Measuring innovation in the public sector

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Abstract

There is sufficient evidence, drawn from surveys of innovation in the public sector and cognitive testing interviews with public sector managers, to provide basic recommendations for how to measure innovation in the public sector. The recommendations recognize the unique characteristics of the public sector and are intended to provide useful information for policy efforts to improve the innovative capabilities and innovation outcomes of public sector organizations. Important topics for measurement include the characteristics of survey respondents and their workplace, innovation drivers, resources for innovation, innovation processes and strategies, innovation outcomes, novelty of innovations, and obstacles to innovation. Although many proposed questions are similar to those included in the Oslo Manual guidelines for measuring innovation in the private sector, surveys of public sector innovation need to delve more deeply into innovation processes and strategies, particularly on how innovations are developed. We also recommend that public sector innovation surveys combine a subject-based method that asks about innovation activities in general and an object-based method that includes questions on a specific 'most important' or 'most recent' innovation. This hybrid approach can improve the accuracy of question responses and provide high-quality data for policy development.

1. Introduction

In high-income countries the public sector contributes to between 20% and 30% of GDP, with the highest shares observed in Scandinavia.[4] This is considerably more than the share of manufacturing, which is less than 12% in many OECD countries, including Canada, the UK and Australia. Given its economic weight, there is growing policy interest in how to encourage innovation in the public sector with the goal of improving productivity, the quality of public services and addressing societal challenges. This requires an ability to measure the inputs, processes and outcomes of public sector innovation in order to determine what works and to benchmark performance.

Guidelines for how to use surveys to measure innovative activities in the private sector have been available via the OECD's Frascati Manual (2015) for R&D since the early 1960s and via the Oslo Manual for other innovation activities since 1992. The Oslo Manual has been updated twice since 1992. These updates extended coverage

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[4] The share of the public sector in national GDP for European countries can calculated from Eurostat tables for 'final consumption expenditures of general government at current prices, percent of GDP' and 'general government gross fixed capital formation of EU-27', see epp.eurostat.ec.europa.eu.

from the 1992 Oslo Manual's limitation to technological innovations in the manufacturing sector to include the service sector and organisational, service and marketing innovations that are not based on technology (OECD/Eurostat, 2005).

A natural progression is to extend the Oslo Manual's definition of innovation and its identification of important innovation inputs, processes and outputs to the public sector environment. The first large-scale survey of innovation in the public sector, the 2008-2009 MEPIN survey of public sector organisations in Scandinavia, adopted this approach (Bugge et al, 2011), with a few changes to the definitions of the four main innovation types that could still maintain comparability with the definitions for the private sector. For example, the MEPIN survey adjusted the concept of 'marketing' innovations in the 2005 Oslo Manual to 'communication' innovations for the public sector, a change that was understood and accepted by public sector managers. Other examples are questions on innovation collaboration or on the sources of innovative ideas. These are equally relevant for the public and private sector.

The MEPIN survey was quickly followed by other surveys of innovation in the public sector and by reviews of the literature that encompassed not only the discipline of the economics of innovation (the theoretical framework of the Oslo Manual and original inspiration for the MEPIN survey), but also the discipline of public administration management. The latter has made a substantial contribution to our understanding of the factors that need to be measured in order to produce useful information on public sector innovation (Djellal et al, 2013). Many of these questions are not relevant to the private sector and are consequently not covered in the Oslo Manual, but have been included and tested in successive iterations of innovation surveys of public sector organisations since the MEPIN survey.

At this time we believe that there is sufficient experience with empirical research on public sector innovation, both through cognitive testing interviews and surveys, to propose basic guidelines for the measurement of public sector innovation. The goal is to collect data that can provide indicators and be used in in-depth econometric analyses to better understand public sector innovation. The guidelines that we provide in this paper are influenced by the Oslo Manual categories of innovation inputs, processes and outcomes because these categories can be usefully applied to all types of innovations. However, the relevant policy questions and the types of questions that public sector managers can answer differ from those for the private sector. This results in the need for questions on innovation novelty, inputs, drivers, information sources, collaboration, support strategies, and outcomes that differ, in part or in their entirety, from those discussed in the Oslo Manual. Furthermore, in order to address some of the unique characteristics of innovation in the public sector, public sector innovation surveys have increasingly used a hybrid survey method that incorporates both the subject-based approach supported by the Oslo Manual, with questions addressed to the firm or organisation as an entity, and an object-based approach that focuses on a single innovation.

In keeping with our proposal to provide basic guidelines for the measurement of public sector innovation, it is important to describe the domain to which these research guidelines should be applied. While public sector innovation surveys can provide an empirical basis to our knowledge, these surveys focus on the *processes* that improve innovation or innovation outcomes and exclude innovation as a high-

level organizational *strategy* for achieving goals that could vary substantially between elected governments or over time. We have a poor understanding so far of the linkages between high-level strategy and innovation activities in the public sector, except for what we can expect from different models of governance. We take up this issue again in the conclusions.

Section 2 reviews the factors that influence public sector innovation, particularly the central role of governance. This is followed in Section 3 by a brief discussion of the main policy issues. Section 4 covers the history of research to measure public sector innovation and makes the case that there is sufficient research at this time to develop measurement guidelines. Section 5 proposes topics that should be measured in public sector innovation surveys, while Section 6 provides a few conclusions and thoughts on the way forward.

