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Risk management in the procurement of innovation

Concepts and empirical evidence in the European Union

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Contact: Tiit Jurimae

European Commission
Office SDME 9/73
B-1049 Brussels

Tel. (32-2) 29-92059
Fax (32-2) 29-98629
E-mail: tiit.jurimae@ec.europa.eu

EUROPEAN COMMISSION

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Expert Group Report

Directorate-General for Research
European Research Area

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EXECUTIVE SUMMARY

This report studies the way risk can be managed to enhance the procurement of innovation. The latter is a concept that goes further than technology procurement, occurring when a public agency places an order for a product or system, which does not exist at the time but which could (probably) be developed within a reasonable period (Edquist et al. 2000). The procurement of innovation includes technology but goes beyond it and addresses non-technological innovation and complex systems, where the technology may be known and proven but not at that scale or level of complexity.

Public procurement can potentially boost demand for innovation and promote lead markets. With public procurement equalling 16% of EU GDP, authorities can stimulate private investment in research and innovation, when they procure either products/services incorporating new technology or the R&D to develop the technology to a point where such products reach the market. However, this type of procurement of innovation is at the moment much less widespread than one would expect from such a promising activity; one of the reasons for this is the large amount of risk inherent in research and innovation activities.

The purpose of this report is to understand the various risks that public procurers are currently facing, identify existing risk management practices and derive recommendations that could help overcome this key barrier. This is done by

- a conceptualisation of risk in public procurement,
- the conduct of 12 case studies and
- insights gained from key incumbents (see below) invited to present at the expert group meetings.

The research carried out was exploratory and the cases were chosen because of their perceived information richness. Research conclusions are thus analytic or contextual rather than rendering universal statistical generalisations. They do, however, lead to concrete recommendations to improve the field.

The conceptualisation refers to the various types of risks that are relevant to the procurement process, and indicates some governance and managerial challenges these pose for a successful process of procuring innovations. The whole exercise builds up on the assumption that the cost of risk management cannot be exactly measured but procurers need to acknowledge in their budgets that it has a cost. It is therefore essential

to get a better grasp for it, to make sure it is not excessive in terms of information and delays and to keep in mind that the cost of no risk management may be a lot higher. The message from this exercise is that for the procurement of innovation *someone* takes responsibility for an additional cost, which leads to private and/or social returns on investment when the cost is in a reasonable relation to the benefit of the innovation.

Risks can be characterised by (a) their nature and origin, (b) the likelihood of them occurring and (c) the potential consequences. Risk management is a process that has to deal with all these properties. It needs to be understood as a *risk-reward management*, as any risk is to be assessed not only against the likelihood of its occurrence and the negative effects once they occur, but also weighed against the benefits out of the procurement for the various actors involved. The benefit is not absolute, but determined in relation to the overall targets and context conditions of the actors involved (see below). Risks in public procurement can only be assessed if they are contextualised and balanced against the benefits associated with the particular procurement.

The conceptualisation relates to the *procurement cycle* and the *innovation cycle* and leads to a *typology of risks*, which were suggested and proved appropriate through the case studies.

Five types of risks were defined:

1. *Technological risks* are all those risks that lead to non-completion, under-performance or false performance of the procured good and service. Due to its more innovative nature, the risk lies in the technical characteristics of the service or product or in its production, and thus originates in the suppliers' side. This risk appears of particular relevance in procurement of products in the fluid phase.
2. *Organisational and societal risks: Organisational risks* are all those risks of the procurement failing or under-delivering for reasons situated within the organisation that procures. *Societal risks* are those related to a lack of acceptance and uptake by the users of the new or changed service delivered within society.
3. *Market risks* are to be found on the *demand and supply* side. The former occur when innovations in public procurement are also intended to spill over to private markets and those private markets are not large or responsive enough or do not built up quickly enough to justify capacity investment. The latter are those that potentially disrupt or delay operations such as political instability and volatile labour market; potential threats that a competitor will take over a supplier and potentially lock out supplies, risks related to delays and insufficient quality.
4. The *financial risks* in public procurement are related to uncertainty in meeting target costs and the ability to secure the funds needed.
5. Finally *turbulence risks* – in fact turbulence uncertainties as they are hard to predict and measure – are associated with large scale-projects and emerge from

a range of unforeseen events that lead various actors in the whole process to re-assess their priorities or change their expectations.

The empirical evidence draws on 12 case studies, which were identified by the group as offering interesting lessons for policy makers. They were not chosen following systematic selection criteria and thus do not reflect a representative sample. While not claiming general validity on the conclusions drawn out, they proved sufficiently diverse in many dimensions and as such led to the identification of explicit and implicit risk management practices.

The cases discussed took place in the Nordic countries, the UK and the Netherlands in the last two decades; some of them took almost a decade to mature and take off. Risk management under all its guises is a time consuming process as was seen in the case studies. It seems that one can observe a **trade off** between the innovative (often complex) character of a product/service to be procured and the speed of the procurement implementation. The various techniques used (breaking down the procurement into more stages, engaging in dialogue, engaging experts and consultants) all need time and *the time elapsing for a typical procurement of innovation is ipso facto longer than in any corresponding standard procurement process.* **Shortening the time is possible**, if all information-gathering processes are foreseen and well designed from the beginning. The **procurement budgets** ranged from 87000 Euros to 270 million Euros indicating that procurement of innovation is possible in all ranges of budgets and is not reserved for larger (or smaller) projects only. There were no systematic differences in risk management between large and small projects. The procurers involved in the case studies were national and regional authorities, municipalities as well as specialised agencies. In the material t**here is no preferred pattern identified**. This again implies that procurement of innovation **should not be considered as a case to be followed by one type of procuring agency / department** but can be designed and implemented by any type of public actor interested in procuring products and services that do not yet exist in the market. Similarly **the suppliers in the case studies varied** including consortia, well-known multinational companies and SMEs. Both **indigenous and foreign** companies have been successful bidders, the former more frequent than the latter. The type of procurement was more often a classic type of **direct public procurement**, whereby administrations buy for their own use. However, in many cases it **proved to be a catalyst** for further technological developments beyond the original request. The procedure used was sometimes part of the standard processes, in others the procurement was broken down into different stages and in others **competitive dialogue was used**. Procurers and suppliers tried not only to reduce risks by improving their access to information, using the tools tolerated by the EU Directives, but occasionally found additional ways to reduce risks by combining the procurement with additional elements of public or private support. In their majority the case studies involved incremental or architectural

innovation, sometimes resulting from design only. In some cases the innovative element emerged from the larger scale or higher complexity of already existing technologies: public procurement avoided applications that have not been tested on a commercial scale, even if the technology existed (in principle). Lack of prior demonstration and design functionality, as well as the coordination of increased complexity, were often the really innovative elements.

In addition to the case studies, lessons were drawn from invited speakers presenting risk management/perceptions in other areas. As with the case studies these presentations reflected specific cases and are not generally valid but should be interpreted as suggestions of good practices. Banks reduce risk through internal and external valuations. When banks are asked to finance risky projects they expect the valuation cost is borne by the bidder; in certain cases national policies are to offer second and third bidders compensation from the State for that cost. Furthermore, banks rely heavily on expert advice; selecting – as needed – best global experts. One way to manage financial risks is offered by banks in the form of "stand-by loans" for potential cost overruns (same or marginally higher interest rate). Insurance coverage is mandatory against all events. In order to decide on the interest of a bank to finance a project in the first place, "Go-stop scorecard" approaches are used, through which risks are perceived and questions get binary responses (yes/no). Evidence from specialised national organisations in the Netherlands and the UK highlight new approaches to encourage innovation. One example is the shift from the traditional concept of procurement to an integrated concept, whereby the procurer sets performance requirements and allows for more freedom of choice on design and specifications to the contractor. Another one includes the Innovation Platforms used in the UK, which enrich intelligence and awareness, reducing technological and market risks. The *business approach* to manage risks focuses on the careful selection of suppliers, building on certifications (ISO or otherwise, depending on the contract), the utilisation of steering committees and project teams to closely monitor progress and negotiations for insurance costs. Finally, risk sharing facilities are increasingly offered by public and private organisations. These constitute a new type of instrument providing strong additional support to research, development and innovation, used also by the EU's 7th Framework Programme for Research to prioritise sectors identified as key drivers of excellence in European research and innovation and present significant lead market potential for Europe.

The deliberations in the expert group have further shown that the current institutional framework in the EU (revision of the Directives) now offers a better set of tools, which procurers are making an increased use of. There is however still a long way to go and significant problems to overcome before the procurement of innovation becomes widespread at the national level; possibly even longer until cross-border procurement is frequent.

It is obvious that risk is a significant hurdle for the procurement of technology. But while risk cannot be eliminated, it can be managed. The basic dimensions of risk management are to identify and reduce risks, mitigate the potential costs (should problems occur) and allocate responsibilities for those dimensions. The *identification* is actively pursued through studies, information and hiring of expertise. Initial information may point at the need for additional knowledge to further reduce risks. *Risk reduction* can be achieved through more accurate information, while mitigation is faced with alternative scenarios, early warning and contingency plans. The allocation of risks is derived from the relative negotiation power of partners but is linked to risk rewards.

There are many trade-offs when managing risks, which need to be carefully addressed. Allocating risk across too many actors may reduce risks but increase delays; if functional requirements are too stringent they reduce the innovative potential of a project; if they are too broad they may jeopardise its success; additional information reduces risk but increases cost and there is a moment where intelligence gathering needs to stop and action needs to start. While the literature consents that well defined risk management pays off, the monetary benefit of risk management is hard to quantify or optimise and, precisely because of the trade offs, one cannot prescribe exactly how much risk management is appropriate for any given situation. Several tools exist and can help procurers in the pre-procurement phase; however the case studies suggest that procurers deal with risk more implicitly than explicitly and the tools used are more generic.

The major condition to manage risk is a change of attitude, embracing and enabling innovation in procurement, not at all costs, but supported by conscious and well designed risk management. In this spirit a set of recommendations conclude the report. The most important addressees of these recommendations are those commissioning and conducting public procurement at all levels, and those policy makers responsible for framework conditions governing procurement in Europe and at the national level. Hence, there are three different sets of recommendations that arise from this report. Their character is not binding but is thought to facilitate the procurement of innovation.

Recommendations for procurers: help them acquire a new culture and deal with procurement of innovation without carrying "personal" risks

Some general principles need to be assimilated into the procurement culture to facilitate procurement of innovation:

- It is important that risk be managed as explicitly and as professionally as possible keeping in mind that it can never be eliminated entirely.
- Procurement of innovation, while associated with enhanced benefits, inevitably

accounts for additional costs and additional time needed both stemming from intelligence gathering, awareness raising, special provisions and contract negotiations.

- It helps when allocation of risk management tasks and responsibilities is not only linked to capabilities (to reduce their likelihood or mitigate their consequences) or responsibilities (for failures), but also to the distribution of the potential benefit linked to the innovation.

Use experience and tools to identify risks ex ante as far as possible and make them explicit.

- "Go-stop" scorecards constitute a good tool for the decision for procurement of innovation or not.
- Another good tool is the practice of procurers to keep a 'risks register' in the management of complex projects to incorporate innovation related risks.
- Technological risks can be identified with market and technological intelligence, selection of high reputation procurers/advisers and can be backed up with appropriate insurance schemes.
- Organisational and societal risks can be identified, reduced and mitigated through early discussions with all stakeholders.
- Market risks can be identified and reduced through a dialogue process with selected groups in the supply chain and potential users of new applications.
- Financial risks can be addressed with instruments such as internal cost calculations, review panels and scoring mechanisms to identify capital availability, its cost, volatility and potential cost overruns.
- Finally turbulence risks can be identified using discursive and brainstorming techniques.

Reduce the likelihood of a risk to occur

- Technological risks, especially with radical innovations designed for a long term application, can be reduced by combining the long term procurement process with research grants, so that a potential supplier shares the risk with a public funding organisation in coordination with the procuring body. Market risks (triggered by the supply chain) may be reduced if combined with venture capital investing in new-technology-based firms participating in public bids.

- Lock-in risks can be reduced by getting technical information from different sources, so that interoperability is possible at a later stage.

- Information increases and uncertainty diminishes as time passes. So it may be good to split the process, if high risks are identified. Disentangling the first stage from the rest of the procurement cycle can reduce risks particularly in the case of radical innovations.

- If societal risks are identified, it is advisable to mobilise the relevant stakeholder groups, make them aware of the benefits of the innovative solution and, if needed, enable to adopt and absorb them. In specific cases this may entail binding contracts with potential private lead users, where this is possible.

- Insufficient private demand, can be reduced if the public bodies involved visibly demonstrate the benefits of the innovation (demonstration projects, acting as key reference etc.) and bundle procurement bids to bring down costs and thus help to activate private buyers. At times, additional general awareness and education measures may be needed to enable broader private uptake of the innovation.

- Explicit risk analysis is more important for mega-projects or generally, for projects that involve innovations which disrupt user patterns and involve high transaction costs. It helps to construct worse-case scenarios as part of the exercise.

<u>Recommended action to mitigate against the consequences if an unwanted event occurs</u>

1. If risk is well identified then a Roadmap, a "Risk Mitigation Strategy" (including contingency plan for alternative action should the innovation fail to materialise), adopted by consensus at an early stage will help deal with the unwanted events.

2. The provision of stand-by loans mitigates the consequences of cost overruns.

3. Trusted committees, composed of experts in different disciplines (technical, financial, social) and from different stakeholder groups for monitoring and early warning give an opportunity for flexible corrective action.

4. Insurance is of course the most effective way of mitigating financial risks and can be used. However, one needs to keep in mind that in some cases insurers may refuse to insure too uncertain projects or the insurance becomes too costly.

Allocating across all functions and sharing risks

As a general rule responsibilities can be allocated during the negotiation and be reflected in the contract; those responsible then have the option to carry the risk themselves or pay for being insured against it. Some concrete ideas are listed below:

- The better the potential market prospect of suppliers, the higher the likelihood that they will accept to allocate responsibilities to them. This refers to technological and market (supply side) risks in particular. Suppliers would then have to pay for insurance. The cost allocation can be included in the contract through payment plans linked to milestones and envisaging late and reduced payments, as well as fines, are instruments to shift risks to the supplier.

- The risks of lack of organisational or societal acceptance of innovations and innovative public services can be allocated to the procurer. If this is the case procurers need to invest resources before the project starts and sometimes throughout the project lifetime to get more information and monitor progress, as the mitigation plan will be their responsibility.

- Financial risks are not easy to allocate and depend on the specificities of each case. Assuring access to the capital needed may be shared by supplier and procurer in larger projects, but can usually be shifted to the supplier alone for smaller ones. In addition this allocation strongly depends on the potential rewards and expectations of future profits (originating from spillover activities). Cost overruns can be allocated based on an agreement on how they occur: cost overruns because of incomplete contracts (interpreted as additional requests) are logically shifted to the procurer, while miscalculations are to be shifted to the supplier. Cost overruns due to macroeconomic problems can be dealt as turbulence risks and treated as suggested below. Insuring cost or other provisions are then carried by the actor accepting the allocation in the first place.

- Organisational and turbulence risks are the most difficult to foresee. Those that can be made explicit in each project and as such can be allocated, but often they are implicit and general provisions (or tacit agreements) may foresee that they are a broader political responsibility.

- Finally risks can be shared with actors outside the concrete procurement, in case it can be combined with other instruments (beyond the procurement itself), e.g. research grants, Venture Capital, special research guarantees for lead markets.

Recommendations for national policy makers: help procurers with improving capabilities and skills

- Work towards a change of attitude, organisational culture and incentives to establish clear awareness and principles for risk identification and mitigation. White papers, policy briefs and similar actions are necessary. Risk-reward considerations need to be backed by high political commitment and decisions to stop or continue a procurement process need to be taken in a conscious process with all parties involved.

- A better empirical base is necessary to understand the innovation impacts of different risk management strategies, in different sectors and in different areas of the public sector and of public services to inform policy.

- Further support would be offered by the creation of a structure, which will help the administration identify on time its future needs and investigate the likelihood to cover them before others (e.g. Technology Platforms or Specialised Agencies)

- In particular in countries where there is no experience with procurement of innovation additional incentives are needed. They could take the form of the launch of a once-off call for proposals for procurers who wish to experiment with the idea of carrying innovation procurement. This call would offer subsidies for their first-time exposure with risky procurement.

Recommendations for the EU: help exploit network externalities, synergies and policy coordination

The EU itself has important financial instruments, which can be used for promoting the procurement of innovation and help procurers manage risks; such instruments are the Structural Funds, green procurement and the procurement of transport equipment .

Good practice identification and dissemination is already taking place. In addition, for certain activities, which would facilitate learning and information, the EU may be better positioned to coordinate/collect them, so that all member states can benefit and do not need to replicate similar activities. Such activities include:

- Systematic collection and dissemination of good practices in a wiki-type presentation so that policy makers in the member states can learn from good practices in other member-states
- Collection of information beyond the European territory to help learning from other countries
- Facilitate all kinds of networking and coordination (between member states, within existing networks of procurers)
- Work together with business association (in particular those representing business research such as the European Round Table, EIRMA or UNICE) to sensitise their members on the support they can give to procurers by sharing risk as a tool for the increase of business innovation and market prospect.

1. Introduction

1.1 *The Expert Group "Managing Risks in Public Technology Procurement" and its objectives*

This report studies the way risk can be managed to enhance the procurement of innovation. The latter is a concept that goes further than technology procurement, occurring when a public agency places an order for a product or system, which does not exist at the time but which could (probably) be developed within a reasonable period (Edquist et al. 2000). The procurement of innovation includes technology but goes beyond it and addresses non-technological innovation and complex systems, where the technology may be known and proven but not at that scale or level of complexity.

