

Capturing Value in Innovation Procurement: A Business Case Methodology

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Abstract

Since 2000, the European Union (EU) has promoted innovation procurement to improve public services while supporting economic growth. Despite these potential benefits, it has become evident that procurers are not participating in innovation procurement to the extent expected – both for pre-commercial procurement (PCP), and the public procurement of innovative solutions (PPI). Key barriers are a lack of incentive and a high risk-aversion on behalf of procurers. In this paper, we introduce a business case methodology for innovation procurement that can help to overcome these barriers by capturing project value and providing justification for project approval. We describe how to construct a business case for PCP or PPI across six steps: 1) needs identification and assessment; 2) prior art analysis and intellectual property rights (IPR) search; 3) analysis of the standards' landscape; 4) preliminary estimates; 5) open market consultation; and 6) detailed economic calculations. Using case studies from Transport for London and the Lombardy Region of Italy, we apply elements of this methodology to show how it can be applied in practice. The methodology can be directly applied by public procurement practitioners during the preparatory phase, and provides valuable insight for policy makers into decision parameters for innovation procurement. Through multidisciplinary research, it furthers academic discussion of technical and economic evaluation of demand-side mechanisms. Further elaboration of the business case methodology is required for its extension to tender design and project management, as is investigation into its congruence with the new innovation partnership mechanism introduced in 2014.

1 Introduction

Public procurers throughout the European Union (EU) spend around 2400 billion euro on a yearly basis (EC, 2014a). Since 2000, the EU has undertaken efforts to steer part of this spending towards purchases of R&D services and of innovative solutions that address specific public sector needs. In the view of the EU, this approach improves the quality and efficiency of public services and generates sustainable economic growth and employment. The EU coined the term 'innovation procurement' to encompass two main approaches: the procurement of pre-commercial R&D services ('Pre-Commercial Procurement' or 'PCP') (EC, 2007) and the procurement of innovative solutions that have moved beyond the R&D Step but may still need conformance testing ('PPI').¹

Since 2009, the European Commission (EC) has made funding available for the set-up of procurer networks and for the deployment of cross-border PPIs and PCPs. European cooperation on PCP and PPI was considered by the European Commission as a tool to speed up public sector modernization at a lower cost and to address issues of interoperability and coherence. In addition to initiatives at the EU level, most Member States have developed strategies in recent years to encourage innovation procurement (EC, 2014a, p.14). However, despite the potential benefits, public procurers do not engage enough in innovation procurement (eafip, 2017). They experience numerous barriers, first and foremost with risk-aversion and a lack of incentives to practice innovation procurement, such as policy commitments and higher management support (Camerer & van Eijl, 2011).

A business case methodology applied to public sector decision making can help to overcome these barriers, by providing economic justification during the preparatory phase for the uptake of innovation procurement. This paper proposes methods to build a business case for the public sector, enabling procurers to estimate the value of conducting a PCP or instead choosing for a technology that is commercially viable (PPI). Besides providing the grounds for an informed decision, the methodology described in this paper can be an effective tool to gain internal and external support for innovation procurements. The business case can also help define procurement documentation; however, we do not discuss this in great depth, in order to focus on the role of the methodology leading up to a potential public procurement. A subsequent and complementary paper will delve into ways that the methodology can improve the *deployment* of a project, beyond its *preparation*.

¹ Both terms are defined in detail below.

This paper is structured as follows. Section 2 introduces the concepts of PCP and PPI. Section 3 introduces elements of a business case methodology used to prepare PCP or PPI, explaining the gathering and processing of information by public procurers. Section 4 subsequently describes how to construct a business case for PCP or PPI, across six steps: needs identification and assessment, prior art analysis and intellectual property rights (IPR) search, analysis of the standards' landscape, preliminary estimates, open market consultation, and detailed economic calculations. By applying elements of the methodology, Section 5 presents an example based on two concrete case studies.² The final Section 6 concludes the paper and presents areas for further research.

2 Innovation procurement

Innovation procurement is performed when public procurers purchase R&D services and/or innovative solutions to meet specific public needs. In this paper, innovation procurement encompasses Pre-Commercial Procurement (PCP) and Public Procurement of Innovative Solutions (PPI). They are briefly described below.

2.1 Pre-Commercial Procurement (PCP)

Pre-Commercial Procurement (PCP) is defined for the purposes of this paper as:

“The procurement of R&D services involving risk-benefit sharing under market conditions, and competitive development in phases, where there is a clear separation between the procurement of the R&D services procured from the deployment of commercial volumes of end-products” (EC, 2016).

PCP steers the development of innovative solutions towards concrete public sector needs by comparing / validating alternative solutions from different technology vendors. Based on the recommendations elaborated by the European Commission in a Communication in 2007 (EC, 2007), PCP is divided into 3 phases, involving multiple suppliers in all phases, yet decreasing the number of suppliers in each step as the solution becomes more evident (Figure 1). Following the development and testing of a limited volume of first products/services in Phase 3, the procurer is ready to decide whether to proceed with commercial roll-out or not. In addition to the economic considerations, the 2007 Communication underlines that re-opening competition

² Both case studies have been collected as part of the eafip (European Assistance for Innovation Procurement) initiative.

after the completion of the PCP prevents the granting of illegal State aid and allows the procurer to restrict the PCP to suppliers that are willing to locate a large portion of the R&D within the European Economic Area or partner countries having signed Stabilisation and Association Agreements.