2. Governance and other factors influencing public innovation

Government organisations can be under pressure to innovate for a variety of reasons, ranging from public demand for new or improved services to budgetary constraints (Walker, 2006; Hartley et al, 2013). How these diffuse pressures filter through to public sector organisations and the ability of these organisations to respond are shaped by the governance model, which determines the involvement of politicians and public servants in innovation and the constraints on the types of innovations that are feasible.

Defining what we mean by the term "governance" is important in setting the scene for what follows. Unfortunately, there is no universally accepted definition of governance in the literature (Bovaird and Loffler, 2003; Stoker, 1998). In much of its present day use in the public sector the term "governance" refers to processes or methods of governing (Rhodes, 2007). For example, Briggs (2007) defines governance as "the set of responsibilities, practices, policies and procedures, exercised by an agency's executive, to provide strategic direction, ensure objectives achieved, manage risks, and use resources responsibly and with accountability." This definition is well-suited to the context of this paper concerning the measurement of innovation activities within public sector organisations.

Under the traditional Weberian governance model, the decision to innovate is taken by elected politicians and the main method of innovation is technology adoption. In theory, this left zero or little ability for public sector managers to influence innovation processes and no involvement for middle managers or front-line staff.

The traditional governance model was criticized for a command-and-control management style and an associated risk-averse culture that discouraged innovation. It was gradually replaced during the late 1970s and 1980s in many high-income countries by New Public Management (NPM) reforms, driven by fiscal pressures. Authority was devolved to senior departmental managers who were encouraged to introduce innovative practices copied from the private sector, such as performance bonuses, competitive tendering, outsourcing, and privatization to generate service delivery efficiencies.

The flaw in the NPM model was to create discrete silos within government, resulting in inefficiencies. This led to experimentation with other forms of governance that can encourage innovation, such as 'joined up government' and networked governance (Hartley et al, 2013; Sorenson and Torfing, 2012). These governance forms create space not only for top-down decisions on innovation, but 'bottom-up' influences where middle management and front-line staff can both suggest innovative ideas and assist with their development and implementation.

Joined-up government retained many of the features of NPM, but addressed the limitations of departmental silos by "joining up" services delivered by different government departments. This required substantially more collaboration within and across government ministries (Hood 1991), plus coordinating mechanisms and supporting administrative processes that encourage people at all levels in the organisation to contribute to improving services and processes. This form of governance should be particularly effective in supporting large, transformative innovation projects. Yet it has been difficult to implement effectively (Lagreid et al, 2013).

A second alternative form of governance that developed during the 1990s is the 'networked' governance model that extended concepts of joined-up governance to include collaborative processes and networks with external parties (Rhodes 1996; Peters & Pierre 1998; Borzel & Ruisse 2010). Networked Government represented a pragmatic change to improve effectiveness through the involvement of a wider range of players in policy and program design and in the delivery of resulting services. Its innovative model is to use collaboration both across government agencies and with external actors that can include businesses, citizen groups, and even individual citizens.

Specific governance models are difficult to identify. Even when announced as a government goal, they are often not fully implemented. Nevertheless, empirical research has determined that many public sector organisations permit multiple sources of ideas for innovations, ranging from front-line staff to politicians, and that the innovative capabilities of public sector agencies show high levels of heterogeneity (Borins, 2001, Bloch and Bugge, 2013, Arundel et al, 2015). Surveys have also shown that over 80% of agency managers report innovating in the previous two years and many of these innovations involve considerably more than top-down adoption. Many innovations are developed through 'bottom-up' input from front-line staff and middle management (Arundel and Huber, 2013).

NPM, joined-up government and networked government were all intended to create organizational innovation cultures that give greater decision-making powers to managers (Bysted and Jespersen, 2014; Lagreid et al, 2011, Perry and Rainey, 1998). Even innovations that are driven by a political directive, for instance a political decision to introduce web-based tax return forms, depend on managers to determine how to develop and implement the decision. Under these forms of governance, managers are key actors in the development and implementation of public sector innovations.

The new forms of governance create both expectations and opportunities for senior managers, middle managers and, in some cases, front-line staff to contribute to the

generation, development and implementation of innovations. Under these conditions, there is a need for better research and metrics to improve our understanding of how innovation occurs within the public sector as part of informing policy on "what works".

2.1 Other factors

The motivation for senior and middle managers to innovate is an important factor in public sector innovation and closely related to the personal and professional development that flows from successful innovative activity (Halvorsen et al, 2005). The personal characteristics of managers can also influence innovation. These include the number of years in a specific position (Meynhart and Diefenback, 2012), whether or not the manager has an 'entrepreneurial mindset' (Damanpour and Schneider, 2006), previous experience with innovation (Boyne et al, 2005), and personal attitudes to risk, with research finding that public sector managers are more risk averse than private sector managers (Chen and Bozeman, 2012; Hartog et al, 2002; Roszkowski and Grable, 2009). This could create resistance to possibly risky innovations or influence the types of strategies that managers implement to innovate.

Halvorsen et al (2005) also identify a common lack of alignment for the objectives and goals of the *organisation* with its incentives to improve the functional and operating characteristics of its activities. Eggers and Singh (2009) also note the absence of a "whole of organisation" approach to innovation, from idea generation and selection to implementation and diffusion. In order for managers to act effectively, they must be able to draw up organisational support and be able to use strategies and tools for supporting innovation.