Public procurement has been identified as key to stimulate demand for innovation and innovative goods and services. It has also been included as a key instrument to support the EU Lead Market Initiative. With public procurement accounting for 16% of EU GDP, public authorities are big market players who can stimulate private investment in research and innovation when they procure either products incorporating new technology or the R&D to develop the technology to a point where such products become available. However, this type of procurement of innovation is much less widespread than one would expect from such a promising activity. One of the reasons of low public procurement for innovation is the risk aversion of public procurers. Developing an explicit and systematic risk management is a good approach to overcome this psychological burden.

This report provides a conceptualisation of risk in public procurement and summarises the findings of 12 case studies, the presentations and the discussions that took place in the context of the Expert Group "Managing Risks in Public Technology Procurement". The objective of the Group was to provide guidance on the management of risks in the procurement of innovation. The risk of failure of new technology is an important issue facing both supplier companies in different sectors and public administrations, which respectively develop and acquire new technology to enhance their operations. The level of risk increases when the R&D itself is part of the procurement. In order to facilitate the process of technology procurement for both policy makers and public procurers the Expert Group examined the following points: i) how the purchasing power of public procurers to boost the demand for innovation can be put into practice, ii) identified

practices in public procurement as well as private sector industrial practices, which could be recommended to public procurers (bearing in mind the similarities and the differences between public and private procurement) and iii) how the culture of risk avoidance could be modified.

The Terms of Reference are set out on Appendices 1, the members of the Group and external speakers invited to give a presentation on Appendix 2. This report has taken into account recent academic literature and expertise stemming from earlier Commission activity in the area of procurement of innovation including the DG ENTR study (Edler et al. 2005) the DG RTD expert group (the Wilkinson report) and the more recent DG INFSO project on public procurement in the ICT sector as well as the ongoing OMC-net project on public technology procurement and the DG ENTR ST EPPIN project on how standards are and could better be used in public procurement to boost innovation.

1.2 *Methodological remarks*

The main interest and focus of the Expert Group - namely risk management in public procurement - is a difficult issue to tackle. Risk management started in the financial sector (insurances and then banks) to be soon adopted by all businesses - bigger companies in particular – and eventually also timidly addressed by new public management. However, in-depth work on public procurement of innovation and risk management is scarce.

In the public procurement practice risk is notorious as a barrier for technology procurement but tools for identifying and managing it are seldom used. As inputs were limited three steps were used to gather as much and as diverse information as possible:

1. Identify in a ***conceptual paper the types of risks*** associated with technology procurement and develop a typology to be used for the case study analysis. This paper, based on a literature survey as well as additional input from the Expert Group and invited speakers, evolved throughout the lifetime of the Expert Group.

2. Analyse a set of ***case studies*** to draw lessons on how policy makers deal with risk when they procure innovation, in other words what differentiates their attitudes and procedures when products or complex systems bought are offered for the first time in the market. These cases were reported in a standard template (Appendix 3). The cases were used to identify the main properties of the projects (time, actors, size), of their innovative character (radical, incremental or diffusion of innovation), associated risks and most importantly risk management.

3. Invite key people from a number of relevant areas, namely the ***banking sector, private industry, public research and semi-public organisations,*** to present their risk perception or the mandate, method of work and results in their own business. Selected lessons, parallels and analogies were drawn from these meetings helping both to reshape the conceptual understanding of risk management in public procurement but also for some of the conclusions and the recommendations presented below.

As a result of this evolutionary and interactive process risks were decomposed and studied in the following categories:

- Technological risks
- Societal and organisational risks
- Market risks
- Financial risks
- Turbulence risks.

1.3 *The case studies*

The group engaged in a search process and tried to identify recent cases in different sectors, in different contexts and presenting a variety of characteristics in terms of innovation strategies and procurement processes. This resulted to a broader number of cases, 12 of which were further pursued with additional documentation and interviews. The research carried out by the expert group was exploratory and the cases were chosen because of their perceived information richness (Patton, 2002, p. 46). In this type of research conclusions are analytic or contextual rather than rendering universal statistical generalisations (Yin, 1994, p. 30; Ragin, 1987, p. 35).

While there was a specific template suggested, which was designed to facilitate the comparative analysis of cases and synthesis, there was freedom in the description of the main issues in each case and these issues differed significantly among them. The methodology of the synthesis was to get as much information as possible to:

- suggest organisational ideas to policy makers in order to make the procurement systems more receptive to innovation procurement and
- identify ways which facilitate procurers willing to go for innovation procurement.

The case studies selected for detailed analysis were the following:

1 Table 1: Presentation of the twelve case studies including country and sector

1	GigaPort Next Generation Network (Netherlands)	ICT
2	Electronics identification card eID 2000-2003 (Belgium)	ICT – public administration
3	e-Voting (only national and local elections not referenda) (Estonia)	ICT – public administration
4	Journey Planner Helsinki Metropolitan Area (Finland)	ICT - transport
5	SIR/GSM-R (Sweden)	ICT - transport
6	Ethanol-Fuelled Pickup Truck (Sweden)	Transport – energy - environment
7	Biogas and Upgrading Plant (the Växtkraft Project) (Sweden)	Energy-environment
8	Passive houses, without central heating (Sweden)	Energy-environment-construction
9	GMWDA PFI Waste and Recycling project (UK)	Energy-environment
10	Column replacement solution 'the slipper'(UK)	Energy-environment
11	Environmental City District Hammarby Sjöstad, Stockholm (Sweden)	Energy-environment-construction
12	Rio-Antirrio bridge (Greece)	Construction - transport

An additional set of case studies were identified (including high tech textile for hospital use, laser development by a French SME, the "Öresund Bridge" to compare with the experience for the "Rio Bridge" and large projects of the European Space Observatory). Unfortunately despite efforts no information could be gathered for these cases, which would be of relevance for risk management.

The report is divided into five Chapters. The first is dedicated to the literature review, from which it derives appropriate concepts for our analysis. It addresses risk management models and practices and then proceeds with an extensive typology of risks, actors, the nature of innovation and types of procurement. These typologies are used in a template to analyse specific cases, which are presented in Chapter Three, where they are briefly described. Then the emphasis in this Chapter is to decompose the cases and synthesise the different dimensions to identify where risks occur and what type of risks they are, using (and confirming the appropriateness) the typology suggested in Chapter Two. A short Chapter Four is portraying the lessons learned from other sectors or actors, such as the banking sector, business enterprises or individual support schemes for similar activities in the member states or the European institutions. The conclusions

and recommendations for risk management in the case of the procurement of innovation are then put together in Chapter Five.

2. Understanding Risk in Public Procurement for Innovation

2.1 Introduction

Public procurement, as part of demand oriented innovation policy, has entered the European innovation policy arena with quite some force now (Kok Report (Kok et al. 2004), Aho Report (Aho et al. 2006), Edler 2009, Edler et al. 2007). Expectations are high for public procurement to contribute to innovation in Europe, mobilise leading edge private demand and link innovation activities with a better public service. Public procurement is a cornerstone of the Lead Market Initiative that is launched for six lead markets[1]. The underlying logic has been described in some detail elsewhere (Wilkinson et al 2005, Edler/Georghiou 2007, Georghiou 2007, Rolfstam 2008), and this logic is compelling.

However, doubts remain, as this logic is demanding on various levels. A well informed governance and implementation structure of the procurement process is called for, from the political decision down to the operational implementation and diffusion of the purchased product. Successful mobilisation of procurement for innovation thus needs entirely new forms of coordination and governance, reconciling at least three different logics: the efficiency logic (for the buyer, value for money), the broader economic logic (direct effect on producers, value chains, spill overs to private demand) and the sectoral policy logic (to deliver good / better public service / societal effects).

One major challenge which has increasingly gained attention is the issue of risk. It has been argued that 'stamina and sophisticated risk management are needed in order to cope with innovations in public services' (Edler and Georghiou, 2007, p. 960). It has also

[1] e-Health, Sustainable construction, protective textiles, Bio-based products, Recycling and Renewable Energy

been argued that risk aversion in society as well as among public procurers need to be remedied in order to face the challenge of global competition (Aho et al. 2006). Reducing risk aversion and allowing risk sharing have also been pinpointed as important factors for strengthening the role of public procurement as a means to stimulate innovation (Nyiri et al. 2007). Other researchers have argued that the risk averse culture typically prevailing in public agencies 'can also act as a barrier to the adoption of appropriate, innovative, reactive and proactive supply strategies' (Cox et al. 2005, p. 1). One the other hand, following experiences of private sector managers, an organisational culture which allows risk taking is in itself an indicator of quality and, ultimately, excellence (Porter, 1997).

Risk management in public procurement is also attracting attention outside the EU. For instance, a report written for the Canadian context established that '[i]t bears repeating that all government procurement actions carry risk and that the effective management of risk is key area of focus for modern public sector procurement management practices' (Currie, 2005, p. 35). National leadership setting the directions and acceptance of risk associated with innovation has also been recommended (Bauer et al. 2008).

Purpose, coverage and structure of this chapter

This section is the result of a conceptualisation that guided and supported the deliberations and the empirical work of the expert group. It outlines a conceptualisation of the various risks involved, their origin and nature, and indicates some governance and management challenges they pose for a successful process of procuring innovations. The conceptual thoughts outlined in this chapter have been used to construct – deductively – the template for the cases (the template is included in the appendix of this report). It has evolved over time, as cases have been interpreted and added to the concept (inductively). Further, the paper has been a basis for the development of lessons to be learned out of the case studies in the expert group.

As one major source for his conceptualisation a literature review was conducted in autumn 2009 and updated in spring 2009. This drew on relevant monographs and edited books (some of them stemming from the area of complex project management) and, most importantly, on the journals of the major academic publishing houses. The focus has been on academic journal articles and to some extent, procurement practitioner's journals. Content words used in the search process were: 'Public Procurement´, ´Risk´, 'Procurement', ´Supply Chain Management', 'Risk Assessment', 'Risk Management', 'Technology Procurement', 'Culture', and 'Project'.

Although the topic of this section should arguably reflect an intersection of two literature streams, literature on public procurement of innovation and literature dealing with different aspects of risk respectively, the emphasis here has been on the latter. Reviews and discussions focusing on public procurement and innovation per se and the overall

governance challenges around public policy and procurement for innovation are available elsewhere (Edquist, Hommen, Tsipouri, 2000; Edler and Georghiou, 2007: Rolfstam, 2008a, Uyarra/Flanagan 2009, Wilkinson et al. 2005).

We are aware that risk management is in fact risk-reward management, as any risk is to be assessed not only against the likelihood of its occurrence and the negative effects once they occur, but also weighed against the **benefits** out of the procurement for the various actors involved and effected, whereby benefit is not absolute, but determined in relation to the overall targets and context conditions of actors involved (see below). This again is covered in the growing literature on public procurement and innovation, and shortly summarised in section 2.2.2 and 2.3 of this chapter.

This chapter is structured as follows. Section 2.2 outlines the basic definitions of risk and the principle function of risk management. The following section 2.3 discusses the specificities of **public** procurement and its organisation. In order to generate a basic understanding of risk management principals, section 2.4 introduces some risk management models and practices, mainly from the private sector. The core of the chapter, section 2.5, develops a typology of risks in public procurement, discusses the complex actor arena and introduces some differentiation stemming from different variants of innovation and public procurement.

2.2 Risk and risk management in public procurement: basic definitions

2.2.1 The concept of risk

Public procurement of innovation concerns the acquisition of new products and/or services, of significantly improved existing services and products or a new application of organisational innovation for the provision of existing products and services. Innovation can be developed by the individual contractor, a consortium of suppliers, further the supply chain (below first tier) or in partnership with the buyer (co-production, see Hommen and Rolfstam, 2009, Uyarra and Flanagan, 2009). What is different from procurement of already existing of-the-shelf items is that in public procurement of innovation, at least some aspects of the procured item or service are uncertain or unknown. Therefore, public procurement of innovation involves a certain degree of risk.

To understand and manage risk in public procurement, we first need a clear understanding of what risk actually is. There is a range of risk definitions. Following Cambridge Advanced Learner's Dictionary (2008) risk is defined as 'the possibility of

something bad happening'. Risk may also be understood as 'something happening that may have an impact on the achievement of objectives… It includes risk as an opportunity, as well as a threat' (NAO, 2000, p. 1, similar OGC 2003). Based on the classical work by Knight (1921), one may include the notion of measurement, of measureable uncertainty. Thus risk can be defined as **measureable uncertainty of outcome, whether positive opportunity or negative impact**, whereby the measureable uncertainty is expressed in terms of likelihood. While we acknowledge that the definition of risk often used is neutral, i.e. having negative or positive effects on the outcome of an activity, the remit of this expert group and the understanding in all cases we analysed is that we **limit ourselves to the negative consequence of a risk** (thus not discussing opportunity management in this report).

To clarify the difference between uncertainty and risk, Perminova et al (2008) define uncertainty as 'a context for risks as events having a negative impact on the project's outcomes…' (Perminova et al, 2008, p. 77). Furthermore, risks are **known** and possible for managers to deal with, while uncertainty is an event or a situation that was not expected to happen.

A broader definition distinguishes between different **sources** for the risk to occur, as risk is resulting 'from the direct and indirect adverse consequences of outcomes and events that were not accounted for or that were ill prepared for, and concerns their effects on individuals, firms or society at large. It can result from many reasons both internally induced and occurring externally with their effects felt internally' (Kogan and Tapiero, 2007, p. 378). From this definition follows the distinction between risk as the result of failures or misjudgements and those which are the results of [to the organisation] uncontrollable events (ibid, p. 378), an important distinction when it comes to risk management.

Another way of distinguishing risk, again highly relevant for risk management and risk perception especially in our context of public procurement, is to look at demand and supply as sources for risk. Analysing the situation in the toy industry, Johnson (2001) observes that, '[d]emand for fad-driven products can move from tepid to boiling overnight and then suddenly evaporate as the next hot product sweeps the market' (ibid, p. 106). Concerning supply,' [s]upply chains that span the globe and include many emerging countries add currency and political risk that can disrupt supply and change cost structures with little notice' (ibid, p. 106). Sodhi and Lee introduce contextual risk as an additional source. (Sodhi and Lee, 2007). Supply risks are e.g. those that potentially disrupt or delay operations such as political instability and volatile labour market; potential threats that a competitor will take over a supplier and potentially lock out supplies, risks related to delays and insufficient quality. Inbound supply risk has been defined as 'the potential occurrence of an incident associated with inbound supply from

individual suppliers or the supply market, in which its outcomes result in the inability of the purchasing [organisation] to meet customer demand or cause threats to customer life and safety' (Zsidisin, Ellram, Carter, Cavito, 2004, p. 397).

Horton adds an important property of risk. For him, risk involves not only the uncertainty, but also the fact that should an event occur (in other words, should something go wrong), the consequences must affect the utility for the actors involved. If the consequences do not affect the cost-benefit calculations, we may face (even measureable) uncertainty that something happens and changes things, but there is no risk, as there are no (negative) consequences. This is not trivial and links to the need to link risk to benefit. As said above, risks in public procurement can only be assessed if they are contextualised and balanced against the benefits associated with a particular procurement. For example, the risk of failure to deliver a public service or to deliver it much later or much more costly, must be weighed against the relative benefit out of this innovative service for the agency and the private stakeholders (the addressees of the service) and against the costs of avoiding unfavourable events to happen and – if they happen – to minimise their negative consequences. In Horton's rationale, the risk, should it realise, would change the utility of an action, but if this utility still is high, if the cost-benefit considerations are still positive even in the event of the risk to occur, the action may still be conducted. Equally, if the utility without the risk to occur is extremely high, and the likelihood of the risk to occur is judged to be rather low or the negative consequences of failure are not prohibitive, the risk would still be taken.

An image of Bernoulli illustrates the meaning of **relative** benefit – and how it influences the perception of risk.

> Somehow a very poor fellow obtains a lottery ticket that will yield with equal probability either nothing or twenty thousand ducats. Will this man evaluate his chance of winning at ten thousand ducats? Would he not be ill- advised to sell this lottery ticket for nine thousand ducats? To me it seems that the answer is in the negative. On the other hand I am inclined to believe that a rich man would be ill-advised to refuse to buy the lottery ticket for nine thou- sand ducats. If I am not wrong then it seems clear that all men cannot use the same rule to evaluate the gamble. …

The decision the 'poor fellow' is exposed to might mean the potential gain of a price if he keeps the lottery ticket and wins. He might also win nothing. If he should decide to sell the lottery ticket he is guaranteed nine thousands ducats, which would for him be a considerable gain. For a rich man, the consequences should he buy the ticket and loose, would be insignificant. What follows from this is that 'the value of an item must not be based on its price, but rather on the utility it yields. The price of the item is dependent only on the thing itself and is equal for everyone; the utility, however, is dependent on

the particular circumstances of the person making the estimate. Thus there is no doubt that a gain of one thousand ducats is more significant to a pauper than to a rich man though both gain the same amount' (Bernoulli, 1738, p. 24).

For risks involved around innovation, similar concepts have been used. Risks involved in radical innovation in general have been mapped according to three dimensions, the degree of uncertainty, the degree of controllability and the relative importance (in other words: benefit). If the likelihood of a bad result is high, the ability and resources available to influence and control outcomes are small, and the potential consequences of failure is high, a project activity should be labelled 'risky' (Keizer and Halman, 2007; Keizer and Halman and Song, 2002). Attempts to measure risk attitudes and risk aversion made through investigating behaviour of game show participants establish risk aversion among individuals (Deck, Lee, Reyes, 2008).