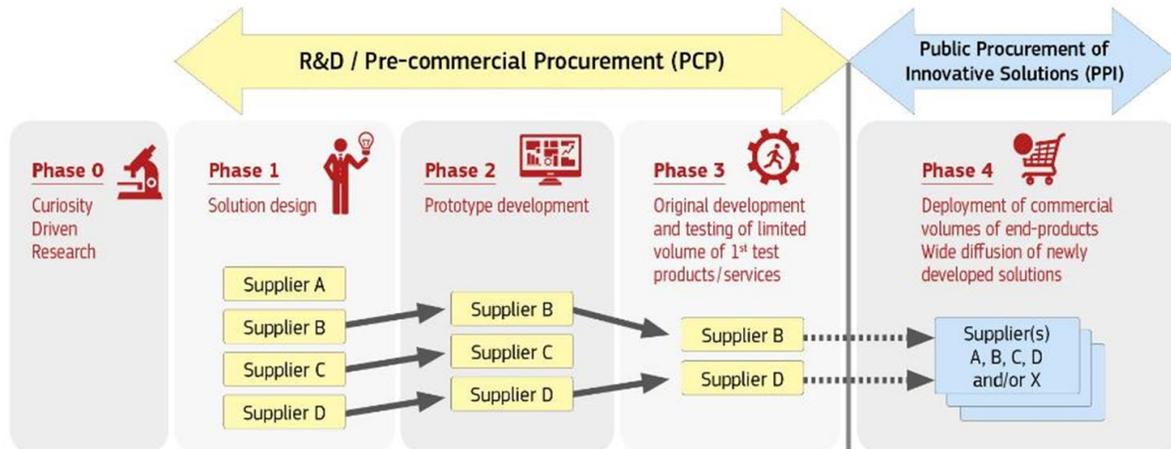


Figure 1 – overview of PCP and PPI, according to the European Commission (2016).

Benefits received by the procurer for this arrangement are upholding competition even within a closed environment between suppliers, which can improve performance and outcomes by creating incentives to win subsequent contracts (Bedin, Decarolis, & Iossa, 2015). Benefits for suppliers for conducting R&D within this environment are the opportunities to receive valuable input from potential end-users of the innovative solution and to use knowledge and technological insight gained through the PCP in the subsequent PPI (where competition is then opened to all market suppliers).

2.2 Public Procurement of Innovative Solutions (PPI)

Public Procurement of Innovative Solutions (PPI) is defined for the purposes of this paper as:

“The purchase of innovative goods or services that have already been developed, but are not yet available on a large scale commercial basis, and may include conformance testing” (EC, 2014b).

The PPI will allow public procurers to act as launching customers / early adopters / first buyers of innovative solutions which have not been adopted on a large scale basis yet, but which are

ready for commercialization. For example, a PPI could be for adaptation of an existing solution to meet the needs presented by a particular procurer. A PPI can occur independently, or may follow a PCP, in order to make the results of the PCP beneficial to the procurer's organization.

3 Elements of a Business Case Methodology

As already mentioned in the introduction, a business case methodology is an effective tool to gain internal and external support for innovation procurements. Internally, a business case methodology can be used for communication with upper management to justify the decision to initiate one of the two types of innovation procurement – PCP or PPI. Externally, it can help gain support from the public and other stakeholders, which may be a prerequisite for beginning a project. If support is not required before commencement, then the methodology can help justify a chosen route, while also providing transparency.

Careful preparation increases the potential to capture innovation during the subsequent procurement. The business case methodology is a part of a preparatory phase designed to yield essential information regarding the procurer's need for innovation and private actors' abilities to meet this need. A public procurer can use this information to calculate and compare between the value of different potential directions that the procurement may take. Based on this, the procurer can choose for one specific type of innovation procurement (PCP or PPI) and begin designing the tender call. The business case methodology described in this paper is particularly suitable for large and complex projects. Especially for such projects, the complexity of purchasing R&D service or innovations creates a greater need for efficient and effective project management (Yeow & Edler, 2012) and by extension a business case approach.

In the next sections, we discuss in general the steps through which a procurer might proceed to inform a business case for a potential decision, touching upon the economic basis of each. We define each step, the information that is required, and the process of using that information in a business case. Later, we apply this method to two practical cases: a PCP followed by a PPI, and a stand-alone PPI.