A mismatch between incentives and organisational support for innovation could act to depress public sector innovation or to limit such innovation to minor, incremental improvements (Osborne and Brown, 2011). Both within and across organisations, the context matters, with critical elements including the organisational level at which innovation is pursued (across the entire public sector, across specific ministries or departments, or only within specific work units), the nature of the challenge and how it is addressed (implementation of externally imposed changes, disruptive or incremental change, and an organisations' innovation culture) and the function or purpose of the organisation. For example, a department of foreign or legal affairs could discourage risk taking, whilst a department of infrastructure or agriculture could be more willing to take on risky innovations (Williamson, 1999).

A risk-averse organisational culture can hamper innovation by preventing experimentation (Borins, 2001; Brown, 2010; Kay and Goldspink, 2012; Osborne and Brown, 2011; Potts and Kastelle, 2010). A risk-averse culture can be created by political damage to elected officials from media scrutiny of failed policies (Albury, 2005; Borins, 2001; Potts and Kastelle, 2010), reputational risks for managers (Parna and Tunzelmann, 2007) and self-selection effects whereby risk-averse individuals are more likely than 'risk tolerant' individuals to seek employment in the public sector (Buurman et al, 2012; Noussair et al, 2014; Pfeifer, 2010). In a recent large-scale Australian study of 4,369 government employees, the 'unwillingness of managers to take risks' considerably reduced the probability of innovating. In contrast, managers were able to overcome other types of barriers such as political uncertainty or budget restrictions (Torugsa and Arundel, 2015).

The risk that an innovation might fail could intensify managerial risk avoidance in risk-averse organisations. Innovations could fail due to technological risks (Parna and Tunzelmann, 2007), rejection by potential users, or a lack of resources and capabilities for developing and implementing an innovation (Kay and Goldspink, 2012).

3. Key policy issues

In order to understand the policy issues that confront public sector managers, we need to distinguish between the elected government and the administrative arm or public service. These two parts of government are subject to different pressures and motivations and generate different types of innovations. Innovations from the elected arm are likely to be relatively large in scale and determine the tasks of the public service. Innovations developed and introduced by the public service are more likely to focus on how tasks are met.

The public policy implications of this distinction are clear. Research on public sector innovation can help to advise governments about the likely impacts of strategically important innovations and by identifying successful transformations, unmet goals and unintended consequences (Sorrensen & Torfing, 2012). In so far as this concerns innovations derived from the elected government, meeting these goals requires knowledge about specific innovations that is best addressed through case studies, although surveys can also provide relevant information if they provide data for single innovations developed in response to government directives.

The major benefit of public sector innovation surveys concerns innovations instigated and developed by the public service. These include new and improved methods of providing good policy advice, delivering services, establishing supportive organizational structures and administrative systems, and managing stakeholders.

In the private sector, the policy focus is on topics that can be influenced by policy instruments, such as investment in innovation, external knowledge sourcing and collaboration activities, and intellectual property. There are only a few policy levers for influencing *how* innovation occurs within firms.

In contrast, policy interest in public sector innovation is specifically concerned with the innovation process within public sector organisations as part of the goal of improving innovation outcomes. This includes the 'innovation culture', which can be defined as "a culture where a group of people's shared values, customs and assumptions are conducive to new ideas and organisational change" (Bason 2010). Factors that contribute to innovation culture include the level of support within the organisation for innovative activities and innovation capabilities such as skills, the strategies and tools available to managers to innovate, and different forms of investment in innovation (time, skills and money). Strategies and tools include the use of design-thinking methods, collaboration, activities to source relevant expertise from internal and external sources, actions to encourage creativity and learning by public sector staff, and strategies that managers can use to manage risk. Policy can directly support the ability of managers in the public service to deal with all of these issues.

One example consists of the skills that agency managers use to innovate and the extent to which they know *how* to innovate. Of interest here, neither the Oslo Manual nor innovation surveys such as the CIS explore how firms innovate. The assumption is that the managers of private enterprises know how to innovate, for instance by drawing on trial-and-error methods developed in the manufacturing sector. Conversely, in the public sector we can't assume that managers know how to innovate (this may apply to private sector services as well). As an analogy, we don't assume that high school graduates know how to teach even though they have attended school for 12 years – potential teachers are taught how to teach - or at least they should be (Economist, 2016).

Public sector managers have not traditionally been taught how to innovate. This may be changing, with the adoption of design thinking (also called co-creation or user centred design) by government agencies in Scandinavia, the UK and the United States. Innovation surveys need to identify what skills have been learnt and which aspects of the design-thinking tool-box are most useful for agency managers.

The policy interest in the innovation culture, capabilities, strategies and tools is of course focused on the effect of these factors on innovation outcomes. Innovation surveys need to provide sufficient data to identify 'what works' and what hinders innovation. These analyses also need to be conducted for specific types of innovations, as what works for developing a new service could differ from what works for improving an internal process. Innovation outcomes are, however, a challenge to measure, due to the lack of a single unified measure of output in the public sector that is equivalent to sales from innovative products in the private sector, multiple objectives of public services, and difficulties in measuring many of these objectives.

In aggregate terms, the value of public sector innovations are greatly dependent on how widely they are diffused throughout the public sector, across agencies, municipalities, schools, hospitals and other types of organisations. Eggers and Singh (2009) highlight in particular three challenges to the diffusion of innovations: a lack of systematic structures to search for and implement new ideas, internal resistance to new ideas, and a lack of incentives to spread good ideas and innovations to others.

