the Centre for Defence Enterprise, which operates the MoD's part of the SBRI, operates a slightly different procedure.

In the following section, we present the challenges that departments face in implementation and operation of the SBRI and the different ways in which departments, both target and non-target, respond to the setting of a target for SBRI. We seek to determine if there is evidence that targets have had an effect upon the way the programme has operated.

FINDINGS

Use of the SBRI Programme

Since the UK SBRI programme was relaunched in 2009, its use has risen steadily, with over £200m spent through the programme by mid-2014, and the number of public sector bodies that have participated has also increased (70) although the majority of use of the programme is concentrated within a small number of departments. The total number of competitions launched during the study period was 195, with 186 awarded contracts by the time of analysis. On average, three competitions per month were launched during this analysis period. Two-phase competitions have appeared as the more and more frequently used approach across departments, taking up 40% of all competitions in Period 1, 47% in Period 2, and as high as 73% in Period 3.[3]

As previously stated, PCP can serve to meet 'operational' or 'policy' objectives, or it can also occur in a hybrid mode (Rigby, 2016). The table below details the number of operational and policy competitions across the various departments.

TABLE 2
Count of Operational and Policy Competitions (by Department)

Department	Number of operational competitions	Number of policy competitions	Total
MOD	78	0	78
NHS	23	0	23
Innovate UK	0	15	15
NC3Rs	0	15	15
HO	11	1	12
DEFRA	0	11	11
DAs	3	6	9
DH	9	0	9
DECC	0	7	7
Other	2	5	7
BIS	0	5	5
DfT	4	0	4
Total	**130**	**65**	**195**

Source: Innovate UK Management Data.
Note: This table includes all competitions that were launched, the number of which is 195 excluding PCP competitions. Departments are sorted according to size of use.

For departments such as healthcare (DH and NHS) and MoD, competitions are exclusively 'operational', i.e. for their own use as end users. In contrast, for departments such as DECC, Defra, and those belonging to the BIS family (including BIS, NC3Rs and Innovate UK), competitions are exclusively in the 'policy' mode. For other departments the nature of competitions has been mixed. From the above table, it can be see that there were twice as many competitions in the operational mode compared to the policy mode. However, excluding MoD (who ran the most number of competitions and all of which were exclusively operational), we see that the other departments launched 52 operational competitions and 65 policy ones in total. The spending on each mode of competitions was fairly even.

Overall, departments expressed positivity towards SBRI; they believe the process is helpful to them, the scheme is relatively easy to use and is effectively managed by Innovate UK. There was a relatively significant amount of 'hand holding' in the early days of SBRI use in individual departments (by Innovate UK), which the departments welcomed, but overall the extent of involvement of Innovate UK in individual departments' challenges and competition varied, depending on the level of complexity of the challenge, capabilities within individual departments and whether there was co-funding involved. However, departments generally did not operate on their own and Innovate UK is always involved in selecting challenges and implementing competitions. Similarly, the organization and management of the SBRI process varied across the various departments. One of the differences in the treatment of SBRI in various departments is the overall responsibility of SBRI. For some departments, SBRI comes under the remit of the procurement/ commercial directorate (even though many of the procurement functions do not have a budget themselves) while in other departments, SBRI may sit under other directorates, e.g. economic growth, innovation or policy teams. For some, the delivery of SBRI can be the responsibility of more than one person/ function. We observe that in most cases there is no overall ownership of the programme/ scheme to take it forward (and champion it). This has been particularly the case for target departments who often ask the question "who's responsibility is it to meet the target?" In the areas of Health and Defence, SBRI has a high level of recognition and there is strategic use of the programme. Elsewhere, decisions about using SBRI are not considered systematically, or against all policy and operational requirements a department may have and against all the other options (i.e. normal procurement, forward commitment procurement, R&D contracts, R&D grants, participation in European Union procurement projects). This is discussed in further detail in the following section.