3.1 Needs identification and assessment

In applying a business case methodology in a potential innovation procurement project, the first step is to clearly define the need for which any future action might yield an innovative solution. An internal procedure can first be used, by which procurers gather information from end-users regarding their needs (e.g. patients/nurses that would eventually need to use the innovative solution). This is most relevant in cases where procurers are purchasing a product or service to be applied within their organizations, such as in direct procurement. Needs identification is particularly important when procurers are within central purchasing agencies and thus separated from the needs of the end-user's organizations. In cases of co-operative or joint procurement when procurers partner with others who deliver similar services of public interest, needs definition can become more complex as the number of actors increase – but the benefits of the purchase are also amplified due to the potential for interoperability and cost reduction. We visit this point again during the case study analysis.

An important outcome of this step is the estimation of the negative impact the identified problem has on the delivery of the public service (e.g. traffic congestion that decreases road safety and work productivity) or the estimation of the business-as-usual costs if the same solution would be implemented, rather than the result of a PPI or a PCP+PPI (e.g. the exploitation cost of the incumbent solution). These costs can be both monetary and non-monetary.

3.2 Prior art analysis and IPR search

This step is crucial for distinguishing between technological trajectories that require a PCP or a PPI. The prior art analysis entails the examination of publicly available information on existing products and on ongoing research or any other published information that is relevant, whether IPR is protected or not. The IPR search focuses on the analysis of registered intellectual property from national or international databases (Eafip, 2017d).

Whenever the analysis reveals that relevant solutions are still at the R&D stage, a PCP will be considered. When relevant solutions have moved beyond R&D but are not widely commercialized and may necessitate conformance testing, a PPI will be considered by the procurer. Finally, whenever the prior art analysis and IPR search reveals that the desired solution is readily available on the market, the procurer will proceed with a normal procurement.

Additionally, the IPR search will indicate whether market entities already possess IPR that is needed to develop the desired innovative solution. This will prompt the procurer to

investigate whether designing around the blocking IPR is possible or whether licensing agreements can be reached (e.g. during the open market consultation). When neither of these two options are viable, the procurer may decide not to proceed with assessment and comparison between these technological trajectories.

During the prior art analysis and IPR search, the procurer will gather information on potential solutions that can subsequently be assessed and compared by using the business case methodology. Areas of assessment include estimated costs/savings of solutions as well as remaining risks (EC, 2014b) such as estimated risk of failure during follow-up R&D and subsequent implementation. The available budget will also determine the choice of the solution to be pursued. Depending on the particular situation, a procurer may be interested in selecting a project area in which a PCP has the potential to result in IPR and wider market revenues that may help to mitigate the risks associated with a high investment in R&D services.

3.3 Analysis of the standards' landscape

In public procurement, agencies may use a variety of types of standards, technical specifications, or eco-labels provided that they are based on:

“scientific information using a procedure in which stakeholders, such as government bodies, consumers, manufacturers, distributors and environmental organizations can participate” (EC, 2008).

These are often termed “voluntary standards”, formed through standardization – defined by the European Commission as the development of “technical specifications based on consensus amongst the interested parties,” (EC, 2014b) including industry, relevant interest groups, and public authorities. The procurement directives cite national standards transposing European standards as the most preferable for technical specifications, for application “without prejudice to mandatory national technical rules.” (EC, 2008). Voluntary standards act within a given sector to uphold product or service quality, security, information and conformity.

An important component of the business case methodology is to conduct a scan of standards inventories to identify whether there are relevant standards to apply within the planned procurement (e.g. consider costs related to the lack of open standards or of interoperability standards). Inventories can be national, European, international, or even sector-specific associations for de facto standards where approved by European legislation (EC, 2014b). An example of the latter is for ICT standards (EC, 2014c). Especially if they have no internal

technical team, procurers might approach a national standards development organization for assistance in developing this inventory.

Whenever appropriate standards exist, the procurer may require suppliers in a PCP or PPI to develop innovative solutions that are compliant with these standards. Standards support greater competition among companies around the desired qualities of the procured product or service, allowing the procurer to choose between a larger number of products that meet these (minimum) requirements and at a lower cost. For PPI, many types of standards are relevant to procurers, and can differ according to the degree of innovation that must take place to meet the procurer's need. For example, measurement / testing / interface and compatibility standards are more relevant when more work must be done to adapt an existing solution. If only minor changes are needed, standards for variety reduction, quality, or information become more relevant.

For procurers whose advanced needs can be met by solutions that require significant R&D, a potential absence of relevant voluntary standards leaves room for standardization efforts to amplify the impacts of a PCP. Procurers can draw upon different standards at each phase of a PCP, such as terminology standards during phase 2, and measurement/testing standards during phase 3. After each of these phases, de facto standards can be created based on knowledge generated within the phase, and used to define requirements for subsequent phases (Rainville, 2016a). These emerging standards help to define the requirements, systems architecture, and protocol or testing that support a successful solution. More formally, procurer engagement within official standardization bodies can speed the time to market of innovative solutions and can ensure future interchangeability between alternative solutions being developed during the PCP (Eafip, 2017b, p.35).

3.4 Open market consultation

Based on the information collected during the previous steps (Section 3.1-3.3), the procurer could then perform preliminary calculations to estimate whether the foreseen project is sufficiently attractive to continue to more in-depth analyses. For those projects where preliminary calculations suggest investing further time and money has sufficient value, the procurer may organize an open market consultation to gain more detailed information to contribute to (economic) planning. This consultation is open in the sense that many suppliers are invited.