Another policy interest, which derives from the long history of the traditional governance model and its continued influence today, is the role of 'top-down' innovation, driven by politicians and senior management, and 'bottom-up' innovation which encourages the involvement of front-line staff and middle management in innovation activities and the generation of ideas for innovation (as long as bottom up innovation does not interfere with the priorities and policies of the elected government). There is some empirical evidence that public sector organizations that encourage 'bottom up' innovation have better innovation outcomes than 'top down' organizations (Arundel et al, 2015). However, policy analysts need to know more about the benefits and limitations of both, for instance if the value of bottom-up innovation is largely limited to incremental improvements to processes and services or if it makes a useful contribution to all types of innovations. This leads to an additional issue of high policy interest: the ability to differentiate between what is required for successful incremental innovation and what is required for transformative

or disruptive innovation in the public sector. The answers to these questions have important implications for the governance of public sector organizations.

4. Relevant empirical research

The current level of our knowledge on public sector innovation is similar to that which existed when the first Oslo Manual (OECD, 1992) was written to provide guidelines for measuring innovation in the private sector.

The earliest empirical research on innovation in the private sector dates from the 1950s and used the object-based method (with the focus on an individual innovation). This method dominated innovation research until the early 1980s (Godin, 2009). A gradual shift to a subject-based method, in which all of the firm's innovative activities are evaluated, began with De Bresson and Murray's (1984) hybrid study that introduced a definition of innovation (still in use in the Oslo Manual) and combined subject and object methods.

The authors of the Oslo Manual drew on the experience of seven experimental subject-based surveys between 1979 and 1987 in the United States, the Netherlands, Germany, France, Italy and the Nordic countries on the innovative activities of manufacturing firms and the testing of survey questions in interviews with company managers (Arundel and Smith, 2013).

Our current level of knowledge on how to measure public sector innovation is derived from two strands of research. The first, and oldest, is from the public administration and management discipline, which has examined innovation through case studies, interviews, analyses of nominees for innovation awards, and surveys. The most useful studies for our purposes are those that evaluated data for multiple innovations through the use of the object-based method or a 'business practice' method that asks survey respondents if their organisation had used any of a list of innovative practices or technologies. Studies using the object-based approach have used award data for 400 innovations in the United States and Commonwealth countries (Borins, 2000, 2001), 51 innovative projects for American State governments (Vanagunas and Webb, 1994), 81 pre-identified innovations in four European countries (Parna and von Tunzelmann, 2007) and 125 innovations chosen by respondents to a survey of British Government agencies (NAO, 2006). Studies using the business practice method include a 1997 and 2001 survey of 1,276 American municipalities with more than 10,000 residents (Damanpour and Schneider, 2006; Moon and de Leon, 2001), a survey of 120 local authorities in England (Walker, 2006) and two studies of approximately 800 each of the heads of public administration agencies in Canada (Lonti and Verona, 2003; Earl, 2004). Subject-based surveys from this strand include Damanpour et al's (2009) survey of 428 local area authority CEOs and managers in England.

The second strand has been partly or entirely influenced by the economics of innovation literature and used the Oslo Manual methodology, including the subject-based approach to measuring innovation. These studies used surveys that were either dedicated to innovation or contained a module of questions that focused on innovation. All of these surveys were conducted after 2000. They include a survey of

121 public sector managers in Norway and Finland conducted in 2002 (Laegreid et al, 2011), an Audit Commission (2007) survey of 275 local authorities in England, and a study by NESTA of 175 health and local authorities in England (Hughes et al, 2011).

Most of the above studies that used surveys are comparatively small, with less than 500 respondents, and focused on municipal governments or local authorities. The latter is due to the ease of identifying municipal governments and to a familiar problem in subject-based private sector surveys: who should be the respondent in a large organisation that is active in multiple lines of business? This is a very challenging issue in the public sector, with government ministries often having tens of thousands of employees and multiple divisions. Furthermore, there are only a limited number of ministries or high-level agencies in Federal or State governments. For instance the Federal government of Australia has approximately 100 agencies or ministries while Denmark has approximately 20 ministries (comprising 100 agencies). An attempt to learn about the innovative activities of the Australian Federal Government through a survey of agency heads only would produce insufficient information for using econometric methods to evaluate important questions such as the effect of innovation inputs and capabilities on outcomes. There are also well-known concerns about the ability of the CEO of a ministry with multiple divisions to be fully informed about all innovation activities. The solution, up to 2008, was either to use the object-based approach or to focus on smaller, more specialised organisations such as municipalities.

Between 2008 and 2011, three large-scale public sector innovation surveys, each with over 2,000 respondents, were conducted in Scandinavia, the 27 member states of the European community and in Australia. The Scandinavian MEPIN survey (Bugge et al, 2011) and the European Innobarometer survey addressed the problem of collecting insufficient data for analysis by surveying public sector organisations at the local, regional and federal level in multiple countries. The Australian survey, in contrast, surveyed the innovative activities of work groups (APSC, 2011), a method similar to that used earlier by Lonti and Verma (2003) in Canada. A second Australian survey, a pilot conducted in 2012, surveyed senior managers in the Federal government that were responsible for a "branch", with each branch having an average of 40 employees (Arundel and Huber, 2013). A similar approach was used in a third Australian survey of management and service innovations in Australian and New Zealand universities (Arundel et al, 2016).

In 2014, a nationwide representative survey was conducted of innovation in public workplaces in Denmark. As with the Australian survey, the Danish survey was aimed at lower level organisations, though covering all governmental levels (central, regional and municipal) and individual workplaces providing public services, including schools, hospitals, nursing homes, daycare centers, police stations, etc. The sample included 1255 public workplaces[5].

[5] See http://innovationsbarometer.coi.dk/.