Our working definition and concept of risk

In sum, risk is a concept not entirely clearly defined in the literature. Our understanding for the remainder of this report is that risk is measureable uncertainty (likelihood) for something to occur that lets projects fail, decreases their utility or increases their costs and duration.[2]. In business project terms, it can have its origin within the project or the organisation(s) involved, or outside, on the demand side, the supply side or the wider context. Further, to know certain risks alone does not suffice, risk has to be weighed against the benefits should the stated goals be achieved and the activity be successful. Consequently, risk-reward ratios will most often be different for the different actors involved in a certain project. Risks can then be characterised according to **nature** (what is the uncertainty), the **likelihood** with which they occur, the potential consequences (**change of the utility** or cost-benefit calculation of a project for **the different stakeholders** and the **sources of risks)**. Risk management, in consequence, has to deal with all those properties.

2.2.2 Basic functions of risk management

In general, empirical evidence suggests that risk management increases the likelihood of success. Studies of new product development (Keizer et al, 2005) and software

[2] We acknowledge that some risk definitions also include the possibility that risks increase the utility, but in line with the majority of literature and the purpose of this group we stick to the interpretation that risks, should they occur, reduce the utility of the outcome of an activity.

development projects (Bannerman, 2007) have shown that the chances of a development project to become a success increase if risks are managed well, including monitoring and application of reflective learning and sense-making throughout projects. Sound public procurement of innovation should therefore involve some kind of risk management, although it may not necessarily mean that a formal risk management structure is set up (Chapman and Ward, 2004).

Risk management also reduces costs. For construction projects, Bauld and McGuiness (2008) have found that public customers in general pay more than private costumers, and that this is related to risk management. Simply stated, they suggest that the price is affected by the risk assumed by the supplier as follows:

> Price to the costumer = Supplier's cost of supply + Risk assumed by the supplier + Profit

From this relationship follows that the more risk the public procurers assign to the supplier the higher the price. Unrealistic allocation of risk built into a contract offered by a public procurer may lead to hidden costs as firms which would be able to deliver may choose not to participate in the tender at all (Bauld and McGuiness, 2008). In this sense risk management for public procurement becomes something that goes beyond the boundaries of the procuring public agency. In extension to this, a point has been made that there is also a need for suppliers, especially those which traditionally have not supplied to public sector to learn and understand the unique environment of public procurement (Davidson and Moser, 2008).

Against this background, and on the basis of the above definitions of risk, there are **three major tasks for risk management**[3]:

1. **define and assess risks** and **reward** for **all partners involved** at the various stages of the procurement process, including (see also AIRMIC et al. 2002)
    - **nature** (kinds of risks) of risks, which may change during the various procurement stages,
    - **causes** and **sources** of risk,
    - **likelihood** of risks to occur,
    - potential **consequences** of risk occurrence (additional costs, reduced reward),

[3] This list should not be confused with the procurement cycle, see table 2 below. But illustrate the major issues when it comes to risk in procurement.

2. for each risk, **take action to avoid** or **reduce the likelihood** of risk to materialise ('the likelihood of an adverse project outcome', Bannerman, 2007) and **allocate responsibilities** to take action to reduce the likelihood,
3. for each risk, **define action to mitigate** the potential consequences and **allocate** who bears the **cost of mitigation** and the **reduced benefits** (contingency plan, i.e. 'having in place a corporate and systematic process for evaluating and addressing the impact of risks in a cost effective way' (NAO 2000, p.2)

In summary, efficient risk management entails that risk should lie with the party able to best manage it. In procurement what is relevant is not only the capacity to identify and bear the risks but also the relative attitudes to risk on the part of the government and the contractor. The nature of the risks and how best to deal with them would depend on the relative complexity of the project, the relative importance of quality aspects vis-à-vis costs for the procurer, the innovation intensity (see section 2.5 below), the heterogeneity of the projects, and other aspects on the supply side (such as number and characteristics of potential suppliers, firms heterogeneity, industry structure, etc.).

2.3 The specificities of public procurement of innovations in terms of risk

2.3.1 Risk and the nature of public service

Public procurement of innovation has two distinct features: (1) public bodies purchase for the delivery of a **public service**, i.e. to introduce a new service or to make the public service more effective (better) and/or more efficient (cheaper) and (2) the purchase of something that is new or a considerable improvement to existing products and services (innovation). Obviously, the risk stems from the innovation aspect, and the nature of the innovation and the processes to generate, absorb and use the innovation lead to all kinds of risks that are defined in the next section. However, when dealing with public procurement of innovation and risk management it is important to note the differences not only between standard and innovation procurement, but also to be aware of the public nature of the procuring organisation and the differences in the perceptions of risk in the public vis-à-vis the private sector. The UK Audit Office (NAO, 2000: p.1) defines **public** sector risks as 'something happening that may have an impact on the achievement of objectives as this is most likely to affect service delivery for citizens.'

Typical risks that government departments face include (NAO, 2000)

- Threats to the achievement of a department's objectives, programmes, or service delivery.
- Anything that could damage the reputation of a department and undermine public's confidence
- Failure to prevent malpractice, waste, or poor value for money.
- Failure to comply with regulations e.g. health and safety and the environment.
- An inability to manage change to prevent or minimise adverse effects on public services delivery.

In public procurement, all those risks are naturally the higher the more innovative a product or service is that is purchased. We discuss this in detail below (5.5.1), however, it is obvious that innovation can, if successfully purchased and implemented, help to fulfil or improve those government functions or reduce the cost of delivering them.

Accordingly, risk management in the **public** sector entails 'having in place a corporate and systematic process for evaluating and addressing the impact of risks in a cost effective way and having staff with the appropriate skills to identify and assess the potential for risks to arise' (NAO, 2000: p.2). While this is true for private organisations as well, risk management is clearly different between the public and private sector (Hood and Rothstein, 2000). For instance whereas in the private sector, the main focus of risk management is to maintain and enhance profitability, in the public sector the focus is on the implementation of objectives and services for citizens. Government decision making is subject to strong expectations regarding transparency and accountability. Therefore, long term benefits may be easier to offset against short term risk in the public sector than in the private sector, as in the private sector risk is assessed considering the perception of stakeholders and financial markets, while in the public sector the delivery of services to citizens is regarded as a 'public value'.[4] Further, strategic decisions affecting risks are dispersed across multiple organisations, while in firms the internal risk allocation is clearer and the overall strategic goals more convergent (Hood and Rothstein, 2000).

2.3.2 Coordination and incentive challenges

As mentioned in the previous section, in the public sector decision making is dispersed across multiple organisations pursuing different goals. In relation to public procurement, the challenge is to bring together at least two mostly separated arenas: (1) domain actors

[4] Although one must concede that short-term electoral cycles also may stand in the ay of long term cost-benefit assessment and lead to short-term risk minimising or budget considerations.

(public actors responsible for public service provision and goals in distinct policy domains) and (2) innovation policy actors. This means that some kind of horizontal coordination between and, not least, within departments, ministries, agencies, contracting authorities or units is crucial, and as we will see below, the various actors have an entirely different cost benefit consideration and accountability requirements when procuring and thus different risk perceptions and management approaches.

Further, we need to consider risk-reward relationships across the arena of stakeholders involved. When considering risks and coordination of ways to deal with risk it is important to compare the risks for certain public actors to the related benefits. The balance between risks and benefits needs to be proportional. A general rule for risk sharing is that any risk should be assigned to the stakeholder best suited to deal with a certain risk (Wade and Björkman, 2004). The problem here is, of course, that the benefit distribution across the procuring administration - and indeed across the stakeholders more widely – does not match the risk distribution, those benefiting most might not be those bearing the highest risk. One major principle of risk management should be not only to align risk and reward distributions generally, but to do so also across stakeholders, so that incentive structures do not lead to inter-stakeholder frictions and thus stalemate in the decision making and risk management process.

This becomes clearer if one looks at the internal, vertical organisation of public administrations. As was observed in earlier studies (Edler et. al 2005), very often, especially in large public organisations, procurement is organised vertically from top decision making for a certain need for purchase to the operational level of actually carrying out the tender and contract process. This is where the risk – reward issue comes in strongly, because internally, within administrations whereby a decision maker who is responsible for the delivery of a public service delegates the purchase of products or services that are needed for this delivery to those internally responsible for procurement and for the implementation of new goods into the operation of the administration. The risk-reward ratio looks very different for the different levels. The vertical coordination is characterised by an asymmetry of knowledge profile, interest and accountability. **Top level decision** makers are interested in and knowledgeable about the societal need they are accountable to their constituencies and their public budget. They (may) take the principal decision for a certain need to tackle and procurement process to start. However, it is at the **mid-level** of organisations where the administrators are responsible both for the actual procurement process and the service delivery. These two functions may be carried out by the same unit or individual or functionally separated between service provision (internally and/or vis-à-vis the citizens) and legal implementation of the procurement process. It is at this mid level in administrations where actors know about 'what works' and how a purchase impinges upon the whole administration, the public users, as well as the citizens. Consequently, it is administrators at this level that are

interested in not only securing the delivery of the process at reasonable costs, but which is accountable towards the citizens that expect sound service and their administrations that need to bear switching costs when innovations are introduced. Finally, the **actual procurer** is interested in a smooth, risk reduced process that leads to cost-efficient solutions in terms of search and implementation costs, and is bound by procurement regulations and efficiency rationales. The way these various interests and functions are organised within administrations has a high influence on the way risks are – collectively – perceived and taken into account.

In addition, procurement of innovation entails a complex decision making process by procurement officials, department officials and innovation policy makers but also suppliers and final users, each with different needs, objectives and perceptions of risks.

The complex interplay between those three levels (strategic, concrete service delivery and operational procurement) and between public bodies and suppliers and further market actors is thus a major challenge that determines the effectiveness and efficiency of procuring innovations. All the actors at different levels have **different incentive structures** and framework conditions, which leads to different attitude towards different kinds of risks – and indeed potentially to **target conflicts** within public administrations (e.g. the innovation goal, the efficiency goal, the service provision goal, and – depending on the concrete issue – a large number of societal goals etc)[5]. Notwithstanding the fact that those actors carry different kinds of risk (see section 2.5 below), the interplay of and transparency between those levels itself is a source of risk or – at best – a source of risk reduction and management.

Finally, there is the communication with suppliers. By nature, in the public procurement process for innovation this cannot work through market signals alone. Specifications describing functions, performance or effects, will need to consider the supplier capacity to react to new needs. In contrast to private procurement, the tender process and direct interaction prior and during the tender process are strictly regulated through the procurement directives. Suppliers need to understand not only the official requirements, but also the complexity of the institutional context (actor constellations, responsibilities, expectations, absorptive capacities etc., see above) of the service or product in question in order to properly assess specifications and the likelihood to satisfy those specifications. All this requires intensive exchange and dialogue. In sum, we can argue that due to the multi-layered and dispersed internal division of labour, the different incentive structures of the various actors and the constraints of public procurement regulations, public procurement would add layers of complexity and institutional and legal requirements that impinge directly on risk occurrence, perceptions and management.

[5] See also Rolfstam 2009.

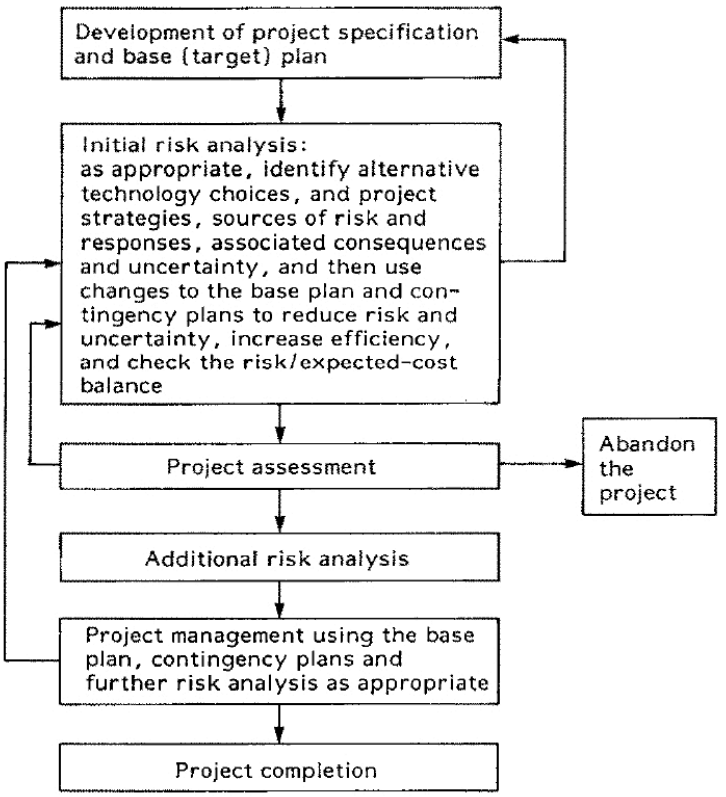
2.4 Risk management models and practices

There are many different perspectives and knowledge domains that are relevant for risk management. Keizer, Halman and Song (2002) discuss the use of a 'risk facilitator', an innovation expert who is not member of the project team and therefore independent and free from bias who can work with the project manager to diagnose risk. Several authors acknowledge the importance of including experienced co-workers for successful risk management (Al-Tabtabai et al, 1997; Wade and Björkman, 2004). Risk management is an issue not only for project owners but also for potential contractors, where one result of such analysis could be to abandon a project (Ward and Chapman, 1991). Risk reviews, contacts with subcontractors, research on persons or client, site visits, and financial considerations are also central elements in risk identification (Bajaj et al, 1997). Evidence also suggests that encouragement to take risks within a working group increases the likelihood of radical innovations to be developed (Cabrales et al, 2008). There is also a stream of research attempting to capture gained experience in different kinds of decision support systems (Al-Tabtabai et al, 1997).

Different models of risk management exist which all have varying degrees of complexity. What many of these models have in common can be summarised as a process consisting of three stages; 1. Risk identification; i.e. that potential risks are determined; 2. Risk assessment, i.e. where the risks identified are evaluated and ranked and; 3. Risk response, i.e. identification of the way risks are dealt with (Orsipova, 2008).

The same underlying principle is also applied in the basic project risk model outlined by Ward and Chapman (1991). At the initial specification of the project, a risk analysis is carried out. The result of this analysis may render the decision to abandon the project. Other results may be that modifications of the project take place. Once the project is running, continuous monitoring should take place to avoid uncertainties as far as possible. This model is outlined in figure 1.

Figure 1: Basic roles for risk analysis



Source: (Ward and Chapman, 1991).

Another generic risk management model suggested by Zhaou and Duan (2008) is displayed in table 1. Similar to the above mentioned models, this model also displays an iterative pattern, but in their version it consists of nine steps. This model follows a life-cycle logic where each phase of a project may be scrutinised according to the steps specified in the model – and its logic can be applied to the procurement cycle model (section 2.5.1).

Table 1. Integrated risk management model

1. Identify Issues, setting the context.
2. Asses Key Risk Areas
3. Measure likelihood and impact
4. Rank risks

5. Set desired results
6. Develop options
7. Select a strategy
8. Implement the strategy
9. Monitor and evaluate and adjust

Source: Zhao and Duan (2008, p. 1390)

Applying the principles described by Zhao and Duan (2008), would prompt an analysis of potential risks in the different phases of public procurement projects. Assume, for instance, that the 'determination of contract award criteria´ would be analysed. An issue concerning the stage of the procurement process in which award criteria are defined lies in the difference between 'should ideally' and 'must have' requirements, i.e. whether or not a specific requirement should be mandatory, i.e. leading to exclusion of tenders which do not comply with it, or if it should be rendering higher evaluation points only (Bauer, Larsen, Bode, Standley, and Stigh, 2008). If a 'must have' specification is used for a given feature, this may exclude suppliers which lack the capability necessary to deliver it, which may, if nothing else, save the public procurers from administrative overhead. On the other hand, if a 'must have' specification is used on a market where no suppliers have in their possession the required capacity, the procurement process will fail, as no supplier will be qualified, or it will be time consuming and costly to build up capacities of a supplier.[6]

It should be noted that the way public procurement projects are set up may vary with the individual project (Osipova and Apleberger, 2007; Grasman et al, 2008). It has even been argued that in practice 'it is virtually impossible to classify procurement by any sort of rational positivist approach' (Tookey et al, 2001, p. 28). No matter how the process is organised, it seems reasonable for procurers to carry out a thorough analysis of the steps envisaged in procurement cycle in the specific case. It may be expected that such analysis would identify potential risks in advance and create opportunities for risk mitigation. If a project includes competent and experienced colleagues in the project, this will increase likelihood of success (Wade and Björkman, 2004).

Zhao and Duan (2008) develop a risk management model for Chinese construction companies'. The purpose with this model is to identify, treat and control risks; establish a procedure for analysing the risks distribution in undergoing building projects; and to price and allocate funds according to different types of risks and to establish risk management

[6] One practical example where a tight technical specification for green technology excluded potential commercially viable not so environmentally friendly technologies can be found in Rolfstam (2008b).

departments. The model includes three modules; the Risk Mechanism, the Quantification Analysis System and Optimizing Decision Making. They also discuss the use of a risk management information system. The module Risk Mechanism captures organisational aspects of risk management, i.e. the need for assigning risk management professionals or teams which at all the stages of a project monitors and coordinates safety issues. Within the Risk Quantitative Module fall different kinds of risk assessment methods. Different dimensions of risk may be assessed, e.g. the risk of natural factors; earthquakes, fires, hurricanes etc and human-induced; economic risk, political risk, material risk etc. This module may also include quantitative analysis of risk such estimations of probability of identified risks are calculated of potential impact. One study were (among other things) such probability – impact rating is discussed is a study on the South African public power company Eskom Holdings (van Wyk, Bowen, Akintoye, 2007).

The Optimizing decision-making module underscores the importance of setting up contingency plans, making optimised allocation decisions on project resources, and throughout the project periods arrange safety symposiums for project participants. (Zhao and Duan, 2008)

Based on a study of Swedish coffee companies Berlin and Leidstedt (2004) develop an a priori model of risk management in procurement where the risk policy of the procuring organisation provides input in early phases of the procurement cycle, and thus becomes an integral part of the purchasing process.