The intention of the market consultation is to gather information from market players / innovators regarding the cost and quality of existing and potential solutions, such as ongoing research and their potential to yield relevant solution to procurer's problem / need. This will help the procurer to check whether the first assumptions made in the business case (e.g. expected benefits, expected costs, remaining risks) reflect realistic prospects. As such, there is a degree of overlap between the market consultation and calculating the value of a project. In this paper, market consultation is presented first, and details on the calculation are elaborated in the following sections 3.5 and 4. Testing the preliminary model through the market consultation adds a degree of rigor, and provides additional information for more accurate estimates.

The ability for market consultation to reveal sufficient information to support a rigorous business case depends to a large extent on the readiness of the market players to share information. Within the legal boundaries meant to prevent distortions of competition (e.g. the same information is conveyed to all participants; the market players are not agreeing on price fixing or market sharing), different strategies can be deployed by the procurer in designing market consultations that are conducive to information sharing. Some examples of these are one-on-one discussions, market surveys, poker planning techniques,³ and the use of an intermediary to act as a facilitator of discussions between public and private actors (Rainville, 2017; eafip, 2017b).

³ The poker planning technique is a debate moderation technique in which vendors are given cards with numbers on (like in the poker game) and they are asked to reply to different statements/questions from the procurer by holding up a card. The planning poker technique enables the procurer to verify with the market whether the assumptions of the business case were set realistically (e.g. feasibility of reaching the desired functionality/performance improvements within the planned time and budget, level of complexity of different solution approaches, required implementation effort and testing set-ups etc.). See eafip Toolkit Module 2 p.68-69.

3.5 Calculating and comparing value

Decisions as to whether to begin a project are based on the value offered by one course of action versus another. Calculating this value is most often done by using a Cost-Benefit Analysis (CBA), which highlights the strengths and weakness of various options. A CBA takes the form of a **Net Present Value (NPV)** calculation, which is the sum of the costs (C) and benefits (B) that occur at different points in the future, at the present time:

$$NPV = PV(B) - PV(C)$$

The use of a discount factor brings these future values back to **present values (PV)**, and is based on a discount rate. The discount rate reflects the time value of money, and opportunity costs of investment. For public projects, the discount rate is called the **social discount rate (SDR)** – for simplicity we continue to refer to it as the discount rate. The discount rate can be calculated using different methods, dependent on the project's funding source (tax or deficit/bond financed), whether loans from abroad are possible (a closed or open economy), and the duration of impacts (intra or inter-generational) (Moore et al., 2004).

In-depth discussion of methods for calculating discount rates lies beyond the scope of this paper. In the most common case – where projects are tax financed and impacts are less than 50 years – Moore and Boardman (2004) recommend annual discount rates of between 1.5% and 4.5%⁴ (0.125% to 0.375% per month).⁵ The lower bound of this recommendation is equivalent to common interest rates at a bank – the private interest rate, in perfect markets. The **timeline** for analysis, which also affects the choice of discount rate, should capture the welfare benefits of a particular project such that all subsequent years offer negligible benefits. Due to the larger uncertainty at times further away in the future, discount rates are lower with longer timelines.⁶

⁵ For longer impacts (i.e., intragenerational), rates can decrease for years occurring further in the future, and range between 0 and 3.5%.

⁶ While the discount rate reflects a degree of uncertainty, including future cash flows and markets, probability calculations may be introduced according to the structure of the project in order to more accurately capture the risks over the short term. This is more relevant to PCP, for example, where a multi-phase procedure is used to limit the risk of total financial loss based on the changes of not being able to meet the technical requirements at the end of each stage. See the eafip (2017c) for a detailed explanation and examples.

A lower discount rate means higher discount factors and a higher NPV. The discount rate is used to determine the **discount factor** δ by using the following formula, where r is the discount rate and t is the number of months from the present time:

$$\delta = \frac{1}{(1+r)^t}$$

The discount factor δ is a weight that is multiplied by different cash flows (investment costs, operation and maintenance costs, revenues, etc.) that occur in subsequent months, which provides its equivalent today. This gives the present value, which is calculated using the formula $PV = \frac{R_0}{(1+r)^t}$ for each of the cash flows, where R_0 is the cost (negative cash flow) or benefit (positive cash flow) in current euros (at time $t = 1$).

Costs for a PCP followed by a PPI will typically be higher than those for a stand-alone PPI, since by definition the activities of the former must include a degree of R&D, whether right from the conceptual phase (phase 1) or only proof of concept (phase 3). A procurer choosing for a PPI can do so due to greater technological and market certainty compared with projects requiring a PCP approach. This makes maximum costs lower than if R&D would also be purchased. Also of relevance to costs in a PCP is the division of the R&D budget, which can differ by number and timing of phases, number of suppliers, and the portion allocated to each supplier (Dimitri, 2017).