Much of the research listed above concerns innovation in public administration organisations.[6] The exceptions are the MEPIN survey, the Danish survey of public workplaces, which included a sample of hospitals and schools in four Scandinavian countries, the object-based studies using nominees for awards, and the university survey. Public administration is a useful target for innovation surveys because it manages how public services are provided. For example, educational and health ministries are responsible for many (though definitely not all) of the major innovations that are implemented in subsidiary service providers such as schools and hospitals. Yet specialized surveys of service providers are also necessary, particularly to identify 'bottom-up' innovations that are suggested and developed by staff within service providers.

In addition to evaluating relevant surveys, this paper draws on extensive cognitive testing in Scandinavia, Spain, Belgium, Italy and Australia. With a few exceptions, the results of cognitive testing have not been published, but the authors either conducted the testing themselves or have access to the interview transcripts or summaries. The cognitive testing results provide an extensive dataset for how public sector managers understand innovation and the types of questions that they can and cannot answer with a reasonable level of accuracy. The cognitive testing results are generally reassuring as they show that public sector managers in multiple countries share a similar understanding of innovation concepts (Arundel and Huber, 2013; OECD, 2014).

Our recommendations are based on the experience gained from the literature cited above, particularly the surveys conducted after 2008 that were either dedicated to innovation or contained an in-depth module on innovation. These studies are summarized in Table 1. The effect of earlier research, such as by Borins (2000) or Lagreid et al (2011), is primarily through their influence on the design of surveys conducted after 2008. There has also been a continual learning process in which each survey has influenced subsequent surveys. For instance, the 2008-2009 MEPIN survey influenced the design of the 2010 Innobarometer survey, which in turn influenced the design of the 2012 APSII survey. Table 1 also includes a 2015 survey of the healthcare sector that applied the lessons learned from many of the other studies listed in Table 1.[7]

[6] Public administration organisations can be identified using their NACE classifications (84.11 for general public administrative activities and 84.12 for regulation of the activities of providing healthcare, education, cultural services and social services excluding social security).

[7] There is a large literature on innovation in healthcare, but most of it focuses on healthcare technologies. The study by Silvander and Hagen (2015) differs by asking about product, service, organizational and communication innovations.

Table 1. Key innovation surveys and cognitive testing of innovation in the public sector

Study	Reference	Date of data	Target organisation	Country	Size[1]	Cognitive testing[2]
MEPIN	Bugge et al, 2011	2008-2009	Public admin, schools, hospitals	Denmark, Finland, Iceland, Norway, Sweden	2,013	60/32[8]
Innobarometer	EC, 2010	2010	Public admin	All 27 EU countries	3,699	-
NESTA	Hughes et al, 2011	2010	Public admin	England	175	?
APSC	APSC, 2011	2011	Public admin	Australia	10,000	-
APSII	Arundel & Huber, 2013	2012	Public admin	Australia	344	32
Universities	Arundel et al, 2016	2015-2016	Universities	Australia & New Zealand	573	13
Statistics Sweden	Silvander & Hagen, 2015	2014	Hospitals & healthcare providers	Sweden	312	4
OECD	Arundel, 2014	2013	Public admin	Belgium, Italy, Spain	-	30
Innovation Barometer	Center for Offentlig Innovation, 2015	2014	All public sectors (workplace, establishment level)	Denmark	1,255	7

1: Number of survey respondents
2: Number of interviews

5. Measurement issues

This section reviews key issues concerning survey measurement of public sector innovation. It examines who to survey in research on public sector innovation, followed by a discussion of the benefits of subject and object methods and the definition of a public sector innovation.

Many of the Oslo Manual questions for innovation in the private sector and found in surveys such as the CIS can be adjusted for use in the public sector, but it is often not advised to use the exact wording. For instance, general questions from the Oslo Manual on the use of external knowledge sources and collaboration are well understood by public sector managers, but many of the specific sources and collaboration partners differ, with public sector managers frequently drawing on the experience of other governments. And, as noted in Section 3 above, meeting policy needs requires a public sector innovation survey to include many questions that are less relevant to private sector firms and not discussed in the Oslo Manual. Table 2 provides a summary of the main topics in the Oslo Manual and the level of comparability with public sector requirements.

[8] In all 60 persons participated in initial focus group meetings and 32 participated in cognitive testing of the questionnaire.

5.1 Who to survey

Innovation surveys can be sent to the CEO of public organizations such government ministries at the State and Federal level, municipalities, counties or local area authorities at the regional level, or individual institutions for service providers of education, health or social welfare. However, as noted above, surveying the CEO of a single state or federal public administration is unlikely to be very useful for domestic research, although it can be useful for research that covers multiple states or countries. At the domestic level, more useful results for federal or state governments require sampling specific functions within large ministries. This is very easy to do if a government organization can provide data on staff job levels, since these can be used to identify senior management staff. It is then possible to sample all respondents for whichever job level is of interest (for instance, management positions with sufficient responsibility to develop and implement innovations).