Zsidisin and Smith highlight the importance of early supplier involvement (ESI) for new product development by referring to a case study of Rolls Royce (Zsidisin and Smith (2005). The importance of interaction is well known in innovation research (e.g. Lundvall 1988, 1992). ESI underlines interaction early in the design cycle of importance to risk management and risk reduction. 'With better exchange of information comes knowledge of the situations surrounding the dynamics of a supply relationship, and with that knowledge comes greater potential for detecting, averting, and managing supply risk' (Zsidisin and Smith, 2005, p. 51). The problem variables these authors identify and how to deal with them are the following:

- Excessive cost. Target costing for suppliers, select only suppliers with cost reduction programs in place.
- Legal liabilities. Determining intellectual property rights during initial agreements. Effecting sharing of expertise.
- Quality problems. Ensuring alignment between designs and capabilities early in the design cycle. And use scorecards to track current supplier performance for determining if they should be invited to participate in new ESI projects.

- Supplier capacity constrains. Ensure supplier production flexibility during pre-selection. Share future demand forecast information immediately with suppliers to improve the planning process.
- Extended product development times. Sharing development information, material and design changes and resources.
- Inability to handle product design changes. Working with suppliers early in the product development process. Having key ESI suppliers provide 'modules' to effectively manage product integration.
- Supply organisational issues. Providing clarity of supplier management structures. Obtaining knowledge of suppliers at both corporate and plant levels.

One interesting ongoing trend in the construction sector discussed by Rahman and Kumaraswamy (2002) is joint risk management. This means that certain risks may not be transferred to one of the contracting partners, but are instead shared. What would be the preferred risk allocation and to what extend risk sharing could be applied in public procurement are examples of interesting questions to pursue further.

While the literature shows a consensus that risk management pays off, the monetary benefit of risk management is hard to quantify. One example is Hewlett-Packard, which introduced a risk management system in their procurement activities in 2006. This paradigmatic change within the company included development of scenario-based measures to quantify uncertainties in demand, cost and availability. This risk management approach on procurement was also changing the ways contracts are managed and development of software in order to handle uncertainties related to demand and component cost. Since its introduction this system has rendered $425 million in savings for the company. (Nagali et al, 2008.).

Much of the literature drawn on in this Section comes from experiences in the private sector. It should be noted that although risk management is commonly used, also in the private sector purchasing professionals perceive that more could be done to mitigate risks within companies (Zsidisin, Panelli, Upton, 2000). Similarly, for the construction industry literature stress the need for 'a fundamental revamping of risk allocation and management principles…' and the need for 'well co-ordinated collective actions towards both innovative and continuous improvements' (Kumaraswamy et al, 2004, p. 323). It has also been argued that in spite of the importance of early risk management, the degree of activity is in practice low (Osipova, 2007). Concerning research on risks in supply chain management, Khan and Burnes state that research in the field 'appear to generate a lot of assumptions and even more speculative advice, but not to a great deal of actual research into how organisations are managing risks…'(Khan and Burns, 2007, p. 211). In other words, although learning from the private sector should be encouraged, one should

also be aware of the fact that, also in the private sector, risk management is a developing area.

2.5 A typology of risks in public procurement

2.5.1 Introduction and overview

In any procurement there is an element of risk, however the risks associated with procuring innovation are rarely explicitly incorporated to risk management practices in procurement. On the basis of the conceptualisation provided in the previous sections, we can understand risks in public procurement of innovation as any action or event relating to the process of planning, purchasing, implementation and management of goods, works or services which not only adversely impacts on the delivery of public services but also on the generation and diffusion of innovations. They can have different origins and affect different aspects during the procurement process or they can influence the innovation outcome.

Within the context of public procurement and the definition of risk as outlined above, we can now develop a typology of risks in public procurement of innovation. We do so in combining three dimensions, summarised in figure 2 below:

- The **procurement cycle**, as risks, risk perception and risk allocation change between the different stages of the procurement process (left column of figure 2 and table 2 below).
- In relation to the whether they influence the procurement process or the innovation outcomes. The former relate to the different stages of the whole procurement cycle and the latter are mainly linked to the **innovation cycle**, i.e. generation, application and diffusion of the innovation, which represents the final and most important risk (right column of figure 1 as well as table 2 below).
- In relation to the **sources** or type of phenomena potentially leading to or explaining the adverse effects on outcomes or processes. According to this characterisation, risks can be, broadly speaking, institutional (within the organisations that procure)/societal, market related, technology related, financial and other ('turbulence').

We stress the **procurement cycle** and the **innovation cycle** because the challenges in terms of risk management and consequences of risks differ considerably between the various stages, and decisions in one stage severely impact upon later stages.

Procurement is a process with various distinct but related phases. An analysis in terms of the public procurement cycle (see

Table 2 below) is useful both for practitioners (OGC 2003) but also as an analytical tool to make sense of the complex process, to break it down into several stages which show distinct but inter-related challenges and opportunities (Lewis 2003, Edler et al. 2006). Somewhat simplified, Bajari and Tadelis (2006) note that 'when considering the procurement of goods and services, the procurer faces many challenges. First, she has to choose what exactly should be procured, and how to transmit her needs to the potential suppliers. Second a contract must be laid out that includes contractual obligations and methods of compensation. Third, the procurer needs to decide how to award the procurement contract between the potential suppliers. Finally, the award mechanism should result in the selection of a qualified and desirable supplier and in the implementation and adoption of a cost-effective final product.' (Bajari and Tadelis, 2006: 122). Awarding criteria could be done on the basis of the lowest price or the most advantageous economic tender (MEAT). A complete project may also consist of several tenders, as the procurer may decide to break the contract into different lots (unbundling) i.e. leading to several procurement life cycles. For instance, sometimes a project is separated in different contracts for design and construction (design-bid-build), sometimes both design and construction is included in one contract (design-build) (e.g. Konchar and Sanvido, 1998).

It should be noted that the procurement cycle is a generic model. In practice, individual procurement projects may vary in detail that may also affect the risk profile for any given project. For instance, pre-commercial procurement may be associated with some risks that are less important to consider in 'conventional' public procurement of innovation and vice versa.

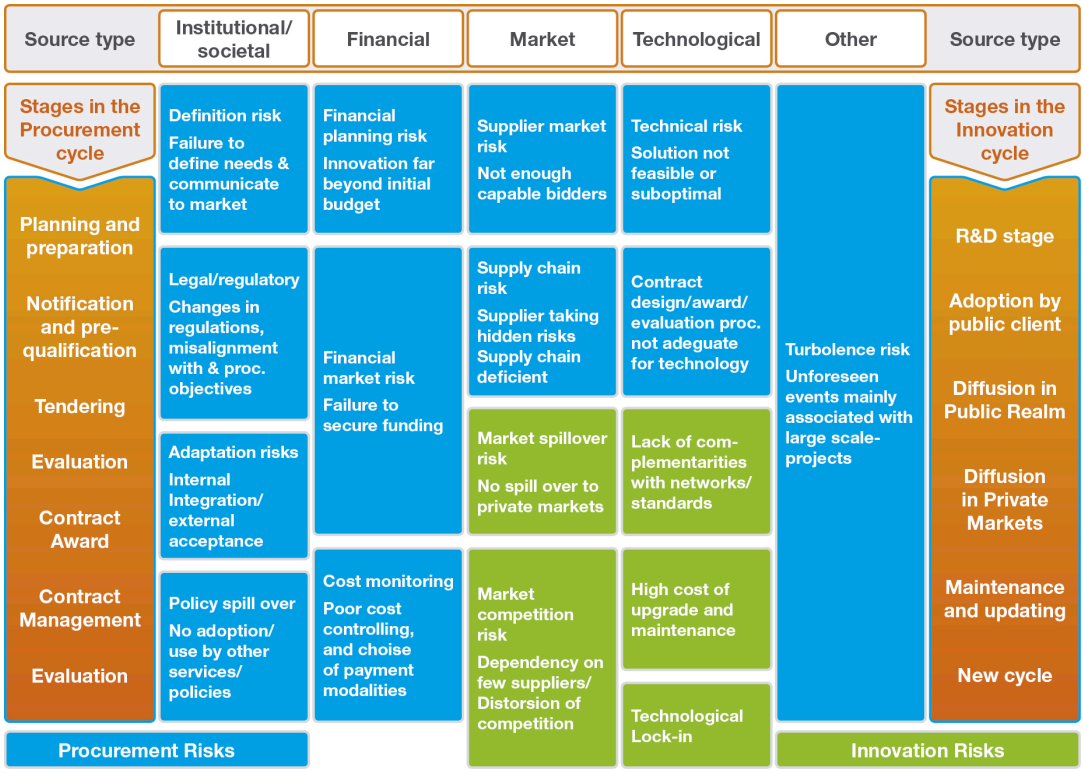
Table 2: Phases of the public procurement cycle (Lewis 2003)

Planning and preparation: Gearing up for procurement
Establishing need
Market consultation
Assembling the teams and partnerships needed to manage the process
Project definition
Selection of procurement procedure
Determination of contract award criteria
Notification and pre-qualification (if applied)
Initial advertisement and contract notice, inviting expressions of interest
Assessment of expressions of interest
Definition of shortlist
Tendering
Issue of tender invitations
Arranging for dealing with clarification requests from bidders
Receipt of tenders
Evaluation
Formal tender opening and checks for compliance with requirements
Tender evaluation of quality and price
Arranging tender presentations (if applied)
Negotiating with selected tenderers (if applied)
Selection of the most economically advantageous tender
Contract Award
Notification to successful tenderer
Notification to unsuccessful tenderers

Appeal process
Signing of contract
Contract Management
Monitoring that delivery meets specification
Evaluation (distinguish from tender evaluation above, this is the process evaluation, self evaluation)
Draw lessons that might improve future procurement projects

Ideally, risk is defined and managed as early as possible, but decisions in relation to risk are made during the entire procurement process, from defining the needs to its implementation and even market impact of the innovation occurring at the post-implementation phase. Further, one general rule that probably is applicable to most procurement projects is that potential risks in any phases of the procurement life cycle should be identified early or ahead of the actual execution of a procurement project (Zsidisin and Smith, 2005; Berlin and Leidstedt, 2004; Osipova, 2008). The various kinds of process risks (see section 2.5.2) potentially arising during the life of the project need to be borne in mind when planning the procurement, developing the contract and managing the project. Early decisions set the stage for certain risks to occur very late in the innovation and procurement cycle (e.g. lock in). This is of course perfectly in line with a general view that a procurer that is well prepared is more likely to be successful in procuring complex systems (Wade and Björkman, 2004). This means that one should go through the phases for the specific procurement life cycle envisaged for the project to be initiated and consider the risks associated with that particular set-up. It should be noted that as risks may also exist after the termination of the procurement project, also a life cycle perspective of the procured good should be assumed in the risk analysis. The concept of the **innovation cycle** is helpful to understand the breadth and the time dimension of risk and their consequences for the various actors involved. It disentangles various stages, from the innovation generation process through to the first adaptation and the broader diffusion.

. **Figure 2: The Risk Map in Public Procurement for Innovation**


Source type
Institutional/ societal
Financial
Market
Technological
Other
Source type
Stages in the Procurement cycle
Definition risk
Failure to define needs & communicate to market
Financial planning risk
Innovation far beyond initial budget
Supplier market risk
Not enough capable bidders
Technical risk
Solution not feasible or suboptimal
Stages in the Innovation cycle
Planning and preparation
Legal/regulatory
Changes in regulations, misalignment with & proc. objectives
Financial market risk
Failure to secure funding
Supply chain risk
Supplier taking hidden risks
Supply chain deficient
Contract design/award/ evaluation proc. not adeguate for technology
Turbolence risk
Unforeseen events mainly associated with large scale-projects
R&D stage
Notification and pre-qualification
Adoption by public client
Tendering
Diffusion in Public Realm
Evaluation
Adaptation risks
Internal Integration/ external acceptance
Market spillover risk
No spill over to private markets
Lack of com-plementarities with networks/ standards
Diffusion in Private Markets
Contract Award
Contract Management
Policy spill over
No adoption/ use by other services/ policies
Cost monitoring
Poor cost controlling, and choise of payment modalities
Market competition risk
Dependency on few suppliers/ Distorsion of competition
High cost of upgrade and maintenance
Maintenance and updating
Evaluation
Technological Lock-in
New cycle
Procurement Risks
Innovation Risks

Conceptually, we need to distinguish between **risks that *lead* to failure** to deliver, to poor delivery or to cost overruns on the one hand (**process risks**) and **the *actual failure* and reduced delivery in terms of the innovation goal on the other hand (innovation risks**). Thus whereas one mainly relates to the short and medium term up to the delivery and implementation of the procurement project, the other has a medium to longer term view in relation to the development and subsequent spillover effects of the particular innovation in the economy. It goes without saying that both types are closely related. **Innovation risks** occur in relation to the **generation, adaptation and diffusion of the innovation** that is procured. Innovations may, for all kinds of reasons triggered by the various process risks described below, never be delivered, suppliers or supply chains may simply fail to produce them. Even if innovations are delivered, they may be much too late, (leading to all kinds of spill over costs), too costly or have reduced functionality. For commissioning projects (PFI), whereby suppliers generate the innovation and operate it for profit for a certain agreed time period, this risk is extended. Not only the delivery of the innovation needs to be ensured, but its smooth and reliable operation over time. Further, the innovation may work in its first applications, but may not diffuse within the public sphere or even in the private market as envisaged. And finally, the innovation that has been purchased and applied may pre-determine a whole trajectory and decisions in a certain procurement process may thus bear negative effects for future innovation and application cycles. All those risks are cyclical and are stylised in figure 2, right column. The most important requirement to manage risk is to understand the different form of risks that *underlie* the Innovation risks (process risks).

2.5.2 Five major procurement risks

Against the background of the procurement cycle and the distinction between risks associated with the procurement process and those associated with the innovation outcome, this section defines and discusses the five different categories of risks. These are based on Miller/Lessard 2008 and Keizer and Halman and Song (2002), but largely extended through our own deliberations in the expert group and complemented with arguments from Zsidisin and Smith, 2005 and Cox/Chicksand/Ireland 2005. The discussion shows how those five risks are linked to process risks and innovation risk (see also figure 2).

2.5.2.1 Technological risks

Technological risks are all those risks that lead to a non-completion, under-performance or false performance of the procured service or product for reasons that lie in the technical

operation of the service or product or in its production, and thus originate with the supplier. Technological risks could arise from suppliers not being able to find the solutions as promised, choosing the wrong or a suboptimal technology (it does not work as expected or is not fit for purpose, does not match standards, or it is not good enough/obsolete), choosing a technology prematurely (we come back to this issue below), failing to acknowledge technological compatibilities or failure to develop the solution in-house or buy components and knowledge as claimed in the tender process. Further, once a certain technology is chosen out of several competing technologies it may be very hard to shift trajectories. This may create problems if the procurement takes place before competing technologies have been explored adequately. This risk should presumably be of particular relevance in procurement of products in the fluid phase, i.e. where there is no dominant design (Utterback, 1994, Currie 2005), where risks of lock in into the 'wrong' technology are highest.

Procurers would aim at incorporating means (contractual or otherwise) of preventing the risk of late, sub-standard and costly delivery or even non-delivery.7. As mentioned earlier, what is different from procuring off-the-shelf items is that, when procuring innovation at least some aspects of the procured item are uncertain or unknown. Procurement of innovation or of highly complex products therefore challenges the extent to which it is possible to write suitable contracts, as well as other key decisions alongside the procurement process directed at structuring incentives to reduce or eliminate risks. In the procurement of standardised goods and services, quality is easily measured and monitored in case of sub-standard performance against which penalties can be included, and competition will work efficiently in selecting the best bidders. However, in innovative projects the expected quality may not be verifiable, and thus performance against these quality targets cannot easily be reflected in the contract. Indeed, the R&D required for innovative projects is often difficult to measure and thus is not non-contractible (Albano et al, 2006).

In the case of radical innovation (for more details see below), a pre-commercial procurement stage may be necessary, including R&D services or design contests before the project bidding process. In order to reduce technological risk, transmitting information to suppliers at an early stage enables capacity planning on the part of the suppliers and plan their innovation investment to react to public sector needs. Besides involving the suppliers, particularly in catalytic procurement, involving potential users helps improve the

[7] Albano et al. refers to those risks as 'procurement risk', defining them as (2006) 'those events that may affect the realization of the contractual performance, and whose occurrence cannot be accurately predicted and influencing by contracting parties'. This definition is a simplification and limitation of the procurement risks as we define it here.

acceptability of the innovation in the market place and thus reduce market risks. Market testing and early supplier involvement is also important in order to learn the possibilities offered by the market and inform the drawing of the specifications

A further major issue here is that much of the remedies that one could suggest (see below) may conflict with existing regulations regarding communication with potential suppliers. This 'conflict' may not be real, but the uncertainty of how far one can go with pre contract interaction with potential suppliers add to the challenge. It is a basic principle of the public procurement directives to ascertain non-discrimination and equal treatment in the public procurement procedure, also before the formal initiation of the process, by means of notification. This will be considered in breach of these principles and illegal, because any advantages to one or some market actors before others, e.g. by improper influence on the specification.

Procurement contracting strategies and related decisions in innovative projects

One major means to manage technological risk is contract design, since different contractual modes offer different incentives for the contractor to deliver quality and not to run excessive costs. They are a form of risk sharing between the buyer and the contractor. For instance fixed price contracts may be appropriate for projects involving little complexity and uncertainty, or when changes to the contract are unlikely, but they may not be suitable to incentivise innovation, as cost-reduction incentives can induce the contractor to save on non-verifiable activities. By contrast, in cost reimbursement contracts, where the buyer agrees to reimburse all document production costs, the contractor has also no incentives to undertake cost-reducing activities. These type may be suitable when contract flexibility is important and when quality is not verifiable in the contract, for instance when innovation is encouraged. Finally, incentive contracts, used often in complex procurements in the construction industry and in the US defence industry, help allocate risk by providing financial incentives to limit cost and some insurance in case of cost overruns. It may also include bonuses if quality surpasses the minimal performance. The degree of cost or risk-sharing depends on several factors, such the ability of the contractor to bear the risk, the relative attitude to risk and the extent to which the risk are foreseeable and influenced.