For innovation procurement in general, a large proportion of the **benefits** will come from the cost-savings from the new solution. In the case of PCP, there is a possibility to introduce revenue sharing agreements to increase the benefits to the procurer, which can help counteract the higher upfront costs of a PCP. Due to the benefits occurring over a number of months – and for a PCP, occurring at a point many months away from the time a given decision is made – the value of the benefits will heavily influence the **break-even time**, as the time in the future when the invested costs are equal to the benefits received. The **baseline** for comparison in calculating these benefits can be the previous solution, as identified in section 3.1 during the needs identification and assessment. Calculating the NPV by using this baseline allows the procurer to calculate the magnitude of potential savings for an updated solution. Once the NPV is conducted, a **sensitivity analysis** can provide an indication of the degree to which the NPV is dependent upon the different inputs, including cash flows as well as discount factors. This tests the robustness of the model, and provides a degree of (un)certainty for the estimates.

Other estimates of project profitability can be used alongside an NPV, to provide complementary information regarding the attractiveness of the project. Namely, these are **return on investment (ROI)** and the **internal rate of return (IRR)**. The ROI expresses how many

additional euro are generated by a single euro invested in the procurement, and is given by the following equation:

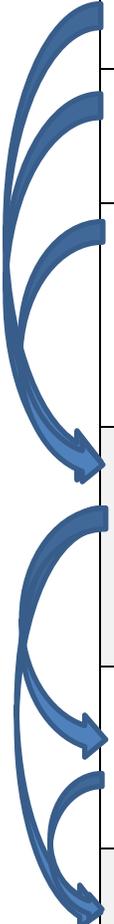
$$ROI = \frac{PV(B) - PV(C)}{PV(C)} = \frac{NPV}{PV(C)}$$

The IRR is the discount rate r required for there to be a positive NPV of the project – i.e., the rate that makes the present value of the benefits outweigh those of the costs. These measures can be compared as a factor of the discount rate chosen for the project. If $ROI > r$, using the example of a private interest rate of 1.4%, then investing the money in an innovation procurement project would be more profitable than in market activities (eafip, 2017c).

4 Using a Business Case Methodology

In this section, we combine the five elements of a business case methodology introduced in the previous section to show how a procurer can use them together in developing a business case. Table 1 presents a summary of these steps, in the order that could apply to many projects.

Table 1 – Summary of public procurement business case methodology steps, outcomes, notes



Step Number	Step Name	Summary	Outcome	Quick Guide
1	Needs identification and assessment	Survey end-users to determine the problem to be solved	Identification of a definite and clear need(s)	A clearly defined need is critical to procuring the best solution
2	Prior art analysis and IPR search	Research the state-of-the-art and look for patents in the solution space	Decision between a PCP or PPI Informed IPR strategies (optional)	A TRL of 1 to 8 -> PCP A TRL of 9 -> PPI IPR blocking -> innovate around / propose licensing agreements
3	Analysis of the standards' landscape	Scan relevant standards inventories Choose standards with the help of technical specialists to support a solution based on needs	Indication of specifications required to meet identified needs A draft standardization strategy (optional)	Degree of intended technological improvement ∞ Need for standardization strategy
4	Preliminary estimates	'Back-of-the-envelope' calculation to estimate project value Include qualitative elements/ranking Review within a team	Decision to pursue one project over another (optional) Value of continuing to a market consultation is understood	NPV is positive -> market consultation NPV is negative -> re-evaluate model & inputs / introduce modifying measures to increase value / stop project
5	Open market consultation	Engage with market players to gather quality and cost info to test assumptions of preliminary estimates	Enhanced rigor of the business case More informed estimates	<i>Quantitative</i> info: costs, quantities, timelines, number and size of suppliers <i>Qualitative</i> info: market openness, knowledge, innovativeness, willingness to cooperate
6	Detailed economic calculations	Improve depth and breadth of value calculations	Sound support for beginning or cancelling the procurement Expected costs (PCP or PCP+PPI); Expected benefits (savings, revenues) NPV, ROI, IRR, break-even point	NPV is positive -> begin project NPV is negative -> re-evaluate model & inputs / introduce modifying measures to increase value / stop project

The value calculations in Steps 4 and 6 should include specific inputs of:

- The baseline (Step 1)
- Choice between a PCP+PPI or PPI (Step 2)
- Costs and benefits from
 - Degree of technological change and IPR (Step 2)
 - Standards availability and standardization efforts (Step 3)
 - Expected feasibility, quantities, prices, market dynamics (Step 5)

The preliminary estimates in Step 4 can include qualitative elements as well, as those which are non-monetary yet useful for deciding which project trajectory to choose, by ranking different potential projects. However, *absolute* scores from such qualitative measurement cannot be used by themselves, as they are non-monetary. It is best to use these estimates instead for *relative* scoring, for example, by a ranking exercise. Ranking helps procurers to consider a wider spectrum of the project criteria, and to identify areas which should receive greater focus. In this way, ranking can be used to summarize and compare non-monetary elements of a business case, from needs identification, prior art analysis, standards landscape, and the open market consultation (Sections 3.1-3.4, above). Once a decision has been made regarding which project to pursue, this project can be the focus of an in-depth CBA based on NPV and other financial analyses (Step 6).