Table 2. Comparability between the Oslo Manual topics for innovation measurement and requirements of public sector innovation surveys

Oslo Manual topic	Public sector comparability	Comments
Innovation types	Yes	The definition of an innovation is not a perfect match, other types of innovations (policy) are important in the public sector
Innovation activities	Partly	Many of the activities covered in the Oslo Manual (R&D, acquisition of external knowledge, design, testing and evaluation) are rarely used in the public sector, while other activities (training and purchases of equipment, ICT etc.) are frequently undertaken. Public sector surveys concentrate more extensively on strategies to support innovation development (design thinking, brainstorming sessions etc.) that are more relevant to service innovations.
Innovation expenditures	No	Internal investments focus on staff, with measurement in terms of numbers, person-months, redeployment, etc.
Information sources	Yes	Good comparability, but in addition public sector surveys need to cover more types of government sources
Collaboration	Yes	Good comparability, but in addition public sector surveys need to cover more types of government sources
Objectives / Outcomes	Partly	Public sector surveys have focused on effects or outcomes, areas of comparability limited to quality, lower costs, speed of supply.
Obstacles	Partly	Similar interests in insufficient resources, but public sector surveys have a greater focus on innovation culture and risk aversion.

5.2 Subject and object approaches: the "most important innovation"

National innovation surveys such as the CIS follow the subject approach, with questions covering all innovation activity for the enterprise. In contrast, surveys of innovation in the public sector have increasingly followed the example of De Bresson and Murray (1984) by using a hybrid approach in which some questions are asked of the organisation (or department or workplace) as a whole and other questions are limited to a single innovation, which can be the 'most important', 'most successful', or 'most recent' innovation.

The inclusion of questions on a single innovation has substantial advantages: it permits questions that can be too difficult for respondents to answer for all of their innovations combined, for instance on the resources invested in an innovation, its level of novelty, or the main source of the idea for an innovation. In addition, it can improve the accuracy and interpretability of the results. If there are adequate resources for manual coding, a written description of a single innovation can also be requested. On the other hand, a sole or primary focus on a single innovation has the disadvantage that answers do not fully reflect the organisation's innovation activity overall.

Table 3 summarizes the types of questions that are suitable for general questions on multiple innovations (the subject), a single innovation (the object), and both. The classifications are based on the usefulness of the data obtained for single or multiple innovations and the ability of respondents to provide accurate responses, with the decision for accuracy based on cognitive testing and item response rates for relevant questions from surveys.

Table 3. Suitability of questions for multiple and single innovations

Question / topic area	Single	Multiple	Comments
Types of innovation(s)	**	**	Can be asked for both & useful for both
Collaboration	**	**	Can be asked for both & useful for both
Staff redeployment / hiring	**	**	Respondents can remember both all hiring/redeployment & those limited to one innovation
Workplace/organisational culture		**	Relevant to all innovations
Innovation support strategies		**	Relevant to all innovations
Obstacles for all innovations		**	Relevant to all innovations
Information sources	*	**	Can be asked of both, but most useful for all innovations
Drivers / reasons for innovating	*	**	Can be asked of both, but most useful for all innovations
Innovation novelty	**	*	For multiple innovations, can ask if any of the innovations were a country first.
Outcomes	**	*	Accuracy better for a single innovation
Obstacles for an abandoned innovation	**		Accuracy much better for a single abandoned, failed or under-performing innovation because these are rare
Resources in head counts	**		Accuracy better for a single innovation
Resources in person-months	**		Accuracy better for a single innovation
Source of the initial idea	**		Accuracy better for a single innovation

Only one star: possible, but not as accurate or useful. Two stars: Significant improvement in accuracy and/or usefulness.

5.3 Definition of public sector innovations

A core element of a measurement framework is the ability to define key concepts, such as what constitutes innovation and the different types of innovation.

The Oslo Manual defines an innovation as something that is new or significantly improved (to the firm) and which has been implemented. Public sector managers have few problems with the 'new or significantly improved' part of this definition or with the concept that an innovation need only be new to their organization. In contrast, cognitive testing shows that their interpretation of the concept of 'implementation' is fuzzy because many public sector innovations are services or processes that are introduced slowly over a lengthy period of time.

A lack of clarity over implementation is confirmed in the survey of university managers (Arundel et al, 2016). At the start of the survey, respondents are given a definition that states that an innovation 'must have been implemented in the last two years'. Later in the questionnaire respondents are asked if their most important innovation was 'completely implemented' or 'partially implemented, with continuing improvements or extensions underway'. The majority, 65% selected the 'partially implemented' option.

A second difference with the Oslo Manual definition is that public sector managers firmly believe that an innovation must 'make something better' or have a goal of 'delivering better outputs'. This is due to the frequency of restructuring in the public sector, which can create churn without necessarily improving efficiency or service quality. Cognitive testing with both Australian and European managers found that they do not view "rearranging organisational structures" as an innovation unless there is an improved outcome or benefit (OECD, 2014). Therefore, any definition of public sector innovation must include a novelty requirement, a 'better outcomes' component, and be flexible on the implementation requirement.

In respect to the type of innovations, the MEPIN definitions of services, processes, organisational and communication innovations are understood by public sector managers (OECD, 2014), although there can be differences in understanding by the function of the public sector organisation. For example, for many respondents it is better to refer to services than 'products' and some respondents have a difficult time separating processes and organizational changes. What is more important for some types of public sector organizations is to include other relevant types of innovations such as policy or service delivery innovations. If these are not listed, respondents will find the closest match out of the available list.

6. Topics and their measurement in public sector innovation surveys

This section discusses key topics concerning public sector innovation and their measurement, drawing on recent experience from cognitive testing and survey data collection. As noted above, both the nature of public sector innovation and policy relevance for public management requires a greater focus, compared to the private sector, on the process of innovation and how innovation is supported in public sector organisations.