In some instances, public bodies also aim to deal with risk by transferring it largely to the supplier by means of financial instruments Public Finance Initiatives (PFIs) which are common mechanisms for financing infrastructure projects, especially in the UK. Under PFI, the private sector designs, builds, finances and operates (DBFO) facilities based on 'output' specifications decided by public sector managers and their departments (Allen, 2001). Value for money in the use of public resources resulting from transferring risk to the

private sector is a key justification for the use of PFIs. Such projects therefore need to achieve a genuine transfer of risk to the private sector contractor to secure value for money (see also Coulson, 2008). However Froud (2003) criticises what she sees as 'technicist' risk transfer arguments, and a tendency to conflate measurable risk with unmeasurable uncertainty (in Boden and Cox, 2009). While risks shift, they still have to be managed, and the PFI necessitates a risk management that extends to the whole phase of providing the service (e.g. reliable use of the infrastructure) on behalf of the public body.

It is also well understood that award procedures and methods for screening bidders may be challenged when procuring innovation. In relation to whether to use a competitive tendering process or more restrictive procedure, open competition can be detrimental to innovation, and in this case restricting competition will provide incentives for qualified suppliers to invest in preparing the bids. Clearly, as discussed above, the degree of competition can have positive or detrimental effects on the level of competition and innovation in the medium and long term. Procedures can include a framework agreements or different modalities of multi-stage process, encouraging bidders to invest more in R&D before the competition stage. Framework agreements are common practice in the UK, whereby several suppliers are competitively selected in a first stage based on quality and price and then in a second stage only the selected ones compete on a regular basis for contracts (restricted competition). Thus a restricted procedure may be more effective in attracting innovative firms. The risk of the tender failing to attract and select good bidders will increase the risk of non-completion. Failing to select innovative suppliers would evidently hamper innovation In order to attract quality bidders, additional incentives may be given to participate, for instance through reimbursement of some of the bidding cost.

A number of options are generally used to screen and therefore avoid risky bids ('abnormally low offers), such as seeking third-party guarantees (such as surety bonds and letters of credits), and choosing 'less competitive' scoring rules (Cabral et al, 2006). However in the case of procurement highly innovative products, it is more difficult to assess risks, and these options may not be effective. A tender for highly innovative products is more likely to attract highly heterogeneous offers than would be the case in standardised products and services. The choice of scoring rules may also have a bias towards less innovative offers. Similarly, insurance schemes screening suppliers may prevent the most risky but innovative firms to participate (Cabral et al, 2006).

A carefully selected scoring mechanism will play a part in incentivising suppliers. By assigning a score to the various components of the proposal, and giving different weights towards the overall score (e.g. privileging quality features over cost) the procurer is able to adjust the incentives for suppliers, attract quality and reduce technological risks. In order to reduce risks, within contract competition can also be included, such as selecting more than one supplier (dual or multi-sourcing sourcing) or switching to lower-ranked offers

(source). Innovation and higher performance may be incentivised trough influencing the prospects of further contracting (e.g. attracting bidders based on past performance or customer satisfaction, or contract assurance through forward commitment procurement).

Finally, for technological risks, Zsidisin and Smith (2005) propose a range of measures around 'early supplier involvement' that may reduce uncertainties and help to ensure that suppliers keep on track. They advice to ensure alignment between designs and capabilities early in the design cycle, where feasible supported by scorecards to track current supplier performance for determining if they should be invited to participate in new ESI projects.. They also recommend to check for supplier capacity constrains trough measures such as sharing future demand developments with potential suppliers early on, providing in-house market intelligence to screen potential suppliers, and to consider second sourcing or at least a stand-by supplier, at least for the conventionally procured products.

2.5.2.2 Organisational and Societal risks

Organisational risks are all those risks of the procurement to fail or under-deliver for reasons situated within the organisation that procures, societal risks are those related to a lack of acceptance and uptake by the users of the new or changed service delivered within society.

A first set of both organisational and societal risks are related to acceptance, compatibility and absorptive capacity: New products and services applied by public administrations to deliver services to society may meet an unforeseen lack of social acceptance (within or outside the administration), lack of compatibility with existing products and institutional routines, lack of absorptive capacity (skills, awareness, readiness to take on switching costs) in administrations, unfavourable regulatory and institutional framework conditions or unforeseen changes thereof. Additional risks are related to short-termism in decision making within organisations (particularly the mismatch between short term budgetary frameworks and long-term benefits), and to misalignment of incentives, as mentioned in section 2.3.2. Measures to limit those risks may include marketing and awareness measures within the administration, some degree of explicit risk tolerance (i.e. acceptance of taking risks and fail – career opportunities), appropriate joint foresight with public lead users and a group of private lead users, transparent life-cycle cost-benefit models to overcome short-termism of budgetary frameworks and legislative cycles, early user involvement (reference groups, user associations or long-term contracting and framework contracts in order to create some form of trust and transparency without stifling innovation and flexibility.

Secondly, next to acceptance problems within public organisation, there is a set of governance challenges for public procurement processes within public organisations. Key

problems often are the lack of strategic thinking and planning, lack of horizontal and vertical coordination and thus lack of alignment between different policy goals (deliver service, societal goals, efficiency, etc.), lack of capacity to understand the market and communicate effectively with market players. Once an innovative solution is proposed, further problems may emerge regarding the organisation of the implementation process. Further, administrations may tend to change specifications too often or too promptly, leading to increased costs for the procurer and/or the supplier far beyond expectations in terms of subsequent market delivery.

To limit the likelihood for those risks to occur transparency of procurement goals for the various actors involved is needed, combined with suitable co-ordination mechanisms linking the three major dimension of service provision, procurement process and relation to market consequences (innovation). Capacities for strategic intelligence in-house need to be set up, both in terms of understanding markets, technologies and – often neglected – mid- and long term internal needs. And last but not least, as with technological risk, discourse with suppliers is needed in order to tailor the innovation to the needs and capabilities of the administration.

Related to these organisational risks, there are risks of the innovation not spilling over into other societal areas and public services. These risks emerge from deferments or non-delivery (for whatever reason) that go beyond the failure to deliver the specific service related to the procurement. There might be knock on effects if a certain innovation does not deliver a service as scheduled. Complementary investments (in technology, training etc.) may be lost, service chains disconnected, and thus (costly) remedies to be found in more than one area. This may lead to severe additional social and financial costs that have effects far beyond the realm of the procuring agency.

Some support to avoid the failure to create spill over across administrations would be provided through a broad ex ante analysis of which services are effected in case of a poor delivery of a service because of a failed procurement process, supplement strategies.

2.5.2.3 Market risks

Market risks are to be found on the supply and demand side. First, **Demand** risks are risks that are relevant especially – but not exclusively – for catalytic procurement or PPP (under concession), whereby the (private) demand does not respond in the scale necessary or expected or public markets remain fragmented. Markets are thus not large enough or built quickly enough to justify capacity investment (capital, labour, technology). Producers might fear to be caught in the market failure trap, i.e. to have invested heavily in R&D and innovation activities without the scale to get the necessary return. Even worse, they have used leading edge know how and applied it into the market, thus opening the door for

second best or second generation solutions of competitors that might hit a private demand. This is the classical risk of any innovator in the market. Especially at very early stages of a technology (pre-commercial stage), this is the usual market failure rationale, it does not compensate to invest in research and innovation, there is a strong disincentive. One means to overcome the problem of insufficient demand is to implement additional demand side measures, such as market awareness and user training schemes, as developed in the early stages of the Swedish market transformation models (see also Edler 2007, 2009 for examples here). Further, the public sector can reduce the risk of scattered demand for innovation through demand aggregation, bundling of public demand. Large or bundled procurement contracts are able to provide the prospect of a large and certain demand for firms, which enables them to recover the costs of investment in R&D and thus avoid market failure. However, aggregating procurement contracts can have detrimental impact on the market. It can prevent SMEs from participating in tendering processes, diminish competitive pressure on incumbent firms, allow incumbent advantages, force competitors to exit the market, reduce diversity of research paths and increase the distance between technology leaders and followers (Cabral et al, 2006). Several alternatives are possible to ensure participation in SMEs and prevent concentration, such as reserving a percentage of contracts to SMEs (this is the case of the US SBRI programme, which establishes at least 2.5% of contracts for SMEs), or to split supply into smaller lots (see the most recent Glover report, Glover et al. 2008) Smaller lots can also allow for 'package bidding'. In this case, a bidder can make offers conditional of being awarded a specific group of complementary contracts, as well as for a single contract (Dimitri et al, 2006). This potentially allows positive complementarities, higher economies of scale and incentives to innovate.

In terms of risks on the **supplier** side, one clear risk is suppliers not responding to the tenders at all, e.g. because the specifications are too daring (too risky for the suppliers) or too radical in their demands. Clearly, companies within supply chains are exposed to all procurement risks mentioned here downward along the supply chain. This is aggravated in complex, modular technologies with interdependent supply networks that add to the capabilities of the first tier supplier. This may lead to extra cost as the supply chain is more expensive than expected, delivers more slowly or has its own technological and completion risks. Even if public procurers disregard the problems down the supply chain and only deal with the first tier supplier, the problems will – one way or the other – emerge as a for the first tier supplier to manage. Measures to limit those supplier market risks would entail a broad market intelligence and in-depth technological knowledge through internal or external experts, paying attention to standards, regulation, as well as gathering intelligence on supply chains and their management (rather than relying on knowledge about the lead contractor, Zsidisin and Smith, 2005). Further, early supplier engagement, information provision on the part of the public sector and generally taking

suppliers' needs into account in their business planning (including IP issues) can also improve capacity planning of the suppliers' side (OGC, 2003).

There is one further element of potential dysfunctionality in public procurement for innovation, as it may, rather than contribute to innovation, constrain innovation and competition. Those dysfunctionalities increase the risks in-built in the procurement process, but they are in themselves deficiencies rather than risks. For example, establishing too restrictive functionality requirements (product, technical specifications) or too idiosyncratic demands would not allow innovation to arise and diffuse respectively. Procurement of an idiosyncratic innovation can lead to reduced competition, greater industrial concentration and vertical integration and a dependence on a reduced number of powerful suppliers. This, in consequence, may lead to excessive costing in future cycle of successor products or complementary products. To reduce the danger of innovation constraints and limitation in competition, one can deliberately increase competition through trying to mobilise a high number of bidders, increase transparency of procedures, relaxing entry barriers, lowering pre-qualification criteria, encouraging and enabling SME to participate and breaking up contracts in smaller lots. Further, efforts should be taken to avoid collusion as well as monopolistic capture by dominant incumbents, for instance the use of multiple-sourcing to encourage competitive pressure during contracts.

2.5.2.4 Financial risk

The financial risks in public procurement are mainly twofold, one related to uncertainty in meeting target costs, the other the ability to secure the funds needed in the first place.

In relation to the first one, there are clear financial risks associated with non-delivery (see technological risks in section 2.5.3.1), such as cost of additional auctions, non-completion, cost overruns and costs of non provision or poor provision of the public service as a result of non-delivery. In addition to general cost controlling, contingency plans, adequate payment modalities etc. Certain procurement practices, such as auctions and e-procurement and aggregation of demand (see above), may bring cost-saving advantages. Public bodies may also enter into target costing arrangements and select suppliers with cost reduction programmes in places (Zsidisn and Smith 2005). Further, risk management strategies themselves may need to be subject to cost-benefit analysis (the cost of risk management strategies may offset the benefits in terms of cost-savings).

There are also financial risks associated with the adequate functioning of financial markets, which may prevent the procurer and the producer from securing the financing of the project. The effect of procurement on R&D would be different depending on whether firms are financially constrained or not, namely whether they can easily raise capital from private investors or not. In industries that are severely financially constrained, R&D

investments may not respond positively to the incentive of higher profits (Cabral et al. 2006). The presence of financial imperfections may benefit existing innovative efforts by incumbents manufacturing the current version would be favoured rather than incentivising outsiders to develop a better version of the product or service (ibid.). In a situation of financially constrained sectors, the public sector could improve access to funding or increase the current clash flows of innovative firms.

2.5.2.5 Turbulence risk

Turbulence risks – in fact turbulence uncertainties as they are hard to predict and measure – are risks that are mainly associated with large scale-projects. Risks emerge from a range of unforeseen events that lead various actors in the whole process to re-assess their priorities, to change their expectations, which may lead to further dysfunctional reactions by other actors in the process and so forth. These risks may occur within organisations, but often are a result of the interplay of various actions and actors within the whole project.

Practices to manage those risks include a constant discourse and monitoring of actor behaviours, especially with complex, large scale projects, and when projects are dependent on complex political decisions and commitments. In addition, care must be taken to construct adequate contract clauses and insurance schemes to cover up for such occurrences as well as possible – since there will always be a residual turbulence risk.

2.5.3 The actor arena

So far, the complexity of the actor landscape in public procurement has been mentioned, but not discussed sufficiently. Three types of actors can be distinguished, public sector actors, suppliers and citizens / private costumers. There are **different incentive systems** and **risk perceptions** for the **various actors**, which have to do with different rationales and objectives of the procurement process depending on the institutional background of the actors. The perception of what is risk and how severe it is and who actually has to carry the burden of managing differs. It is important to understand the different kinds of risks for those actor groups.

To highlight the variety of roles and associated risks, a highly simplified categorisation of major actor types includes the following:

- High level policy maker in the relevant sectoral department(s), Officers responsible for the service provision and commissioning procurement: risk of failure to deliver new service, improved service, costs
- Innovation Policy makers: risk of beneficiary, economic spill over for other constituencies

- Specialised public procurer: risk of having to invest a more expensive solution with no rewards for better service
- Finance ministries, actors responsible for budgets: costs, failrure to appreciate benefits
- Internal, administrative end users: risk of failure to learn and adapt or to manage new interface with end beneficiaries, risk of being made redundant.

As for market actors, the **type of supplier** and **where they are placed in the supply chain** will also impact on the types, incidence and perception of risk. SMEs, large firms and the voluntary sector can be public sector suppliers, and each will experience different types and combination of risks.

Procurement is increasingly done in partnerships with other public and private sector organisations. Strategies for managing partnerships and complex supply chains are key here. Government has traditionally focused on the contracting process with first tier suppliers (OGC, 2006), thus overlooking the benefits supply chain management in terms of efficiency, innovation, improved access to contracts, early communication with public sector, etc. The supply chain is the 'combination of all parties (e.g. external suppliers, including their sub-suppliers, partner organisations, internal corporate services units) both inside and outside the organisation, involved in delivering the inputs, outputs or outcomes that will meet a specified public sector requirement'. The supply chain may be inbound into the public sector – an operational requirement for internal customers for example, or outbound from the public sector – in place to deliver wider organisational objectives to provide services for delivery to citizens, or a combination of both. The OGC (2006) further characterizes supply chains: these can be integrated, or characterised by arms length contractor-subcontractor relationships; they can be strategic or ad-hoc; they would differ from government sector to sector and from industry sector to sector.

Finally, as outlined above (societal risks) there are risks carried by the **end user**, the citizens to which a public service is delivered.

To understand and summarise the different kinds of risks for the three main actor groups, the innovation cycle model is again useful. Table 3 illustrates what **kinds of risks** are related to the **actor groups** for the various stages of the **innovation cycle**. It further indicates the various **sources** for those risks (in ***italics***)

Table 3: Illustration of risk and risk perception in public procurement: Consequences of failures along the innovation cycle and potential causes for failure (*in italics*) for the three main actor groups involved

Innovation risk along the innovation cycle	**Producer** **Supply chain**	**Public User, Policy makers***	**End beneficiary (the citizen**
R&D fails to deliver	No delivery, no revenue *over specification or false specification or false assumptions etc.*	Delay in service provision, additional time lag, costs *Poor contractor involvement, short-term focus*	No innovative product service
First adoption by public client failed or delayed	*Failure to communicate needs to client and to recognise lack of absorptive capacity*	No new, improved service, sunk costs. *Unexpected failure to adapt, internal resistance, switching costs too high , lack of complementarity a. leadership*	Disruption in service
Diffusion in Public Realm smaller or non existent	High or prohibitive adaptation costs *Preferences of other costumers not as uniform as expected*	Poor adoption *risk aversion, change aversion, competence gap, switching costs, lack of complementarity infrastructure, lack of leadership*	No innovative services related areas *Absorptive capacity acceptance of beneficiar insufficient*
Spill over in Private Markets does not realise as expected	Lack of revenues needed and expected *Failure to identify market opportunities.*	Policy goal (market creation, societal goal contribution) failed *Failure to anticipate private demand.*	Consequence: Society do not benefit from innovati Lack of sophisticat consumers, prohibit prices, or counterproduct standards.
Subsequent maintenance and updating costly and counter-productive (future lock in)	Burden of after sale maintenance exceeds expectations, higher costs for re-adjustment of users	Runaway costs due to poor life-cycle costing or commissioning conditions. Disruptions because of poor supply-chain	Discontinuation innovation, lack of upgrade innovation

	Calculations in bid too optimistic	management and lack of whole-life costing	
New cycle	Disadvantage for newcomers and poor future planning. *Poor signals as to long term needs due to lack of strategic prioritisation and assessment of needs or changes in policy priorities. Exacerbated through over-reliance on public contracts*.	Failure to adjust to policy *due to technological or organisational lock in*.	Re-adjustments and learni costs, poor satisfaction changing needs due to lock *Poor articulation of futu needs*

2.5.4 Some further differences of risks for different kinds of procurement and innovation

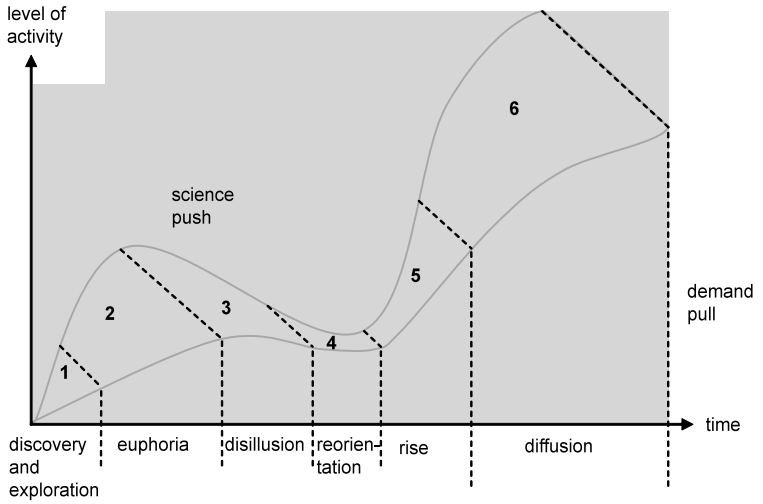
In the following, we differentiate risks according to a set of further important distinctions, which all impinge upon the various risks discussed above, namely the degree of innovativeness and the position in the technology cycle, the project character of the procurement, and the intended outreach to private markets (domestic, global). Further, the probability of occurrence and remedies for risk vary along the procurement cycle. These differentiations are crucial, as they set the scene for the nature of risk and their remedies.