Of course, a project where the NPV is positive and acceptably high provides a sound justification for beginning a procurement project – so long as it has been carefully designed, input with the right type and amount of information, and within acceptable ranges of uncertainty. If the calculations show a negative NPV, a sensitivity analysis can reveal which factors most heavily influence this outcome. Then, a procurer (preferably as part of the project team) can decide whether these values are accurate, and whether they are accurately captured in the model. The help of a specialist may be required to provide assistance with (re)evaluation to help ensure a high degree of quality. If the final decision is to reject a project – based on a completed business case that clearly points to the disproportional disadvantages – then it is best practice for the procurer to share these findings with other procurers to support learning regarding the business case methodology and insight into the (economic) barriers to progress in an area of social interest (Rainville, 2016b).

5 Case Studies

5.1 Case study – Public Procurement of Innovative Solutions

In providing an example of an effective use of business case methodology, we first turn to a PPI. Knowing what technical possibilities on the market could possibly meet a procurer's needs are often the core question for a procurer who chooses PPI. As such, the market consultation phase is of greatest importance. The following example demonstrates this.

Beginning in 2014, Transport for London (TfL) was faced with the problem of needing to install new lighting in five different types of areas across the city. Namely, these areas were above the escalator, high access area, low access area, platforms, and the 'back of house'. The current lighting used was T8/Linear fluorescent lights (LFSs) – a technology which became commercially available decades earlier. The procurer was interested in better understanding the potential of light emitting diodes (LEDs) lighting, which are commonly known for their high efficiency, and consequently reduced energy demands and associated environmental impact from electricity generation.

To evaluate initially whether this course of action was worth considering, TfL began by breaking down costs and benefits of an average LED solution, to compare it with an average LFS solution which served as the baseline, Business-As-Usual (BAU), or benchmark. **Costs** were broken down into capital costs of purchasing the product, incurred before installation, and costs from operation and maintenance (O&M) once the product was installed. The time period chosen for these calculations was 25 years, over which the products were predicted to remain viable. A discount rate of 3.5% was applied. O&M costs included costs of installation, energy use (490g of CO₂ emitted per kWh, and electricity cost €0.12 per kWh), carbon tariffs (€3.52 per tonne, increasing 2% per year), cleaning, storage, and general maintenance. **Benefits** were considered to be cost savings, such that a cost which was present in the current solution but smaller in the new potential solution would be included as a benefit to the LED lighting. Using this method, TfL identified a potential cost savings for using an average LED solution compared with the old lighting, which outweighed the average costs estimated. Overall, the benefit of LEDs outweighed the higher product costs in comparison to the current LFS.

Motivated by this, a decision was made to conduct a more detailed calculation of the value offered by different potential solutions. Examining the particular costs more in-depth, TfL found that savings were more pronounced in two areas in particular: above the escalator, and in the high access areas, due to the reduced maintenance requirements of the average LED solution. These findings contributed to the design of an implementation strategy where

procurements for these areas were conducted first, in order for the procurer to receive higher cost-savings over a shorter time. Thus, the strategy offered a shorter pay-back time and a higher return on investment (ROI). This likely also fed in to the award criteria of ease of use to support low maintenance costs, in the final phase of procurement.

Next, to understand different technologies available, their cost and performance, TfL began a market consultation. This occurred both *prior to* the procurement, in the form of events that were open to the entire market, and *during* procurement, by inviting particular suppliers. During the open events, TfL gathered information from more than 70 suppliers for more than 300 different technologies. Technical specifications for pre-selection during the procurement (qualification phase) were created based on these findings, as well as voluntary standards. Namely, standards were for minimum quality requirements of luminance maintenance and hours of operation within acceptable confidence intervals and under given operating conditions, and maximum acceptable failure rates. Based on learnings from the project, TfL also contributed to standardization, providing information to update the London Underground Lighting Standard (S1066).

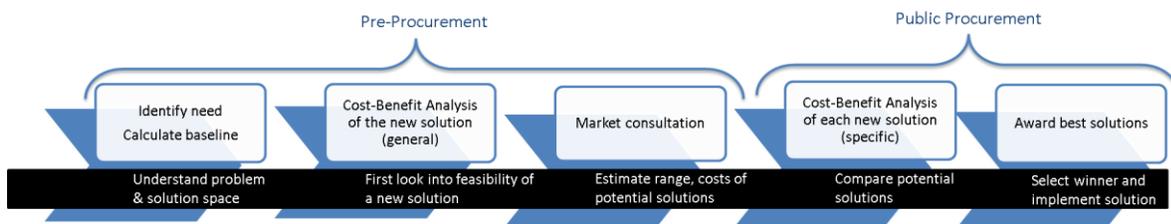


Figure 2 – Business case methodology used by Transport for London

5.2 Case study – Pre-Commercial Procurement

We turn now to an example of a business case methodology that was used in a PCP. The case study we examine here is the purchase of devices to assist in moving hospital beds, in the Lombardy Region of Italy (Strategic Planning, University and Research Directorate). In this case, process used to select this need, which became the focus of the PCP, is of greatest interest here.