There is also variability in terms of departmental capability to originate, administer and finance a challenge. Two departments, MoD and DH/ NHS have developed their own in house capability; this does not yet however make either completely self-sufficient in any of these respects for all types of challenge. MoD SBRI activities are mostly operated through the MoD Centre for Defence Enterprise. All the NHS England competitions are run through EAHSN and HEE but not all the

DH ones and there is an NHS in each of the devolved administrations also which, if they run SBRI, they do themselves. The budget to fund SBRI competitions typically comes under the area or programme within a particular department where the challenge originated.

Effects of the Target Set

The target for the use of the SBRI programme was intended to increase the use of the programme amongst government departments (the target departments) but also to change attitudes about the use of the programme. While the targets appear to have led to an increase in use, overall the effect of the targets set has been somewhat negative and was met with some resistance by target departments.

On the one hand, departments considered that the target has given a well-justified emphasis to a scheme which has the potential to contribute in a number of ways to the UK economy and society through its use by a range of public sector bodies and raised its visibility. It has also made departments more aware of the procurement of innovation agenda generally, and of the possibility of realizing benefits for departmental policy and operational objectives from the programme. On the other hand, it caused some confusion and frustration as the targets set were regarded by some as "simplistic and inflexible" and even "ill-informed". The decision to set targets was taken by HM Treasury and communicated to departments by letter from the Cabinet Office. It was felt that while there was a rationale for the target based on SME engagement targets of government departments, the target was set without detailed consideration of how departments would actually use the Programme. In other words the target setting process did not look into how the programme would be used in practice, based on a forward planning exercise. While the target spend through SBRI for 2013-14 was £100m, the average annual spend of all the target departments (since 2009) has only been around £18m. Furthermore, the six-year average of SBRI spend as a proportion of gross procurement budgets was only 0.08%; nowhere near the targeted 0.25%. This represented an enormous challenge for the target departments, one which some have taken head on while some others struggled slightly more to tackle.

Importantly, departments (both target and non-target) were not opposed to the setting or presence of a target per se, but stressed the importance of having targets that were reasonable and achievable. Many felt that a consultation process for target setting, and sufficient time to develop internally a realistic understanding of how the programme could be developed, used and how targets could be met would have been more productive and ultimately would have secured greater buy-in to the notion of a target. Crucially, while PPoI has the word 'procurement' in it and does involve a purchasing activity (i.e. an R&D service), for many of the departments the money for SBRI does not come from the procurement budget (and in fact in many cases the procurement function did not have a budget). Furthermore, the expectation to increase use of the programme was not matched by corresponding levels of increased funds and even in departments where there was will to increase its use, they were hindered by a lack of money available to fund more competitions. The costs of operations of the programme consist of (1) contracts given to firms; and (2) administrative costs of departmental/ Innovate UK staff. The UK programme was established without specific recommendations for how much the programme would cost to operate and the study team believes that no special budget for staff time exists within departments for the use of the programme with the exception of Innovate UK which, as the organization responsible for the support and administration of the whole programme, has mechanisms for assessing staff time allocated to SBRI activities. The respondents' concern with a lack of increased funding mainly relates to (1) rather than (2). Staff time spent on operating the programme is likely to be higher during the first years of operation as staff in departments acquire and develop the expertise to operate it. However, without regular use of the programme, such capacities may decline. Furthermore, the programme is complex, hence the need for the specialist help of Innovate UK, and although the scheme has been documented and procedures detailed, there are many aspects that cannot be written down and must be learned through practice.

In the period after the target began, spending rose significantly, although the amounts spent through the SBRI programme were well short of the proportion expected. When we compare the target and non-target departments, the former account for around 66% of total expenditure (of the programme), and non-target departments were

not increasing their use of the programme at the same rate as the target departments.