2.5.5 Risk and the nature of innovation: radical, incremental, diffusion

The nature of all of the risks described so far is shaped by the nature of the innovation and the entry point of the procurement in the innovation cycle (Edler 2008). The innovation cycle describes the various levels and scope of activities before an innovation actually is diffused into the market. It shows that for many innovations there is a S-shaped curve, whereby an early euphoria about the potential of an innovation cools down and only after re-orientation is there s more constant diffusion path (figure 3, Dreher et al 2006, Bradke et al, 2007). The challenge for procurement, of course, is to understand where on this

innovation curve a certain product / technology is and what its potential is to actually reach the diffusion stage at all, as, for example, a direct procurement of a product in its 'fluid' phase may constitute a quite different risk profile than a catalytic procurement in the late stage of a product's life cycle (Hommen and Rolfstam, 2009). For the early phase of the cycle, innovations that look like being on the rise and ripe for the market, might in fact not be yet. Further, procurement practice and risk will be very different for innovations that are approaching the diffusion stage, as technological risks may be very minor, while market risks (esp. on the demand side, public and private) may become more important (e.g. projections of market size and speed of diffusion may be overly optimistic). Finally, however, we should be careful not to over-interpret the last stage of this cycle, which should not signal that a technology that is ripe and diffused might not show potential for disruptive new variants or new applications etc.

Figure 3: The innovation cycle: the entry point for procurement determines nature of risk



Source: Dreher et al 2006, Bradke et al. 2007

This cycle is of course linked to a more common differentiation of the innovation literature, the distinction between radical and incremental. A radical innovation is not yet in the market at all and is radically new to the users. It is either developed on demand or it is in the pipeline and might be taken up by the public procurer. In the first case, the procurement may lead to R&D activities and to a complex, timely process of change and development within the supplying company. The radical innovation means changes and

challenges in relation to technology, organisation, resources and the downstream and upstream market, with new internal and external networks and relations. Subsequently, uncertainties in all of the above risk dimensions rise. However, ideally so do the market opportunities and user benefits, which renders the whole process more risky and potentially more beneficial.

The consequences for the procurement process are severe, the stakes are higher for all parties involved. The risk of technological failure at all stages and of market failures on the supply side (downmarket, upmarket and supplier markets (monopoly)) are exceptionally high. Equally, a potential lack of complementarity, of institutional failures and of increasing financial demands remain high.

Thus, for radical innovations risk management becomes even more important for success. It necessitates credible signals form both sides (demand and supply) about the ability to absorb and finance (demand) and the ability to develop and deliver (supply). The procurer and user of the technology needs in-depth technological and market knowledge to assess the technological risk and assess potential market alternatives. Technology and market intelligence – to understand at which position the technology cycle the product is – becomes key for the procuring administration.

In the early stages of the technology (or in case of a radical innovation), technological explorations is key, the risks may be too high for a large procurement, so the procurer may decide to run a pilot or experimental stage first to test the benefits of the technology prior to large- scale procurement. Further, if public procurement is about the design, production and purchase of one big, complex project (Mega-Projects) then risk management in procurement equals project and risk management in mega-projects such as large, complex building, new ICT infrastructure, new road pricing system of new defence systems (Flyberg et al 2003, Millar/Lessard 2008).

In contrast, for incremental innovations uncertainties are much lower, and with it the demand for change and adaptations at all levels. Similarly, if a product is fully developed, and public procurement spurs the diffusion of a developed product, the technological risks are negligible (which might alter if scale increases quickly). However, the risk here stems exactly from the expectation of scale through diffusion and the risk of course is that public demand (the users in administration) and private demand do not materialise.

The potential remedies here are manifold. Public procurement may create critical mass as early? as possible to set in motion a virtuous circle of scale, price reduction and diffusion. Further, demonstration project, and all sorts of awareness, training, labelling measures (to reduce switching costs and uncertainty) are essential here to hold market risk at bay.

2.5.6 Risk in public procurement vs. catalytic procurement

The diffusion challenge just described is of course linked to the question of whether procurement is catalytic and therefore aims for creation of a large private market (co-operative procurement would be a combination of both public and private users). The risks associated with catalytic procurement stem from the uncertainty if the general demand comes in, responds quickly and broadly enough.

In procurement exclusively done for the public sector suppliers face potential institutional and societal risks as described above (see also demand risks above). Organisations may establish internal user and acceptance dialogues, training measures and the like, it may even define the functionalities together with the public users. In terms of the societal acceptance of the innovation early awareness and training (if needed) help to overcome switching cost barriers.

In catalytic procurement the remedies are the ones just described above (diffusion). Market conditions must be checked and if need be adjusted. This might mean, as in the first generation market transformation programme of Sweden (Neji 1999, Suvilehto/Överholm 1998) a sound market analysis, combined with a demand foresight if need be and subsequently a whole range of demand side measures such as awareness, marketing, training, (tax) subsidies, complementary regulations to put pressure on consumers etc. Further, consistent dialogue and openness, early warning mechanism and contingency plans (including clear legal arrangements in case of failure and clear IPR rules) need to be in place. As the reaction of other markets is entirely unclear, broader foresight processes are essential in cases of catalytic or cooperative procurement. Cooperative procurement would combine the benefits and risks of both abovementioned variants of procurement.

2.6 Conclusion

This chapter conceptualised risk in public procurement for innovation. This served a double purpose: first, it gives a common framework to discuss risk – as one of the key hindrance for public procurement of innovation. Second, it enables the analysis of the cases that is provided in the next chapter.

The literature review has shown that risk is a rather ill defined concept. For our purposes, we have defined risk as measureable uncertainty (likelihood) for something to happen that decreases the utility of an outcome of an activity or reduces the achievement of certain goals (of an organisation, a project etc.). However, for risk management in public procurement of innovation it is crucial to keep in mind that all risk comes along with reward, and for all actors involved it is the risk-reward ratio that has to be kept in mind.

The section has introduced different types of risks, namely technological risks (innovation does not materialise for technological reasons), market risks (insufficiencies on demand and supply side), financial risks, organisational risks (deficiencies within the procuring organisation) and societal risks (lack of acceptance of the innovative public service) and turbulence risk (unforeseen events). All those risks – which have been labelled process risks – potentially lead to failure of delivering the innovation as foreseen (i.e. not at all, with reduced functionality, to higher costs or with log delays).

Further, different kinds of actor groups involved (a range of public body actors, suppliers, citizens and private consumers) carry different kinds of risks and perceive risks differently. Risks also change over the course of the procurement cycle and are different for different kinds of innovations (radical, incremental) for different stages of their maturity.

Three basic functions of risk management can be distinguished:

First, in order to manage risk in public procurement, it is crucial to get a **holistic and differentiated picture of all those risk dimensions** very early on in the process: the types of risks, when they (potentially) occur and what they mean for which actors.

Secondly, on the basis of this identification, risk management is about the **definition of action** – again as early as possible – **to reduce the likelihood of the risk to occur** along the whole procurement cycle.

Third, risk management must design strategies to **mitigate the consequences of risks** once they occur and seek to **allocate** the **share of burden** for the various actors involved (the different risks to the actors better placed to deal with them) – again those measures and allocation must be agreed upon long before the risks may materialise.

The major condition to manage risk, however, is a change of attitude. Once a conscious process of risk management along those three basic functions is designed and implemented, risk in public procurement can be de-mystified, all actors involved can reduce their risk aversion and thus increase the inclination of procuring innovation. The following Chapters illustrate how risk in public procurement can be successfully managed.

3. Synthesising empirical evidence

3.1 A short description per case

A short overview of the characteristics of the cases is presented hereafter focusing on their innovative characters, actors and risks identified/managed.

The ***Journey Planner for Public Transportation*** (started in the year 2000) in the Helsinki Metropolitan Area was directly procured by the local government. Although only incremental and based on specification of similar services elsewhere the Planer combined existing features to create a new more advanced service. The product constitutes a better service. A variety of risks were associated with the product associated mainly with technology failure (a similar system failed in the past), potential lack of public acceptance (in particular because of privacy but the system was ran as an anonymous service, hence this risk could be avoided thanks to early risk identification) and potential cost overrun in the provision of maintenance, which did not occur. Throughout the planning and procurement information was gathered to minimize or at least identify and allocate risks. A three stage approach and consulting as well as research costs (approximately 25-30% of the investment) were used for risk identification and risk reduction respectively. This amount was not included in the project cost. The lessons learned from the project suggest that good planning helps mitigate risks and whole life-cycle cost considerations justify similar procurement cases.

The ***Environmental City District Hammarby Sjöstad in Stockholm*** (a total budget of 8,5 million Euros -or 75 MSEK - over the years 1998–2004) was an attempt by the local government of the City of Stockholm to test and implement a set of environmentally-friendly technologies (partly tested in exhibitions and small projects) by a number of different technical system suppliers developing domestic technology and infrastructure. The challenge and merit of the project lied in the large-scale attempt and the combination of known technologies, a holistic ideology with large ambitions. It was a catalytic public procurement. Buyers groups were created of representatives, both public and private (e.g., housing companies), and the LIP council aided procurements. Because of the large number of technologies applied the innovative elements ranged from simple technology transfer to radical innovations in the case of fuel cells. The project had a very strong political backing and standards were very high in all areas (Land use, transportation, building materials, energy, water, sewage and waste management). As the project was launched to upgrade the technology used in the buildings, the main risks identified by the city were the ones associated with technology failure (in particular because of the ambitious standards) and non-delivery. Social acceptance was thought not be a problem

because of the high sensitisation of Swedes, however in selected cases there were disinterested stakeholders. An example of (a non-anticipated) risk of this kind was the lack of suppliers for an environmentally friendly asphalt and asphalt-laying process. Implementation problems occurred because of an inadequate overall planning process, making implementation of some of the solutions difficult or in some cases impossible. This was partly a problem of the underlying legislation (the law was not very clear) but eventually this debate demonstrated the ability to include environmental impact as selection criteria. Through the project legislation, interpretation regarding regulating the field became clearer. In addition, strong political backing was helpful in handling all uncertainties and question marks. Operational risk was the highest problem, as the challenge was to assure low cost operations. Central government's Local Investment Program (LIP) together with the city of Stockholm took the financial risks. They funded 100% of the project management and expertise for the procurements. The total government subsidy for Stockholm LIP was about 21%. Consultants were hired for technical expertise. The entire project management was considered to be an exercise in risk management and the problems that emerged proved the need to apply market dialogue and assure involvement of all stakeholders wherever possible.

An ***Ethanol-Fuelled Pickup Truck*** in Stockholm (2006) procured by the local government (Stockholm Environment and Health Administration) of the City of Stockholm was a peculiar project, in the sense that it did not involve direct procurement but was a facilitation. The German VW was the counterpart of the City offering incremental innovations using ethanol (already used in cars) to trucks. A biogas Caddy was delivered eventually with reduced price but later than the target date. The City intervened for the implementation of a cooperative and catalytic public procurement aggregating demand and lowering the price per unit sold without however guaranteeing the supplier a pre-agreed volume of sales. Beside the incremental innovation the project would help increase the degree of utilisation of existing infrastructure (filling stations). The operational risks were not high, as the technology was proven in similar products, except in the case of the acceptance of standards and certification (no standards exist for the E85 cars. Institutional risks and societal risks were low with the exception of the reputation of the City Government. The highest risk was associated with the market, possibly not generating enough demand, especially for all types of ethanol-fuelled pickup trucks. The financial risks in this case would be considerable, as the development cost is sunk cost. Turbulence is often in this type of projects as they depend in the short term on oil prices and in the longer term on the selection of alternative optimal energy sources. The city of Stockholm had to bear the risk that the attempt to create the market failed; while the financial cost was not a problem loss in time and trust was an issue. SKL Kommentus AB agreed to take the financial risks for assuming responsibility for carrying out the procurement and entering into a contract with the selected supplier through a framework agreement, based on a fee from the suppliers as a percentage on the actual sales. Volkswagen agreed to take

the technological and also trust risks. Risk management was very thorough on feasibility study for market demand. The cost was 600 000 SEK for the city, including management of the project (survey, seminars, meetings with the car industry, etc.). While the project was an overall positive experienceconsidering the risks that have been realised, a stricter contract should have been prepared with compensation clauses regarding non-delivery.

The ***realisation of e-voting software in Estonia*** was a very interesting project (2004) procured by the Estonian National Electoral Committee (NEC), part of the national government and supplied by an Estonian SME in the form of a strict public procurement. The technical improvements were incremental but the social implications reflected a radical changes needing new legislation and a high political risks as the project could result in vote fraud and lead to the cancellation of the election. Technical risks were considerable, not because of the general software needs but in relation to security of the system. Non-delivery, under-performance and the selection of sub-optimal technology were additional technical risks. Societal risks were also considerable: the lack of public acceptance, absorptive capacity and perceived security risk might jeopardize the project and weaken democratic procedures. American experiences recommended avoiding similar systems. Financial risk was not really an issue. NEC carried the risk, using IT-experts and KPMG Baltics to review and monitor security sensitive aspects as a conscious ex ante risk identification and risk mitigation. The Estonian e-voting software was eventually a success, which relied on these principles: Involve interdisciplinary, high-level and dedicated specialists, guaranteeing in-depth technological and societal knowledge; achieve consistent dialogue and openness and demonstrating the need for strong preparatory works, mapping and handling of technological and legal risks. The case proves i.a. that SMEs are perfectly capable to successfully responding to technology procurement.

Passive houses in the Växjö Municipality in Sweden was another large-scale project integrating known environmental technologies in 2007 in the form of direct public procurement wit catalytic elements. The procurer was an agency owned by the municipality and supplier a consortium led by a leading large Nordic construction company. The first passive houses were built in Germany early 1990s and thus, the idea of passive houses was not in itself new; however the project was innovative in terms of size (eight floors) and the building material used (wood). The contract applied functional specifications, which in general gives room for supplier innovation. User innovation was also required in the sense that the 'users' of the new homes, the inhabitants, would have to adjust somewhat their behaviour in terms of ventilation habits as compared to living in conventional houses and get fire safety training. Different research activities funded by Swedish national agencies and the European Commission were involved in the project. Risks were of all kind: technological because of the use of wood for the first time in such a scale, a risk taken by the supplier; organisational and societal carried by the procurer both for potential institutional failures and the small risks of lack of societal acceptance;

financial risks were also carried by the public company although with some liability clauses (fines of 0.5% per week for delaying delivery without meeting the specification). Turbulence occurs because of the credit crunch income elasticity may render the rent unacceptably high. In general risks were identified early in the project. The supplier considered risk in the submitted budget. Additional risks were identified in the period of development meetings. The procurer carried the risks initially; the suppliers in the development phase, and once the project finished, the procurer again. After the contract had been signed, the procurer and the supplier had a series of meetings where different solutions were discussed. However, risk management was not explicit. The local political leadership was prepared to accept some financial losses if the homes would not attract tenants, as planned. The procurers acted on directives from the local political leadership. The risk and opportunity analysis was carried out by the supplier before submitting a bid and in the budget funds were allocated to cover unforeseeable cost related to the usage of wood (the innovative element) in the construction. A de-facto risk management dialogue between procurer and supplier took place in the period of the development meetings before the actual building phase started. Certain tensions were not avoided during the project but in general there seems to have been lot of interacting learning going on between the procurer, supplier and different experts attached to the project. Several experts were consulted to solve specific problems that emerged as the project continued. For instance, expert on energy efficiency was used to set up environmental criteria. An expert in measuring air tightness was consulted to figure out how to establish adequate air tightness. Thus, associating the required knowledge could be considered as risk management. The procurer tried to suggest as a part of the delivery, that the supplier should develop brand new technology for additional heating. This was a risk that the supplier did not accept. A speculative reflection could be that maybe, if some kind of innovation insurance existed, a radically new piece of technology could have come out of the project.