6.1 Characteristics of the respondent and their workplace

Managers and workplace characteristics can have a significant impact on innovation activities in the public sector, as discussed in Section 2 above. Relevant questions on managers include their gender, the length of time they have been in their current position, and their job level in the public sector hierarchy (this may be known in advance and used for sampling). For surveys that cover departments within a government Ministry or agency, is it important to collect data on the number of employees that report to the respondent and the function of the manager's department, for instance if it provides services to citizens or businesses or IT or business services to the government ministry.

6.2 Innovation drivers or reasons for innovating

Public sector innovation drivers include both drivers that are external to the government and internal drivers. The first group includes demand for improved or new services by citizens, NGOs, or businesses. Governmental drivers include restructuring, policy directives or changes in laws or regulations, a crisis requiring an urgent response, and budgetary drivers, including both a change in the budget and the 'need to do more with the same budget'.

6.3 Resources for innovation

Cognitive testing in multiple countries, plus the results of the MEPIN and NESTA pilot surveys, found that a high share of public sector respondents can not provide financial estimates of investments in innovation. This is because most of the inputs are limited to staff time.

Managers are capable of providing reasonably accurate data to questions related to staff time. This includes the number of staff involved in innovation (OECD 2014), the person-months required to develop an identified innovation,[9] the number of new hires to work specifically on innovations, and the number of existing staff that are redeployed to work on innovations. Other questions on internal resources for innovation can ask if sufficient resources (funding, time, or personnel) are available for developing innovations or if the manager received extra funds specifically for innovation activities.

Questions on external resources can inquire into purchases of R&D services, consultants, IT purchases, etc. on a 'Yes' or 'No' basis. Questions for financial estimates of the costs of external purchases have not been tested. Departmental respondents may not know the answer if the finances are handled by another department. External expenditure questions might be more suitable for surveys of the CEOs of ministries or agencies.

6.4 Innovation processes and strategies

In terms of the internal processes through which innovations are developed, the Oslo Manual focuses on linkages with other firms or universities as either information sources or collaboration partners. Both are worth asking in surveys of public sector organizations, although the list of information sources or collaboration partners need to include more details on government organizations, such as other departments

[9] The APSII pilot survey found that managers will provide person-month estimates for all innovations, but these responses are less accurate that questions limited to a single innovation.

within the same ministry, other ministries or governments at the local, state or federal level, examples of best practice by other government organizations, etc.

However, policy interests require public sector innovation surveys to delve much more deeply and also cover internal capabilities, strategies and methods that managers can use to innovate and collect data of relevance to questions on the location of innovative activity within the hierarchy: is it dependent on top-down decisions by senior managers or can it also occur as a bottom-up process in which all staff can be actively engaged in innovation?

Research on top-down/bottom-up innovation can be supported through a question on the source of the initial idea for a single 'most important' innovation. The question should include options that cover the entire organizational hierarchy: government ministers, politicians, top-level managers, the respondent, staff that report to the respondent, and other staff. The question can also include external sources such as businesses or consultants, other governmental organizations, and NGOs.

The management literature suggests that the organizational or workplace culture for innovation is a major factor in either supporting or hindering innovation. Measures of a supportive culture include whether or not the organization has a written innovation strategy, the level of support by senior management for innovation, the provision of incentives, and the attitudes of both management and other staff towards risk and change. An option is to include separate questions on different management strategies and query the extent to which these strategies are 'supportive of innovation' or a 'hindrance to innovation', as in the survey by Silvander and Hagen (2015).

The overall benefits of innovations are dependent on their uptake across the public sector. A number of the topics covered here provide insight on activities concerning the exchange of new ideas and experience, such as collaboration and information sources, and innovations that are adopted from others. These can be supplemented by a question on the practices organisations use both to learn and access knowledge from others and to diffuse their own innovations to other government agencies.

Since the last Oslo Manual was prepared in 2005, a notable change in how innovation occurs is the rapid adoption by firms and some public sector organizations in the United States and Europe of "design-thinking" principles, also called 'co-creation' or 'user-led' innovation. These consist of a set of methods for how to innovate that are particularly useful for service sector firms and public organizations, where the trial and error approach used in R&D is less effective. Relevant design-thinking methods include the use of focus groups, stakeholder surveys or research, testing of the 'ease-of-use of a planned innovation on a sample of users, pilot tests, and post-implementation studies to identify or solve problems. Other relevant questions include the use of brainstorming to identify ideas for innovations, working groups to develop or implement innovations, giving specific people responsibility for taking an idea to the implementation stage, systems for identifying innovative ideas suggested by staff, and providing staff with feedback on their ideas.

6.5 Outcomes

There is no equivalent for the public sector of the share of sales due to innovations (a key outcome measure for the private sector). So far, the benefits of public sector

innovation have only been measured through subjective measures, such as the respondents' perceptions on the level of improvement to services, improved user satisfaction, improved user access to information, better working conditions for employees, simplified administrative procedures, faster delivery of services, and a reduction on the costs of providing services.

It is not generally possible to collect quantitative evidence on these outcome measures in an innovation survey, though in some cases it may be possible to supplement a survey with data on innovation outcomes from other sources, such as user satisfaction surveys, surveys of employee working conditions and administrative data. One way to strengthen innovation survey data on outcomes is to ask whether the answers are based on an evaluation of the outcomes of innovation projects by the organisation (either by internal or external means) or if they are based on a subjective assessment alone.