Target departments highlighted the fact that there was no known consequence of hitting (or missing) the target. A lack of incentive (or even disincentive), whether financial or otherwise, to achieve the target spend made it difficult for departments to figure out a way to approach the announcement, and they did not know to what extent they should or needed to prioritise or push the presence of a target. In contrast, the US SBIR is a mandated scheme where departments are legally obliged to meet their targets for use and where sanctions are dealt if such targets are missed. While some departments appear to have run more competitions and increased their spend as a result of the target, this does not appear to be sustainable in the long-run without additional funds (SBRI-specific or otherwise) made available to do so. This is crucial for both target and non-target departments, as all departments interviewed mention the difficulties they are facing overall due to year on year budget cuts in the public sector.

As previously mentioned, ownership of the SBRI process also emerged as a key issue in determining how departments organize themselves to undertake SBRI. Each department had an SBRI contact or Champion, who is normally based in either procurement or an innovation function. There might also be a challenge user, who may be responsible for the origination of the challenge within the department and who can specify the need/ challenge to which the technology is a solution. In the case of the target departments, the ambiguity of whom the responsibility of the target lay with was an added issue. In some cases it appears that procurement are responsible for delivering the target but as previously mentioned, procurement very rarely had the budget for SBRI (or even anything). Currently, no ministerial portfolio includes explicit reference to responsibility for the SBRI programme.

Nonetheless, the majority of interviewees cited that the presence of the target had (initially) increased awareness of SBRI within their departments and made people think about approaching challenges via this route to contribute towards the target (whenever possible). However, uptake of SBRI is still faced with the challenge of where to find the money for the competition in the first place.

We also consider whether the target setting process has been effective in changing attitudes and capabilities within departments to use the programme. Target departments believed that the removal of the target would not change their behaviour or attitude towards SBRI. For those who already run a substantial number of SBRI competitions or at least use SBRI regularly, the feeling is that they use SBRI to meet their needs regardless of whether there is a target or not, which is just an added pressure/ marker to hit, but without the appropriate incentive/ motivation/ support. This is particularly the case for smaller departments, i.e. those with smaller targets and who use SBRI to a lesser extent (i.e. run fewer and smaller competitions). For the larger departments, the feeling is that the removal of targets might actually create a more positive attitude towards SBRI.

Contrastingly, many of the non-target departments indicated that a target for them would not be a bad thing as it might increase the use of SBRI within their departments and create the justification to ask for additional funding towards this spend and promote the view that innovation should support the work of government. However, this was spoken with a cautious note that the target set had to be realistic, feasible and achievable, as many were aware of the difficulties the target departments were facing in trying to hit their target spend. For one, target departments were frustrated by the annualised nature of these targets, which further creates artificial boundaries and potentially leads to results that do not accurately reflect the true picture of the uptake, use and success of SBRI within departments. SBRI competitions normally operate over a period greater than one year and the nature of innovation means that there are often external factors that influence the innovation process. It was suggested that consideration of flexibility in financial year limitations to achieve the target (e.g. over 3-5 years rather than annually) would be helpful and reduce the risk of departments attempting to 'game' the system. It also helps in situations where there is uncertainty over budgetary amounts for competitions and uncertainty over start dates.

We have also previously highlighted the role of Innovate UK; not only do they have overall responsibility for the scheme, they are also an important financial contributor to it, providing funding where it is responsible for the formulation of challenges that address key public policy objectives, but also co-funding challenges that are led by, or

which involve, combinations of departments. This co-funding by Innovate UK has been an important feature of the use of the programme in that it has formed a substantial part of the money allocated to competitions. The degree to which Innovate UK money has been able to leverage departmental money into the SBRI competition is difficult to determine, but it appears that this spending is likely to have had some effect in helping departments raise their own spending on the programme, thereby helping them achieve the target. Whether this support of departments to achieve targets is desirable or practicable are difficult questions. Clearly, there may be competitions that might need the involvement of Innovate UK as a technical partner. But it is perhaps less justifiable that Innovate UK should in effect subsidize departmental use.

DISCUSSION

The above has shown that there is no one-single way to approach SBRI or even use it. Here we discuss some of the implications of the current state of play of SBRI and the effect of the announcement of a set target.