Under a policy driver to improve quality and efficiency in healthcare service delivery – which amounted to 80% of the region's expenditure – the Lombardy region began in 2011 to identify potential needs to address by means of a PCP. The project team began with five hospital needs for innovative solutions, and conducted a prior art analysis and intellectual property right (IPR) search. They then discarded two needs which already had patented solutions. This left them with three potential solutions: an automatic robotic system for venipuncture, an automatic and universal bed mover, and a universal interface devices for home medical devices.

To decide which of these needs to focus on, the Lombardy region undertook a ranking exercise. A point-based system was used, according to scales of low, medium or high for each criteria examined. Costs considered were those of the actual product, as well as costs due to supply side concentration and a lack of open standards or interoperability with existing solutions. To estimate cost savings due to **economies of scale**, the degree of relevance (low, medium, or high) to other purchasers (only for this procurer, public/private procurers, all buyers) was estimated. As well, costs due to **supply-side concentration** were estimated using the current procurements in each area, with high for orders which involved more than 6 suppliers, medium for 4-5 suppliers, and low for 3 or fewer suppliers. Direct benefits measured expected improvement based on service efficiency and improvements in public service. For cost savings potential from **reduced lock-in**, ratings varied according to the skills required of new users to use the solution and the degree of industry activity. Current costs estimates due to **openness** used the existence of open standards and the degree of interoperability of solutions from different suppliers. Finally, the degree of clinical risks and technical complexity was estimated based on how closely connected the solution was to patient health.

Once costs and benefits were identified, each of the three project areas received a score (14, 15, and 17) and were subsequently ranked based on those scores. End users (medical and nursing personnel, socio-health operators, clinical engineers, and health managers) were consulted to help define which of these solutions offered the greatest benefit to them. Based on insight provided by this combined approach, the robotic system was abandoned due to low anticipated user acceptance, and the universal interface device due to the limitations of developing a universal standard through a regional initiative.

Focusing on the need for improved bed movement, the procurer envisioned an automated system which was easy for personnel to use, did not rely on route guidance or have mobility limitations, and had safety systems to reduce collisions. A CBA was then undertaken, to calculate the current costs of bed movements by the time per movement and number of movements required per day across all the beds to which the new solution would be applicable. Costs of the PCP were set, at €750,000. By reducing the number of personnel required to move one bed by half, alongside with estimation of efficiency gains (from reduced injury and downtime) of 20%, cost savings were calculated to be €921,600 per year. This estimation amounted to a 40% savings compared with the current hospital beds. Based on this information gathered through the business case methodology, the Lombardy region had sufficient justification to proceed with the PCP on the bed movement project.

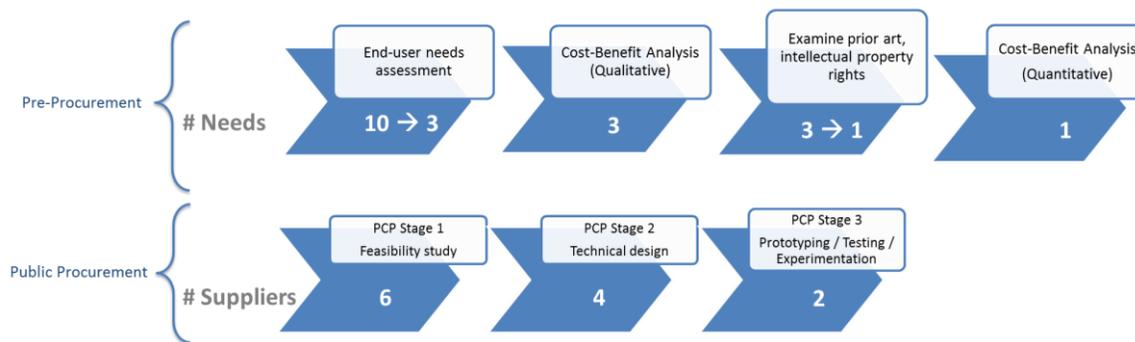


Figure 3 – Business case methodology used by the Lombardy region

6 Conclusions and Further Research

In approaching innovation procurement, public procurers are faced with multiple unknowns, including from a lack of information on the value of pursuing a new solution. This often deters procurers from initiating such projects. A business case methodology can help procurers overcome knowledge deficits and gain internal and external support for the deployment of innovation procurements, by demonstrating the value of a certain solution or of a certain course of action. Additionally, a business case methodology can help mitigate risks such as project failure or cost overruns, by helping procurers to choose the solutions with the highest and most realistic prospects of reward.

We have introduced for the first time an overarching view of the process of applying a business case methodology, for informing and guiding innovation procurement projects. We

presented a broad overview of the key components of this methodology, and examined two case studies (PPI and a PCP) to highlight ways in which these have been applied in practice. We also highlighted the importance of a rigorous preparatory phase, which includes clear definition of end-user needs, analysis of pre-existing knowledge (prior art analysis, IPR search and analysis of the standards' landscape) and an open market consultation. In order to gain in-depth information on the various alternatives to address the public need, procurers should allocate appropriate time and resources to these activities in accordance with their relative importance to the project.