Several surveys have experimented with obtaining other output measures that are more objective. For example, the APSII survey experimented with a categorical question that asked about the percentage reduction in expenditures due to all process innovations in the previous two years, since reducing costs is an important policy goal. The question had an unacceptably high non-response rate of approximately 50%, but it may be possible to obtain useable data when this type of question is asked of a single process innovation. Other less objective output measures that require more research is the share of services that are new or significantly improved and the number or share of users that are affected by a new or improved service (Bloch, OECD, 2014).

6.6 Innovation novelty

With some exceptions, novelty is best addressed through questions on the respondent's most important innovation, since respondents can answer these types of questions more easily for a specific innovation than for multiple innovations. It is possible to ask if the most important innovation is a transformative innovation, the amount of person-months or number of staff members that were required to develop and implement it, or if it is the first use of this type of innovation in their country.

There is considerable variation in the novelty and technical complexity of public sector innovations, with innovations ranging along a scale from minor incremental changes (Bugge and Bloch, 2016; Fuglsang, 2010) to disruptive or transformative innovations that completely alter or replace how services are provided or the services themselves (Osborne and Brown, 2011). Although the theoretical concept of transformative innovations in the public sector has been verified in case studies, the incidence of such innovations and how they can be managed effectively have not undergone rigorous empirical analysis (Mandell and Keast, 2013). There is little empirical evidence on the relative outcomes of transformative and incremental innovations. Transformative innovations are assumed to produce larger benefits than incremental innovations, but they could also increase the risk of failure. In some contexts, incremental innovations could have the edge.

If a written or oral description of a single innovation is obtained, this information can be used to estimate the novelty of the innovation. Bugge and Bloch (2016) coded 1,536 written descriptions of innovations from the MEPIN study (these were not

limited to 'most important innovations') and estimated that 27.7% of them did not meet the definition of an innovation, while 32.6% were minor innovations.

6.7 Obstacles

The 'revealed barriers' issue identified by D'Este et al (2012) for the private sector suggests that responses to questions on obstacles can produce counter-intuitive results where successful innovators are more likely to report or give a higher importance to obstacles than unsuccessful innovators. These results have also been found for the public sector (Torugsa and Arundel, 2015). In many situations it is possible to eliminate the need for questions on obstacles by using questions that ask about the presence, absence or importance of specific innovation inputs or contextual factors affecting innovation.

When this is not possible, questions on obstacles should cover insufficient resources (money, time or skills), risk-aversion and related factors such as a resistance to change and uncertainty of success, difficulties with contractors or finding collaborative partners, and regulatory requirements.

Obstacles to innovation can result in the abandonment of an idea for an innovation or the failure of an innovation. In this case, work on an innovation is begun or its performance is below expectations.[10] Alternatively, obstacles can slow the development or implementation of an innovation. If questions on obstacles are used, it may be worthwhile to ask separate questions for abandoned/under-performing innovations and for completed innovations.

7. Conclusions

Due in part to a number of recent surveys, the measurement of public sector innovation has now reached a level where there is sufficient experience to propose basic measurement guidelines. These guidelines draw on recent work both on the public and the private sectors; however, it is equally important that they are relevant for the types of policy issues that are important to public sector organisations. In contrast to the private sector, these issues include the governance and management of innovation and how organisations innovate. The paper also reviews the theoretical literature on governance and other factors that have been identified in the literature as important for public sector innovation.

These proposals suggest using a hybrid approach that combines the object-based method with questions on a single innovation with the subject-based method with general questions on innovation strategies and capabilities. Both methods can contribute to measuring or 'mapping' public sector innovation. The object-based method is particularly valuable for providing both a bottom-up and a top-down

[10] Public sector managers do not like to think in terms of innovation failure and often do not consider that their innovations have failed. Instead, they are more likely to change the expectations for the innovation or change it into a different type of innovation. This is probably why only 18.6% of respondents to the Australian 2012 APSII survey reported that they had a 'failed' innovation. A better approach, tested in the Australian university survey, is to ask about 'abandoned or under-performing' innovations.

perspective on innovation by identifying the source of ideas for specific innovations. However, the proposed guidelines do not encompass a high-level strategic perspective on innovation goals and the mechanisms that relate to the systematic generation and management of innovation ideas, their evaluation, implementation and diffusion. Adding a strategic and systematic perspective would add an important layer and permit analyses that can link managerial strategies to the *why* of innovation activities.

Windrum's (2008) framework for public sector innovation commences with 1) the ideological foundations of government and associated world views, and follows through with 2) policy frameworks, 3) organisational and administrative arrangements, 4) services and 5) service delivery. The proposed guidelines in this paper focus on points 3 to 5, but do not track point 1 at all and only allude to point 2. A fuller picture would require two additional areas for empirical research.

The first is the strategic context within which public sector innovation takes place. This would require new questions to be asked of the CEOs of public sector organizations. Optimally, we could link data on innovations at lower levels within the hierarchy to high-level strategies in order to determine the effects (if any) of the broader organizational context on innovation activities.

The second is that the development of theories of public sector innovation requires empirical research on the motivations for innovation. To date, research on motivation has yet to systematically address the organizational level incentives that affect individual motivations and work-unit level innovation activities. At the organizational level there may well be substantial external pressures for smaller and more efficient government, but they may not influence the middle and lower levels of an organization unless channelled there via a 'whole of organization' strategy inviting response across the organization. Understanding what these organizational incentives are, how they are perceived at different levels in the organization, and what impact they have, would be a fruitful area of future research.

Finally, some of the questions and methods that have been used successfully in surveys of public sector innovation could be of great value if applied to the private sector. This is particularly the case for innovations in private sector services, which often share some of the same problems that face public sector services.

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