The SBRI programme aims to help realize departmental policy objectives and/or meet operational needs.[4] To that end it is clear that it has been successful. Overall, for all departments, SBRI has also had the important and useful outcome of triggering more strategic thinking about their operational and policy objectives, and creative ways in which these problems might be solved. This might be through the use of SBRI but can also be through other tools and instruments. Crucially, such a view propels SBRI beyond an end in itself and instead is a means to an end (of achieving innovation procurement to meet departmental objectives). Nonetheless, even if SBRI is the way to go, there is still an underlying issue of money to fund the competitions.

Departments were not always aware of the benefits that arose from policy competitions since they were not direct beneficiaries of them. Consequently, they might not be able to assess the social and economic impacts which their competitions might have produced once the technologies were developed and commercialized. This ‘pulling through’ of the benefits into the commercialization stage is crucial and is something that still needs to be overcome.

SBRI is one within an arsenal of tools that can be used as a matter of routine to achieve departmental objectives but is not presently. One challenge is that the process of formulating a broad challenge area and a competition from a range of departmental objectives needs some new capabilities in departments, involvement from staff at senior level, and the accumulation of experience at all levels to make the process effective and efficient. One way to tackle this is to ensure that person responsible for overseeing the programme has an overview of the department (and its activities) and can make the link between how SBRI could support those activities effectively and thus would be able to drive the programme forward. This idea of an "innovation champion" has gained traction in the literature. Innovation champions, in order to have significant impact, are typically powerful individuals high up in the management structure of the organization (Wilkinson et al., 2005; Yeow & Edler, 2012). Currently, responsibility for using SBRI lies at relatively low levels in many departments and is not considered as a policy tool that can be used strategically. Similarly, embedding SBRI within departments as business-as-usual may overcome some of the cost of constantly trying to reinvent the wheel with each competition. For example, regular challenge announcements are made on a six-monthly cycle in the area of Health. This not only allows them to allocate capacity and resources more efficiently, but also enables industry to better respond to these competition announcements, facilitating early engagement and better relationships between (eventual) buyer and supplier (Georghiou et al., 2014; Uyarra et al., 2014). Furthermore, SBRI is one of many tools within the PPoI portfolio. Thus, it should not be considered in isolation but needs to be seamlessly woven into the fabric of the organization and used where appropriate to support policy and operational objectives rather than being an end in itself.

SBRI is not just for triggering innovation in firms to help departments achieve their policy and operational goals. SBRI also has an aim to contribute to the development of public sector bodies' innovation capability in a number of ways: it is meant to make government departments more aware of the opportunities that may exist for innovation amongst the UK SME supplier base; it is intended to provide departments with a greater understanding of how its own departmental responsibilities and needs can be discharged through more innovation procurement activities. These changes that are

expected are what we term capacity and capability developments: they are a change in organizational capability and readiness to work in new and improved ways. It can be seen that as a result of long-term and continuous exposure to and success with SBRI, most departments have begun to think more strategically about procurement although not all have the administrative capability to 'routinize' SBRI in the policy making process.

In terms of the effect of the announcement of targets set, we have seen that the initial reaction has been a negative one. Nonetheless, most departments recognise that 'resistance is futile' and have 'got on' with trying to make sense of the target and finding ways in which it could be met. This was difficult, given the main underlying issue of a requirement to increase spend through SBRI competitions but not being given any corresponding increase in funding to achieve that, not to mention a lack of ownership of the target and understanding of the consequences of meeting or missing it. Some departments were able to increase their spend, but not to a level anywhere near their target amount. In some ways, a lack of sanctions with regards to not meeting the target has allowed departments to increase their SBRI use at comfortable levels without fear of repercussions and therefore achieving an initial aim of the target in the first place. However, that same uncertainty and ambiguity made departments unsure about the extent to which they should or needed to push the agenda, and therefore perhaps did not increase their SBRI activity level to its fullest potential.