The ***Belgian eID Card*** was procurement carried out in 2000-2003 by the Ministry of Economic Affairs and supplied by a Belgian company. It can be seen as an integration type of innovation consisting of integration of existing technology and for the new eID application. However the chip on the eID card was the most innovative part of the eID innovation: it was a processor chip that makes use of the PKI-solution for the authentication and electronic signature function. The success of the innovation is due to its mandatory use for each Belgian citizen that guarantees the diffusion aspect of the innovation. While a direct public procurement, the project had cooperative characteristics because suppliers were stimulated to develop new applications for the private sector (e.g. entrance access to corporate buildings, HR applications). Technical (the infrastructure) and operational risks were taken care of by a sequence of an internal and external (CSC) pre-study, a prototyping phase, a pilot phase followed by full scale roll-out. Technical risks were dealt with through an appropriate preparation and exploration phase. The risk for

technical problems and late delivery were carried exclusively by the supplier of the eID card. The institutional risks, in the form of coordination, including the physical handling of the distribution to the citizens, were taken care of by the central government and no major problems are reported. Social risks were not anticipated and indeed there was no societal resistance, partly because most of the social resistance was already taken away by the introduction in the '98 of the SIS-card (Social Information System) that citizens need to get medicines and to get medical treatment in hospitals. Similarly there were no market risks for the card itself; however the derivative public applications are not picked up at the desired speed (tax-on-web and other applications). Supply risks were higher because the project is an integration type of project with on the one hand the eID card (that is integration as well) and on the other hand the electronic infrastructure and hence the supply chain has somewhat a vulnerable character. This was handled by splitting the project in distinct phases, including a pilot phase. There is no major financial risk for the government: the financial risk was mainly carried by the suppliers. The costs were known upfront and no external funding had to be secured by the government: payments are made on a monthly basis based on the number of eID cards issued. The biggest problem is most probably the risk for discontinuity (bankruptcy) of the supplier since the implementation process took about 6 years. Risk was explicitly discussed and reduced because for the tender preparation and assessment of the offers the Contracting Authority could rely on FEDICT as a supporting federal agency for ICT matters. The total cost for the preparation phase was estimated at 5-6 million Euros. In fact the whole preparation phase can be seen as risk management cost but neither risk-sharing nor incentives were foreseen: the tender document only contains penalty clauses in case of default for several supply situations. Political commitment (and visionary politicians or project champions) was a driving force for major projects and can have a positive effect on risk behaviour in the administration The project proved i.a. that a preparation/technology exploration phase can be very helpful to manage risk (pre-study, concept, prototype, pilot). The preparation cost compared to the value of the purchase is comparable to the R&D cost as a percentage of sales. Technical assessment capacity is a must when dealing with technology innovation in order to manage technology risk. Technical dialogue between supplier and contracting authority is necessary to be able to compare offers, clarify things and to let the suppliers know what the buyer exactly wants. Procurement procedures allowing negotiation seem to be most appropriate for the purchase of innovative goods or services.

The ***Biogas and Upgrading Plant*** (the Växtkraft Project) in Sweden starting in 2001-2002 was a direct procurement, which could also be considered as cooperative procurement, because the procurer is owned by several organisations. It also involved catalytic properties creating a market for organic waste and agricultural crop. The procurer was a multi-owner (users and suppliers) company and the main suppliers a German subsidiary of a Spanish firm and a Swedish subsidiary of a Finnish company. This was a demonstration

project of state-of-the-art technology. A similar plant had never been built before. Technology had to be developed after the contract had been signed. The complex character of this project suggests that the innovativeness comes somewhere between 'radical' and 'new combinations'. The project involves innovation defined as the creation of new markets. A market for supply of ley crop from local farmers was established. The project has rendered organisational adoption in the sense that a complete system for handling waste has been integrated with a production facility for bio-fuel. As a direct consequence of the procurement project, local public agencies could introduce vehicles that would run on bio-fuel, as the system would be able to provide enough volumes of supply of bio-fuel. Technical risks were related to the project integration and implementation; the acceptance and active cooperation of the various stakeholders (suppliers of waste and users of bio-fuel) were crucial because the success of the project depends on its operation not its construction only. Concerning sharing of risks between procurer and supplier the general principles applied through the project was that a certain risk is carried by the partner best suited to deal with the risk. This typically means that the supplier deals with the risks connected to his responsibility to deliver required functionality. The procurer should bear risks related to risks of political type such as tax changes, changes in legislation, new mandatory standards. In PBP (a Performance-Based Procurement), as the design is carried out by the supplier it is also the supplier that carries the operational risks connected to the design. As the design and the actual implementation is carried out by the same entity, conflicts between the supplier implementing a design versus the designer of the system that could happen in traditional contracts when something goes wrong, can be avoided. When the contract was signed much of the risk was carried by the supplier. Expressed in terms of knowledge, a supplier signing a contract based on PBP also takes the risk that the knowledge required to deliver the procured function may not exist at the time for the signature of the contract. This is typically a relevant problem in procurement projects leading to innovation, where all aspects of the procured function are not known at the time for the contract signature. Overall the risk was carried by the procurer as the supplier guarantees to deliver a certain function only. For the procurer, work with issues related to risk management was focused on the pre-procurement stage (i.e. the time before the contract has been signed). When the contract was signed the operative responsibility was carried by the supplier. If anything, the case proved that it is not always possible to determine in an absolute sense who is carrying risks in public procurement of innovation. Still, in terms of the project, given the contractual set-up and the payment model applied, it could be argued that the main risk was carried by the supplier(s). There was no formal organisation or person dedicated to risk management explicitly. There are however clear elements of a de-facto risk management structure in the project reflected in very careful and precise preparation and conditions that had to be met regarding the expected outcomes and anticipated cost, long-term agreements with local farmers for supply of ley crop, long-term agreements with local bus company for buying bio-fuel. Required legal documents, e.g. related to

environmental laws were in place. Document from the food industry were approved verifying that the fertilisers that would come out of the system could be used for food production. People who lived near the location for the planned system had been consulted. In the contract clauses were included defining fines that the supplier would pay should he fail to deliver. A very experienced public procurer acted as a consultant to the project. Suppliers followed existing legal framework for handling e.g. explosive gas and work environment. In that sense, institutionalised de-facto risk management was carried out. The lesson learned was that risk management may exist in a project although there might not be any formal structures put in place for that specific purpose. Many risks were identified and used before a go-ahead decision for the entire project was made. Risk distribution is affected by the contractual set-up. A lot of effort was invested in arranging meetings and establishing acceptance for the new system. Examples of categories involved in this interaction were procurers, farmers (as suppliers of ley crop), farmers (as customers of bio fertilisers), other public agencies, NGOs, people who lived nearby.

The integrated waste management contract with the Greater Manchester Waste Disposal Authority (GMWDA) was a procurement which started in 2005 and the contract was awarded in 2009. The procurer is GMWDA, the largest waste disposal authority in England and the supplier a consortia of two large UK companies in construction and waste management. The innovativeness of the project lies in the size and complexity of the integrated technical solution (architectural innovation) using mechanical and biological treatment (MBT) and anaerobic digestion for energy recovery by waste, plus the construction of an outlet for electricity generation from this fuel. Hence the type of innovation is incremental / architectural, based on combinations of existing proven technologies. The procurement, although strictly public tried to stimulate a new market and catch up technologically with more advanced countries in the EU. The size and complexity of the project entailed a variety of risks beside technology including demand for waste (because of the large time horizon for amortisation and the dependence on alternative energy resources' prices), and potential regulatory changes reflecting institutional risks. The number of actors called for close cooperation, the public participation in recycling and good leadership to assure implementation. The credit crunch was a turbulence that affected this risk further. A typical PFI would transfer risk to the contractor in respect to the design, construction, planning, operating facility, residual value of the facility, finance, performance, technology issues and the issue of obsolescence. In waste management projects there is more sharing of risk in 3 areas: planning, demand and regulatory change. On planning, once the proposal has been agreed, the contractor must try to secure planning and if they do that and then subsequently fail to get planning permission the risk reverses back to the public sector contractor. In this particular case planning risk was minimised by the nature of the project and extensive stakeholder consultation and engagement, leading to wide acceptance of the project, and the length of the procurement process, which meant that planning

permission was granted by the time the contract was closed. On demand, ranges are established of volume of waste in the tender documents, specifying the maximum and minimum throughput of waste it expects to be processed. Within those ranges the contractor is responsible for managing the variation from the norm, and outside of these parameters is a matter for the public sector. The GMWDA set up outcome specifications in terms of recycling performance and performance in terms of diversion of waste from landfill. The successful bidder was the one that was able to put forward a proposal to accept contractual risk on the achievements of substantial improvements in respect to these targets. On regulatory change the distinction is usually made between what can be and what cannot be foreseen. Generally a specific change in law which was not foreseeable is the risk of the authority, while a change in law which was foreseeable is the risk of the contractor. The recommended approach is that the parties should agree a specific list of foreseeable waste sector laws. These laws and the cost and implications of implementing them will vary depending on the solutions proposed by bidders, which needs to be borne in mind during the bid evaluation and due diligence process. A waste management procurement pack has been developed by the Public Private Partnerships programme (4Ps) to provide specific assistance to local authorities in England with the procurement of waste management projects through PFI. The lessons learned demonstrate a good experience and support in risk management and large costs in consulting fees to reduce risks ex ante.

The Slipper column, which is a street lighting replacement system started a decade ago, as a strictly public procurement by a local authority, was a new design for installing and maintaining street lighting in the broader area. The new design offered significant innovative features with benefits including operational savings per unit replaced, reduction of the number of visits to the site, speed of replacement (crucial for traffic safety, crime reduction and in emergency cases) minimal disruption for pedestrians and local residents
and last but not least environmental benefits, with reduction of waste going to landfill and CO_2 emissions. Because of the nature of the innovation technical risks were minimal and only associated with the design selection, financial risks were related to the diffusion rather than the implementation of the project there were no societal risks but the institutional risks, including the non-cooperation among different local authorities were higher. The perceptions of risk were different and risk was shared between the procurer and supplier. Risk management was obviously mandatory for the electrical maintenance, highways safety, health and safety as well as the design validation, but there was no explicit risk management related to innovation. Consultancy fees were paid to the University of Manchester to reduce technical risks but an explicit quantification of risk management could not be made. While this was a relatively simple innovation, further improvements and potential market creation has been prevented by lack of diffusion and coordination across local authorities. There seems to be in the current financial context a

renewed interest for the invention in councils that initially rejected the solution, due to its money-saving benefits.

GigaPort Next Generation Network Project (optical network) – Contract phase: April 2004 – end of 2010 was the only case of a clear radical innovation where SURFnet BV, a corporate entity with a not-for-profit mission (a subsidiary of the SURF organisation, in which all Dutch research institutes collaborate to implement their ICT facilities) procured through catalytic procurement a thoroughly new functionality and a new architecture. The procurer was Nortel. It is a hybrid and dynamic network, 'beyond internet'. The internet is based on cutting up information sending it to its destination through many routers. This may limit the volume of data traffic at a certain moment. Large data sending (e.g. 10gbit/second) isn't possible on the internet as it is implemented nowadays. SURFnet wanted an optical network with increased capacity, which would be able to carry traffic for internet and for direct point-to-point high capacity connections as well. SURFnet had already realised a first light path connection in 2002. Light-paths proved to be very reliable for high capacity point-to-point traffic. Therefore SURFnet wanted to launch a network in the Netherlands for scientific applications with sufficient capacity for relevant research facilities, which would be able to carry the growing internet-workload as well. Therefore the GigPort NG project was started in 2004. The project had to deliver a new type of network, SURFnet6, because additional to offering internet functions it would also allow high capacity point-to-point connections. This was the first 'hybrid' network in the world combining internet functionality with these point-to-point connections. This hybrid network architecture has now become the de facto standard for research networks worldwide. The Supplier had to take important operational risks including compliance, timing and maintenance. SURFnet itself accepted the risks of the operation and maintenance of the new network; the availability of Managed Dark Fiber and Collocation Facilities and the connections with other (national and international) networks. Institutional risks in terms of cooperation were shifted to SURFnet and societal risks (which were not negligible given the novelty of the technology) were mainly taken into account by the SURFnet stakeholders. An important financial risk was the ambiguity of the BSIK subsidy rules, which could jeopardise the project as a whole and did delay the project (3 months). All above mentioned risks might have a considerable financial impact, both for the supplier, for SURFnet, its shareholders and the other members of the GigaPort NG consortium. As a part of the investments are covered by a government subsidy, the government was also bearing a financial risk. The suppliers and in particular the consortium leader carried most of the risk. The risks were always very clearly perceived by the various actors. Risk management has been built in from the beginning and has been part of every step taken. Some of the team members have been explicitly asked beforehand to pay extra attention to risk matters and possible worst-case situations. Technical risks were reduced because the negotiation phase was done with four potential suppliers. It consisted of three rounds, each round the time available per bidder was three

hours. SURFnet made sure that bidders were not aware of their competitors. Three rounds were necessary to substantially improve the proposals. There has been a debriefing with each of the bidders. Because risk management was an integrated part of the procurement process its management costs cannot easily be separately determined. However those costs have been low in comparison with the risks covered. Risk management is an integral part of the whole process during every step and should be explicitly mentioned in all Phases and Steps. All members of the project team should be aware of potential risks, but it helps if some members of the team have an explicit extra duty to apply continuously a 'worst case view' on what might happen.

The SIR/GSM-R Case, planned from 1990 with project termination 2006 was ***the world's first GSM-R radio communication system for railroad traffic management and operative maintenance***. The procuring institution was the Swedish Rail Administration and the supplier a consortium including Siemens, Sagem and others. The procurement was strictly public but expanded later to private users. The project included incremental innovations and new combinations and resulted into increased security and efficiency/better time keeping and shorter and more frequent transportation. A variety of events (personnel changes, bankruptcies etc) occurred, which delayed the process. Operational risks included time to delivery (indeed some functionalities were delayed and software not fully developed according to plan), the institutional risks was higher than anticipated because some analyses were based on wrong assumptions, regarding coverage, technical capacity, etc. but there were no societal risks, neither any real market risks associated with the project itself. Financial risks, in particular in the form of cost overruns were possible and occurred indeed in selected cases. However, the total cost for the project was not exceeded, considering an index adjustment of approximately 4 %. Risks were present in all phases and often they occurred. Probably the buyer carried most of them (implicitly) since the consequences of delays etc postponed the efficient implementation. The supplier, however, also had a watching eye internationally on themselves, which could jeopardize their credibility. The contract was rather strong, putting high pressure on the supplier to deliver quality in time. However, since the specifications were not 100 % developed from start, there were loopholes, which lead to some extra development costs for the buyer. The ex ante agreements were not sufficiently detailed and quality level disagreements were settled in negotiations.

The Rio-Antirrio Bridge (discussed for decades and built within schedule once the contracts signed) was the first Greek PPP and addressed the construction of a bridge with major technical (seismic ground, unstable see bottom, deep water) and societal risks (reaction from the status quo). The Greek Government, at national level was a direct procurer (in PPP form) but the responsibility was with the Ministry of Public Works but a complex structure and many advisers were involved, mainly because of the risks associated with the construction. The construction was undertaken by the GEFYRA

consortium, led by a French company but composed of Greek, French and English companies in the construction sector. Part of the technical solutions were radically new, namely the way to reinforce the unstable sea bottom; there were adaptations of the basic design that was borrowed from off shore platforms but was never applied to bridges in the past; there was an organisational adaptation as it was the first Greek PPP without a legal framework underpinning it. Operational risks were high because the technical solutions were not known when the first discussions started. The supplier took the risk to undertake some of the necessary research before his selection; the public sector took the risk to perform excavations to increase knowledge of the composition of the bottom of the sea. The Ministry of Public Works and the consortium (which was nearly the same as the consortium eventually selected) carried the risks before the signature of the contracts. Non-completion risks after the signature of contracts were carried by the consortium of Banks that guaranteed the technically impeccable completion. To reduce the technical risk the procurer paid for exploration work before the launch of the tender. This is common practice to offer second and third bidders some kind of reward for investments in identifying and mitigating technical risks. Institutional risks were associated to the very big number of organisations involved, while societal risks were mixed because end users were very much in favour but competing interests from the ferry operators are reported to have delayed the process. Market risks were high relating to subsequent demand in overall, private market: the roads connecting the bridge are of bad quality and its full utilisation will emerge once these roads are completed. The financial risks were very high, both in terms of assuring finance (a large international bank consortium was involved) and in cost overruns (which were covered with a reserve facility by the financing consortium). Turbulence which could occur because of an incomplete legal framework in PPPs was totally carried by the government. A group of academic advisers to the government advised to accept this risk. The individual experts and consulting groups used in every phase of the project were high and many of them world class. Their cost can be assumed to be the incremental cost of concession being equal the risk management fee.

3.2 Looking at specific dimensions to characterise the cases

Although the case studies were not selected to be inclusive or representative we can make some general observations from their synthesis:

3.2.1 Sectoral and geographical breakdown

The ***sectors*** where procurement of innovation was more easily identified were ICT and environmental technologies; in terms of utilisation it is mainly the public administration, the transport and the energy sector using them. In PPP and PFI cases there is also often an element of innovation (often because of their large scale). One can of course not generalise but one may suggest that in these areas there may be more cases of interest for innovation procurement.

In terms of ***geographical concentration*** the Nordic countries, the UK and the Netherlands seemed to offer more cases than other countries where the Expert Group tried to identify cases. This, however, is only a remark based on the case studies and cannot suffice for a generalisation on the geographical concentration of innovation procurement in Europe, as it is based on a limited search.

3.2.2 The time dimension

In terms of ***time*** cases were implemented in the last two decades but many took almost a decade to mature and take off.