With respect to how the information gained during the preparatory phase is used, we conclude that a quantitative assessment method such as a CBA can provide sound insight into the value of a prospective solution or course of action for procurers, and additional information to help structure the project (e.g. the most significant costs and benefits, and break-even time). The value calculations can complement more qualitative scoring and ranking exercises that incorporate information gathered within the different steps of the methodology, for a complete understanding of the potential project. These findings can be carefully translated into a rigorous assessment framework in the procurement documentation, opening the procurement to more suppliers and solutions and bringing expected costs and benefits even more in line with procurer's preferences.

When looking at the examples provided in this paper, the different ways that each case used a business case methodology highlights the need for adequate expertise in project planning, if not by the procurer then within the project team. A team lead can provide guidance over the course of the project to help procurers to make sense of what their economic and legal possibilities are, beginning with the preparatory phase. Further research is required for a better understanding of both the elements of a business case methodology and its connection to different types of innovation procurements, such as innovation partnerships. While the business case methodology presented here for PCP and PPI will have many parallels to that used for innovation partnerships, we expect there to be important changes and elaborations required, due to the different ways technologies and markets are approached.

7 References

- Bedin S, Decarolis F, Iossa E (2015). "Quantifying the impact of Pre-Commercial Procurement (PCP) in Europe based on evidence from the ICT sector." (SMART: 2014/0009). Brussels: European Commission.
- Camerer E, and van Eijl H (2011). "Demand-side innovation policies in the European Union", in Demand-side innovation policies. Paris: OECD.
- Dimitri, Nicola. (2017). "The Economics of Eu Innovation Procurement." In MSM Working Paper. Corvers-MSM Chair of Innovation Procurement: Maastricht: Maastricht School of Management.
- EC. (2016). "Innovation Procurement". Brussels: European Commission. 24 April, 2016. Retrieved from <https://ec.europa.eu/digital-single-market/innovation-procurement>
- EC. (2014a). "Public Procurement as a Driver of Innovation in SMEs and Public Services" Brussels: European Union. Available at <http://www.ecpar.org/files/public-procurement-driver-of-innovation.pdf>.
- EC. (2014b). "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." Brussels: European Commission.
- EC. (2014c). "Commission Implementing Decision of 3 April 2014 on the Identification of Ict Technical Specifications Eligible for Referencing in Public Procurement (Notified under Document C(2014) 2120) (2014/188/Eu)."
- EC. (2008). "Towards an increased contribution from standardisation to innovation in Europe: Commission of the European Communities." Brussels: European Commission.
- EC. (2007). "Pre-Commercial Procurement: Driving Innovation to Ensure Sustainable High Quality Public Services in Europe." Brussels: European Commission.
- Eafip. (2017a). "Module 1 – Strategic." Eafip Toolkit. Brussels: European Assistance for Innovation Procurement. Available at <http://eafip.eu/toolkit/>.
- Eafip. (2017b). "Module 2 – Operational." Eafip Toolkit. Brussels: European Assistance for Innovation Procurement, p. 25. Available at <http://eafip.eu/toolkit/>.
- Eafip. (2017c). "Module 2 Annex – Spreadsheet." Eafip Toolkit. Brussels: European Assistance for Innovation Procurement. Available at <http://eafip.eu/toolkit/>
- Eafip. (2017d). "Module 3 – Legal." Eafip Toolkit. Brussels: European Assistance for Innovation Procurement, pp. 25-26. Available at <http://eafip.eu/toolkit/>.
- Europe Innova. (2008). "Standards in European Public Procurement Leading to Innovation (Steppin)." edited by Directorate General Enterprise and Industry. Brussels: European Commission.
- Moore, Mark A., Anthony E. Boardman, Aidan R. Vining, David L. Weimer, and David H. Greenberg (2004). "'Just Give Me a Number!' Practical Values for the Social Discount Rate." 2004, 789.
- Rainville, Anne. (2017). "Stimulating a More Circular Economy through Public Procurement: Roles and Dynamics of Intermediation." Working Paper. DOI: 10.13140/RG.2.2.19675.77608
- Rainville, Anne. (2016a). "Standards in Green Public Procurement – a Framework to Enhance Innovation." Journal of Cleaner Production. <http://dx.doi.org/10.1016/j.jclepro.2016.10.088>
- Rainville, Anne. (2016b). "From Whence the Knowledge Came: Heterogeneity of Innovation Procurement across Europe." Journal of Public Procurement 16, no. 4 (Winter 2016): 463-504.
- Transport for London (2016). "Innovative lighting procurement for London's Underground network." GPP in Practice, September, issue 64.
- Yeow, J, and J Edler. (2012). "Innovation Procurement as Projects." Journal of Public Procurement 12, no. 4 (Winter 2012): 472-504.