It is quite clear that a one-size fit-all approach to the target (albeit one that is proportional to departmental spend) does not work. A more flexible target that takes into account the capacity and level of use within departments, departmental budgetary cycles and fluctuating rates of uptake will allow the scheme to be used more as well as more effectively, and consequently enable better reflection of the actual outcome against any target set. Encouraging and enabling departments to actively participate in the target setting process would also help to circumvent problems of unrealistic expectations, underachieving potential and frustration with the programme, and ultimately secure buy-in to the idea through early engagement. Such steps have been proven to help overcome some of the challenges in the procurement of innovation (Edler & Yeow, 2016).

In terms of dealing with and responding to uncertainty; the importance of good communication in times of uncertainty helps to create a viable environment in which decisions made can be undertaken. The decision was taken in HM Treasury and correspondence from the Cabinet Office to departments indicates that the target was communicated by letter to departments. The Government also indicated its policy in the Appendix to the House of Commons Science and Technology Committee in the summer of 2013 (House of Lords Science and Technology Committee, 2013). Such "top down" communication was fairly unwelcomed, and appeared to undermine the efforts and importance of those who actually run the scheme at the departmental level.

The effect of such targets for savings may impact upon the ability of departments to implement and operate the SBRI despite the fact that SBRI may allow departments to save costs in the long run. There is no clear strategy within departments on how SBRI can contribute specifically to the realization of the major aims of the government's austerity programme.

An effective target relies upon a defined owner of the target and upon the existence, implied by the term "target", of some form of sanction if the target is not met. At present, departments do not have clear ownership of the programme, nor is there a clear penalty if the target is missed. SBRI champions within departments with the exception of a notable couple are not senior staff and have no programme office or permanent budget. For SBRI to become one of the tools of choice for the development of organizational improvement (through operational competitions) or for policy purposes (through policy competitions), the SBRI programme needs greater recognition within departments and those departments would benefit from greater capability in how to use SBRI.

CONCLUSION

Public sector bodies are key actors in the SBRI process; to this end it is important to understand the challenges they face in undertaking SBRI activities and explore how they manage and organize the process to overcome these challenges and thus show good practice. We have seen how UK government departments have operational competitions that aim to meet the needs of departments, but in a visionary way with technologies that do not yet exist. Similarly

they have policy competitions to address the needs of the department, which may include the needs of a wider public or private sector client. They also can operate on their own in selecting challenges and implementing competitions, however they have not generally done so and have often been assisted by Innovate UK albeit in varying degrees depending on level of complexity of challenge, capabilities available within and experience of undertaking SBRI of the department involved. The level of involvement of Innovate UK can also be in financial terms and can influence the type or depth of competition posed.

Procurement of innovation is not (and cannot be) an activity limited to procurement departments; it is much wider and must involve multiple stakeholders within government organizations to fully respond to complex policy agendas. Capacity is required at the strategic level in terms of knowledge of how to use SBRI within departmental priority setting and how to formulate challenges, as well as at the operational level in terms of engagement with firms to fully exploit the programme. To a large extent, the responsibility for SBRI falls under the remit of innovation in the majority of departments but the involvement and enrolment of procurement is still vital.

Procurement is often seen as something of a policy panacea and repeated efforts to put procurement budgets to work to drive innovation have been met with limited success (NESTA, 2012). Barriers to effective implementation that have been documented extensively in the literature include organizational, regulatory, a lack of skills and the risk averse nature of the public sector. In this article, we looked at some of the ways in which government departments organize themselves to undertake SBRI and how they have responded to the publication and expectation of an SBRI use target. The SBRI is an ambitious programme with multiple objectives, one of which is to improve the operation of Government departments. Nonetheless, to reap the benefits of it requires significant changes in mind set, practice and resources. This research has shown that there is a need for clear understanding of the logic and benefits of the programme, to see it as a means to an end and not just an end to itself, dedicated resources and clear lines of responsibility to fully reap the benefits of the programme.

The creation of the target has given the SBRI programme greater visibility in government; it has made departments more aware of the

procurement of innovation agenda, and of the possibility of realising benefits for departmental policy and operational objectives through SBRI. To that end, it has achieved one of its aims. The challenges that are encountered in using SBRI are not so much in terms of willingness or understanding, but rather it appears to be hindered by resource constraints. This remains a challenge in times of austerity and continuous budget cuts.

The SBRI programme will have benefits on departmental budgets in terms of efficiency and effectiveness. However, to assess the extent of the savings properly, good data needs to be kept over a significant period of time, and the programme must be allowed to run without constant tweaks and changes so that any outcome can be attributed directly to SBRI.

ACKNOWLEDGEMENTS

The authors wish to thank Innovate UK for permission to use some of the material presented in this paper which is based on research carried out in the course of the first full-scale evaluation of the UK Small Business Research Initiative that took place in 2014 and 2015.

NOTES

1. The other step which the government took to promote the programme was to require all departments to ensure that their SME action plans identified how departments should make more use of SBRI (House of Lords Science and Technology Committee, 2013, p. 9, page 9).
2. The target for Health applies to both the Department of Health (DH) and the National Health Service (NHS) so both organisations were interviewed. However, interview discussions revealed that DH and NHS rarely fund competitions together or share common funding channels thus are treated as separate departments in our analysis. The team did not manage to interview MoD.
3. The periods studied were: October 2008 – August 2010 (Period 1); September 2010 – September 2012(Period 2); and October 2012 – July 2014 (Period 3).

4. While the distinction is made by Innovate UK between policy and operational competitions, certain competitions may fall under both descriptions, and in any case all competitions whether policy or operational have the potential for the technologies to be sold beyond the lead customer.

REFERENCES

Allman, K., Edler, J., Georghiou, L., Jones, B., Miles, I., Omidvar, O., Ramlogan, R., & Rigby, J. (2011). *Measuring Wider Framework Conditions for Successful Innovation: A System's Review of UK and International Innovation Data*. [Online]. Available at http://www.nesta.org.uk/library/documents/Measuring_Framework_web_v2.pdf.

Aschhoff, B., & Sofka, W. (2009). "Innovation on Demand-Can Public Procurement Drive Market Success of Innovations?" *Research policy, 38*(8): 1235-1247.

Bonaccorsi, A., Cappiello, F., & Molinari, F. (2012, 2012). *The Challenges of Bringing Innovation Through Public Procurement At Regional Level - Early Experiments in Italy*, Manchester, UK: Demand, Innovation and Policy: Underpinning Policy Trends with Academic Analysis Conference, 22-23 March.

Caloghirou, Y., Protogerou, A., & Panagiotopoulos, P. (2016). "Public Procurement for Innovation: A Novel eGovernment Services Scheme in Greek Local Authorities." *Technological Forecasting and Social Change, 103*: 1-10.

Edler, J., & Gee, S. (2013). *Public Procurement and the Co-production of Process Innovation*. Manchester.

Edler, J., & Georghiou, L. (2007). "Public Procurement and Innovation - Resurrecting the Demand Side." *Research policy, 36*(7): 949-963.

Edler, J., Georghiou, L., Blind, K., & Uyarra, E. (2012). "Evaluating the Demand Side". *Research Evaluation, 21*(1): 33-47.

Edler, J., Georghiou, L., Uyarra, E., & Yeow, J. (2011). *Procurement and Innovation: Underpinning the Debate*. Background paper for forum organised within the UNDERPINN project. [Online]

https://underpinn.portals.mbs.ac.uk/Home/tabid/1537/language/en-US/Default.aspx

Edler, J., Rigby, J., Hommen, L., & Tsipouri, L. (2005). *Innovation and Public Procurement–Review of Issues at Stake. Study for the European Commission (No ENTR/03/24). Final Report*. Retrieved from https://cordis.europa.eu/pub/innovation-policy/studies/full_study.pdf

Edler, J., & Yeow, J. (2016). "Connecting Demand and Supply: The Role of Intermediation in Public Procurement of Innovation". *Research Policy, 45*(2): 414-426.

Edquist, C., Hommen, L., & Tsipouri, L. (2000). *Public Technology Procurement and Innovation*. Norwell MA: Kluwer Academic Publishers.

Edquist, C., Vornatas, N. S., Zabala-Iturriagagoitia, J. M., & Edler, J. (Eds.). (2015). *Public Procurement for Innovation*, Cheltenham: Edward Elgar.

Edquist, C., & Zabala-Iturriagagoitia, J. M. (2012). "Public Procurement for Innovation as Mission-oriented Innovation Policy". *Research Policy, 41*(10): 1757-1769.

European Commission. (2006). *Community Framework for State Aid for Research And Development and Innovation*. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52014XC0627%2801%29

European Commission. (2007a). *Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions COM(2007) 799 final Pre-commercial Procurement: Driving innovation to ensure sustainable high quality public services in Europe, {SEC(2007) 1668},*. Brussels.

European Commission. (2007b). A Lead Market Initiative for Europe (pp. 1-11). Brussels.

European Commission. (2011). *Mid-Term Review of the R&D&I Framework*. Retrieved from Brussels: http://ec.europa.eu/competition/state_aid/legislation/rdi_mid_term_review_en.pdf

Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on Public Procurement and Repealing Directive 2004/18/EC Text with EEA relevance (2014).

European Union. (2014). *Public Procurement as a Driver of Innovation in SMEs and Public Services*. Brussels: DG Enterprise and Industry

Georghiou, L., Edler, J., Uyarra, E., & Yeow, J. (2014). "Policy Instruments for Public Procurement of Innovation: Choice, Design And Assessment". *Technological Forecasting and Social Change, 86*(0): 1-12.

Green, P. (2010). *Efficiency Review - Key findings and recommendations* Retrieved from http://www.cabinetoffice.gov.uk/sites/default/files/resources/sir philipgreenreview.pdf

Guerzoni, M., & Raiteri, E. (2015). "Demand-Side Vs. Supply-Side Technology Policies: Hidden Treatment and New Empirical Evidence on the Policy Mix". *Research Policy, 44*(3): 726-747.

Hommen, L., & Rolfstam, M. (2009). "Public Procurement and Innovation: Towards a Taxonomy". *Journal of Public Procurement,* 9(1): 17-56.

House of Lords Science and Technology Committee. (2013). *Third Special Report: Bridging the Valley of Death: Improving the Commercialisation of Research: Government Response to the Committee's Eighth Report of Session 2012-13*. London: HMSO.

ICLEI. (2015). Procurement of Innovation Platform. Retrieved from https://www.innovation-procurement.org/home/?no_cache=1

Innovate UK. (2015). Data on Administrative Costs Provided to the Study Team.

Izsak, K., & Edler, J. (2011). *Trends and Challenges in Demand-Side Innovation Policies in Europe*. Retrieved from http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=5532&lang=en &tpa_id=0&displayType=library

Kyratsis, Y., Ahmad, R., & Holmes, A. (2010). "Understanding the Process of Innovation Adoption in 12 NHS Trusts-Technology

Selection, Procurement and Implementation to Help Reduce HCAIs". *Department of Health, England, 331*.

Lember, V., Kalvet, T., Kattel, R., Penna, C., & Suurna, M. (2007). *Public Procurement for Innovation in Baltic Metropolises*. Retrieved from: https://www.tallinn.ee/est/g2420s33519

Meerveld, H., Nauta, J., & Whyles, G. (2015). "Forward Commitment Procurement and its Effect on Perceived Risks in PPI". In *Public Procurement for Innovation*. C. Edquist, N. S. Vornatas, J. M. Zabala-Iturriagagoitia and J. Edler. Cheltenham, Edward Elgar: 110-143.

Miles, I., Wilkinson, C., Edler, J., Bleda, M., Simmonds, P., & Clark, J. (2009). *The Wider Conditions for Innovation in the UK: How the UK Compares to Leading Innovation Nations. NESTA Index Report*. Retrieved from: https://www.nesta.org.uk/sites/default/files/wider-conditions-for-innovation-report.pdf

NESTA. (2012). *Plan I: The Case for Innovation-Led Growth*. Retrieved from: http://www.nesta.org.uk/sites/default/files/plan_i.pdf

OECD. (2011). *Demand Side Innovation Policies*: OECD Directorate for Science, Technology and Industry. Paris: OECD

Rigby, J. (2016). The Impact of Pre-Commercial Procurement on Innovation. In J. Edler, P. Cunningham, A. Gök, & P. Shapira (Eds.), (pp. 614-648), Cheltenham: Edward Elgar.

Rolfstam, M. (2013). *Public Procurement and Innovation - the Role of Institutions*, Cheltenham: Edward Elgar.

Rolfstam, M., Phillips, W., & Bakker, E. (2009). *Public Procurement of Innovation Diffusion: Exploring the Role of Institutions and Institutional Coordination*. Paper presented at the CIRCLE Working Paper No.2009/07, Lund University; Lund, Sweden.

Rothwell, R., & Zegveld, W. (1981). Government Regulations and Innovation - Industrial Innovation and Public Policy. In R. Rothwell & W. Zegveld (Eds.), *Industrial innovation and Public Policy: Preparing for the 1980s and the 1990s*. Westport: Greenwood Press.

Rye, C. B., & Kimberly, J. R. (2007). The Adoption of Innovations by Provider Organizations in Health Care. *Medical Care Research and Review, 64*(3): 235-278.

Tassabehji, R., & Moorhouse, A. (2008). The Changing Role of Procurement: Developing Professional Effectiveness. *Journal of Purchasing and Supply Management, 14*(1): 55-68.

Tsipouri, L., Edler, J., Rolfstam, M., & Uyarra, E. (2009). *Risk Management in the Procurement of Innovation. Concepts and Empirical Evidence in the European Union*. Retrieved from Brussels: http://ec.europa.eu/invest-in-research/pdf/download_en/risk_management.pdf

Uyarra, E. (2010). Opportunities for Innovation Through Local Government Procurement: A Case Study of Greater Manchester (pp. 1-54). NESTA.

Uyarra, E. (2016). The Impact of Public Procurement of Innovation. In J. Edler, P. Cunningham, A. Gök, & P. Shapira (Eds.), (pp. 568-613), Cheltenham: Edward Elgar.

Uyarra, E., Edler, J., Garcia-Estevez, J., Georghiou, L., & Yeow, J. (2014). "Barriers to Innovation Through Public Procurement: A Supplier Perspective". *Technovation, 34*(10): 631-645.

Uyarra, E., Edler, J., Georghiou, L., Gee, S., & Yeow, J. (2013). UK Public Procurement of Innovation: The UK case. In Rainer Kattel, T. Kalvet, & V. Lember (Eds.), *Public Procurement, Innovation and Policy: International Perspectives* (pp. 233-258). London: Springer-Verlag.

Uyarra, E., & Flanagan, K. (2010). "Understanding the Innovation Impacts of Public Procurement". *European Planning Studies, 18*(1): 123-143.

Wilkinson, R., Georghiou, L., Cave, J., Bosch, C., Caloghirou, Y., Corvers, S., Dalpé, R., Edler, J., Hornbanger, K., & Mabile, M. (2005). Procurement for Research and Innovation. Report of an Expert Group on Measures and Actions to Assist in the Development of Procurement Practices Favourable to Private Investment in R&D and Innovation, Brussels. *EC, DG Research, EUR, 21793*.

Yeow, J., & Edler, J. (2012). “Innovation Procurement as Projects”. *Journal of Public Procurement, 12*(4): 472-504.

Yeow, J., Uyarra, E., & Gee, S. (2015). Closing the Loop - Examining the Case of the Procurement of a Sustainable Innovation. In C. Edquist, J. M. Zabala-Iturriagagoitia, N. S. Vornatas, & J. Edler (Eds.), *Public Procurement for Innovation* (pp. 235-262). Cheltenham: Edward Elgar.