Table 2: Time between conception, implementation and delivery in the cases studied

Case	***Timing (pre, start, planned end, end)***
GigaPort Next Generation Network	2003, 2004, 2008 on time
Electronics identification card eID 2000-2003	2000, 2003, 09/2009
e-Voting (only national and local elections not referenda)	2002, 2004, 2005 on time
Journey Planner Helsinki Metropolitan Area	1996, 2000, 2001 on time
SIR/GSM-R (Sweden, Sven Eric)	1990, 1997, 2003, 2006
Ethanol-Fuelled Pickup Truck	mid 1990s, 2006, spring 2008, Nov 2009 (promised)
Biogas and Upgrading Plant (the Växtkraft Project)	1990, 2003 (contracts signed), 2005 (bio gas plant in operation)
Passive houses (without central heating)	2006, 2007, 2009, 1st house finished 1/07/09, 2nd 1/10/09
Manchester waste management	2005, 2009, 25-year duration
Street lighting case	1998 (approx.) – still on going
Environmental City District Hammarby Sjöstad	1998, 2012

Rio-Antirrio bridge	'70s, 1997, 2004 on time

It seems that one can observe a trade off between the innovative character of a product/service to be procured and the speed of the procurement implementation. By definition innovation is loaded with risks/uncertainty and risk reduction can only be addressed by increasing information; this takes time. The various techniques used (breaking down the procurement into more stages, engaging in dialogue, engaging experts and consultants) all request time and *the time elapsing for a typical procurement of innovation is ipso facto longer than in any corresponding standard procurement process.* Shortening the time is possible, if all information-gathering processes are foreseen and well designed from the beginning.

3.2.3 Procurement budget

In the cases studied the procurement budget ranged from 87000 Euros to 270 million Euros. Although the cases are not representative this broad range suggests that procurement of innovation is possible in all ranges of budgets and is not to be reserved for larger (or smaller) projects only.

Table 3: Budget of the cases studied

Case	***Budget (foreseen, ex post)***
GigaPort Next Generation Network	About €85m, initial fixed equipment budget of €15m
Electronics identification card eID 2000-2003	100 MMEUR, total costs for preparation phase about 5-6 MEUR (est.)
e-Voting (only national and local elections not referenda)	87 000 EUR (excl. VAT)
Journey Planner Helsinki Metropolitan Area	160 000 EUR - price of the product
SIR/GSM-R	835 000 000 SEK (ca EUR 90 million)
Ethanol-Fuelled Pickup Truck	332 MSEK (excl. VAT)
Biogas and Upgrading Plant (the Växtkraft Project)	170 million SEK (ca EUR 17 million) – total cost
Passive houses (without central heating)	108,318,000 SEK (ca EUR 11 million)
Manchester waste management	£3.8 billion (contract value), £640 million (total construction)
Street lighting case	Around £5 million in Tameside

Environmental City District Hammarby Sjöstad	634 MSEK for the national government subsidy program in Stockholm, 60 MSEK for public procurement for innovation
Rio-Antirrio bridge	270 M Euros

3.2.4 Actors involved

The procurers involved in the case studies were national and regional authorities as well as specialised agencies. There is no preferred pattern identified. This implies that again procurement of innovation should not be considered as a case to be followed by one type of procurer but can be designed and implemented by any type of public actor interested in procuring products and services that do not yet exist in the market. Like with size of budget there are no constraints or specific recommendations emerging from the case studies.

Table 4: Actors (procurers and suppliers) in the 12 case studies

Case	***Procurer (national, regional)***	***Supplier (nationality)***
GigaPort Next Generation Network	A users consortium, all major players in the Dutch research community	Consortium (NORTEL NETWORKS B.V., TELINDUS B.V. and AVICI SYSTEMS EUROPE B.V (tnc))
Electronics identification card eID 2000-2003	Ministry of Internal Affairs	Zetes NV (Belgian Company)
e-Voting (only national and local elections not referenda)	Estonian National Electoral Committee (NEC) (part of the national government)	Cybernetica AS (Estonian private R&D company)
Journey Planner Helsinki Metropolitan Area	Helsinki Metropolitan Area Council (YTV), local government	Dipec.com OY (currently part of Logica) (tnc)
SIR/GSM-R	Swedish Rail Administration	Siemens and others (Sagem for mobile phones) (tnc)
Ethanol-Fuelled Pickup Truck	Stockholm Environment /Health Administration, local government	Volkswagen AG (tnc)

Biogas and Upgrading Plant (the Växtkraft Project)	Svensk Växtkraft AB (national)	Ros Roca (Spain) with German branch, waste treatment, Swedish branch of YIT (Finland) YIT Vatten & Miljöteknik
Passive houses (without central heating)	Hyresbostäder i Växjö (owned by Växjö Municipality, Sweden)	NCC (Nordic construction/property development company) in collaboration with architects and sub-suppliers (Swedish)
Manchester waste management	Greater Manchester Waste Disposal Authority (national)	Consortium (Viridor Waste Management and John Laing Infrastructure) (English)
Street lighting case	Tameside Local Authority, Street lighting department	BW installations, production and installation of the columns
Environmental City District Hammarby Sjöstad	City of Stockholm, Various construction companies, Stockholm Water Company (city owned), Fortum energy company	Various technical system suppliers (domestic technology, infrastructure)
Rio-Antirrio bridge	National government, Ministry	Consortium (French and Greek)

Similarly the ***suppliers*** in the case studies varied. In bigger projects the project was implemented by consortia; many well-known multinational companies were among the suppliers; more often than not (but by far not exclusively) the supplier (or the consortium leader) were national companies or local subsidiaries of multinationals. But overall, again in the case of the suppliers, the case studies showed that both bigger companies and SMEs, national, foreign and multinational companies can win tenders for procurement of innovation.

3.2.5 The type of procurement

The type of procurement was more often a classic type of direct public procurement, whereby administrations buy for their own use. However, in many cases it proved to act as a catalyst for further technological developments beyond the original request. In the latter case, in several cases, the benefits were visible for the supplier's profitability, productivity

and in selected cases social achievements. In addition, three cases which started as pure public procurement triggered an expanding market.

Table 5: Type of procurement

Case	*Type of procurement (direct, public, catalytic etc)*
GigaPort Next Generation Network	Catalytic
Electronics identification card eID 2000-2003	Strictly public at the time of procurement , slowly became cooperative
e-Voting (only national and local elections not referenda)	Strictly public
Journey Planner Helsinki Metropolitan Area	Strictly public
SIR/GSM-R	Strictly public, expanded to other private user (PPP) and international follow-ups
Ethanol-Fuelled Pickup Truck	Cooperative and catalytic public procurement
Biogas and Upgrading Plant (the Växtkraft Project)	Cooperative, also direct / strictly public, also catalytic properties, Performance-Based Procurement (PBP)
Passive houses (without central heating)	Public, with catalytic elements
Manchester waste management	Strictly public with catalytic elements
Street lighting case	Strictly public
Environmental City District Hammarby Sjöstad	Catalytic public procurement
Rio-Antirrio bridge	Strictly public but operated as PPP

3.2.6 The tender and implementation procedure

The procedure used in the cases studied often went beyond the standard processes and used competitive dialogue and breaking down the procurement into stages. Sometimes there was a combination with *research subsidies* and the discussion for combining innovation procurement with *venture capital*. The interesting feature emerging from the case studies in that respect is that, since there is no standard procedure for the procurement of innovation, procurers and suppliers tried not only to reduce risks by better access to information, using the tools tolerated by the EU Directives, but occasionally found additional ways to reduce risks by combining the procurement with additional elements of public or private support.

Table 6: The tender procedure used and additional elements to reduce risks

Case	***Procedure used***
GigaPort Next Generation Network	Tender procedure in two phases: qualification (information and potential bidders' identification) and bidding (bids, negotiation and awarding); procurement in parallel with research
Electronics identification card eID 2000-2003	Negotiated procedure was used.
e-Voting (only national and local elections not referenda)	Normal tender procedure, with searches for technical solutions before the launch of the tender.
Journey Planner Helsinki Metropolitan Area	An initial attempt failed. A three stage competition was organised. Some funds were used for research.
SIR/GSM-R	1990-1997information gathering and specifications; tender documents to three potential suppliers following a pre-qualification procedure.
Ethanol-Fuelled Pickup Truck	The tender was complemented with a framework agreement for future deliveries.
Biogas and Upgrading Plant (the Växtkraft Project)	The procurement was carried out as a Performance-Based Procurement, an integrated process. The contractor finally chosen designs and builds the facility in the way he/she finds most efficient based on a functional specification
Passive houses (without central heating)	A pre-study was launched to gather information a year before the tender. A research project was running in parallel promising potential future diffusion.
Manchester waste management	A contract notice and prequalification questionnaire were used before launching the tender.
Street lighting case	Normal procurement procedure with a late diffusion after advertising.
Environmental City District Hammarby Sjöstad	Preparatory work was carried out and a buyers' group was created. 30 public procurements were carried out because of the size of the project.
Rio-Antirrio bridge	Initial exploration of the sea bottom paid by the government; PFI used without having the necessary legislative background

3.2.7 Type of innovation

In their large majority the case studies involved incremental or architectural innovation, sometimes resulting from design only. In some cases the innovative element emerged from the larger scale or higher complexity of already existing technologies: public procurement avoids applications, which have not been proved at commercial scale, even if the technology exists (in principle). Lack of prior demonstration and design functionality as well as the coordination of increased complexity were often the really innovative elements.

Only in one case was a purely radical innovation (in the sense that it may change the trajectory of the product/service provided) studied and in others there were elements of higher innovative content in an overall less risky project. Many projects, however, ended up with more innovative ideas than what was originally expected.

As we cannot generalise from the case studies there are no universal conclusions to draw regarding the propensity of European procurers to accept risks. The more radical innovations usually come from sectors which were not represented in the case studies, such as the defence and space sector. But what the case studies demonstrate and one can safely conclude is that the procurement of innovation makes sense for both radical and incremental innovations and that it is particularly suitable for larger scale, complex projects for which individual technologies may pre-exist but have not been used in this scale and/or combination in the past.

Table 7: Type of innovation procured

Case	***Type of innovation*** (radical, incremental, complex integration, design
GigaPort Next Generation Network	Radical, new combinations
Electronics identification card eID 2000-2003	integration type of innovation
e-Voting (only national and local elections not referenda)	Technical improvements: incremental, social implications: radical change/high risk
Journey Planner Helsinki Metropolitan Area	Incremental
SIR/GSM-R (Sweden, Sven Eric)	Incremental and new combinations
Ethanol-Fuelled Pickup Truck	Incremental
Biogas and Upgrading Plant (the Växtkraft Project)	Radical and new combinations
Passive houses (without central	Innovative in terms of size and the building material

heating)	used, new combinations of existing knowledge
Manchester waste management	Incremental/architectural, based on combinations of existing proven technologies
Street lighting case	New design of an existing product
Environmental City District Hammarby Sjöstad	Mostly incremental; some also radical
Rio-Antirrio bridge	Some technical solutions radically new, organisational adaptation

3.3 Risks, risk management and its cost in the 12 case studies

The case studies demonstrated that the risks encountered could be adequately described by the typology of risks included in Chapter 2 above.

Technological risks were present in all the projects, sometimes higher, others lower. It was, as expected, the case that the higher the degree of innovation the higher the technological risks. Fuel cells and the alternative internet architecture presented the highest risks. Security risks in the case of ICT are considerable, not because of technological immaturity but because of problems of potentially wrong technological choices. In some of the cases negative technical experiences in the past (in the same country or elsewhere) made the procurers more reluctant to risk and triggered a process of shifting risks to the supplier. Suppliers were willing to take responsibility for technological risks when the market was promising or they were confident for their technology. In the cases studies the technological risks were more often carried by the supplier, this risk being expressed either in the form of fines of non-delivery or late delivery or by simple shift of payments to the end of the contract. No technical inability to deliver was reported, there were however several delays or amendments. In some more explicitly dealt risks the procurer designed functionalities rather than products to be delivered. Some suppliers proved overoptimistic ex post. However there were cases where the procurer was willing to take risks because a political/project champion had a special interest attached to the innovative element of the project and the market prospects were still too remote (as in the case of the utilisation of wood for passive houses). But there the operational risks were at least taken by the supplier. When more than one procurer was involved (more often as partners in a joint venture) risk sharing was included in the contract creating the joint venture. As a conclusion from the case studies one can say that technological risks ranged from low to high; in four cases the suppliers explicitly agreed to carry the technological risks, in others the clauses were also pointing at the suppliers as risk carriers.

In terms of managing technological risks the case studies demonstrate a rather conventional approach: procurers try to reduce risk through early stage intelligence gathering (and pre-studies in some cases) and shift it as much as possible to the supplier through the request of guarantees or the payment modalities agreed. No specific contracts were used in the form of cost reimbursement or incentive contracts, as mentioned in the literature.

The difficulty for complying with standards and regulations (as in the case of the ethanol fuelled trucks) was a mixture of technical and ***organisational risk.*** Organisational risks were reported in many cases due to lack or volatility of standards (this was mainly in the case of environmental projects, where technologies are in a fluid status and oil prices change significantly) and there were also risks in social acceptance and compliance. Personal data was a specific case indicating that all services need to be anonymised to avoid such societal risks. Absorptive capacities seemed to play a less relevant role. The ICT and construction sectors were less influenced by this type of risks. Organisational risks increased considerably when the amortisation was foreseen in a longer term horizon (again in waste management). Procurers and public authorities were in most cases ready to carry the standards and legal risks in particular for the environmental and public administration applications, where the public gain was visible and commercial profitability less so. A particular organisational risk is one that derives from the interaction and coordination of many actors (SURFnet, waste management, bigger housing projects), where obligations were again tried to be resolved contractually. However, given the incomplete nature of contracts, this remains a major challenge for risk management. Early involvement and explicit discussions with stakeholders are an imperative for risk management; however only in certain case studies was this mentioned as an explicit practice. As a general remark one can state that organisational risks are reported, mainly in the form of legal and political risks; in most cases they were (often implicitly) carried by procurer/political personalities. In half of the cases were societal risks suggested (i.e. a risk that citizens would not accept the innovation); in the cases where they were important the risk could fully (citizens considered as buyers) or partially (citizens as users) jeopardize the project. In those cases, the political decision makers carried this risk.

Market risks occurred both from the demand (insufficient articulation of the need for and ability to adopt innovation) and supply side (lack of good bidders, supply chain insufficiencies), but appeared to be of lower concern when negotiating the procurement contract. To minimise *demand side risks* users were (when possible) consulted early and in certain cases they were in a position to indicate the solutions acceptable to them (as in the case of the Hammar district). The demand risk in the case of the ethanol-fuelled trucks was the determinant factor, which was apparently not sufficiently taken into consideration and jeopardised the project. Finally the effect of prices (elasticity of demand) and income are very relevant factors, which were affected by the credit crisis and there were not

anticipated. In the case of waste management the willingness of future users to cooperate was identified as a risk and was dealt with through awareness raising. Supply side risks were only seldom reported, supply chains operated and only in exceptional cases suppliers were not interested but this was partly due to market imperfections (as in the case of the asphalt cartel in Sweden). In short, market risks were partly demand and partly supply driven; demand seems to preoccupy the procurers, supply the contractors.

Financial risks were present everywhere but were also those easier to deal with because there is the highest experience with them. The banking sector providing loans has often suggested solutions for the financial risks. As a consequence they were easy to quantify and share. This was visible in the Public-Private Partnerships and Privately Financed Initiatives. Financial risks in the case of environmental projects were carried mainly by the public sector; in cases in which market prospects are good the supplier appears to be ready to carry the cost.

Finally ***turbulence risk*** were mostly associated with changes in technology sometimes also with regulation thus overlapping with organisational risks. Turbulence risks were only thought through in cases where similar experiences pre-existed; spill over risks almost never considered.

Risk management in most cases was reported as built-in ex ante by accessing additional information through an early involvement in information gathering, pre-procurement studies and expert involvement. Monitoring, awareness raising and training were also used in several cases although it seems that they were mostly ad hoc or ex post and not explicitly planned in connection with the procurement. Risk sharing was always present in the contract negotiation but not using explicit tools. No case reported a systematic overview of risks and how they should best be addressed but in all cases the risks were taken into consideration, even if in a cruder way than in a systematic conceptual approach. Nor was a risk facilitator identified in any case (although experts may have played this role implicitly in some cases). In short: the political will played a major role in the cases studied, the tools used for identifying and assessing risk were mostly conventional and *the cost of risk management can hardly be calculated. Nevertheless, although often implicit and not quantifiable in all cases interviewees reported that they had a very positive learning experience in risk management***.**

4. Learning from others

As the world progresses more and more towards open innovation models there is an increasing need to work in partnerships. Public procurement cannot be an exception. In

addition the credit crunch and world recession request new ways of addressing the economic woes. As pointed out in a recent Financial Times article by the CEO of IBM (Samuel Palmisano 2009) "governments need to shape stimulus investments that envision and enable a smarter future". This includes a neo-Keynesian approach, where public expenditure for infrastructure goes beyond the classic "digging holes and fill them up" and unlike the New Deal the New New Deal needs to address smart unproven solutions. In that sense technology procurement becomes not only an instrument that helps enhance innovation and competitiveness but an instrument to combat the credit crunch. However, while in economic theory and at the political this is well recognised, policy makers themselves still have to fight for its implementation: as smart procurement under the New New Deal requests more risk taking than digging holes or building roads so the risk management techniques will allow procurers to ally with economists and policy makers is a cornerstone of this new policy.

Procurers of public and hybrid nature, private companies and bankers were invited to present their views on procurement and risk management. They were asked to describe their processes and experiences in identifying, allocating and managing risks.

A very clear lesson drawn from these presentations was the very diverse risk perceptions by different actors. While innovation policy makers love risk (because this is the way innovation is enhanced) procurers are on the other extreme: they do not like it at all and if possible avoid it. Bankers are an interesting case from whom one can learn because they have a long experience in using explicit risk management tools. Bankers, just like procurers, do not like risk but because of the nature of their business they cannot avoid it; to manage it they use tools to identify it and distribute it by charging a premium. These tools constitute interesting examples for procurers to study and adapt to their own purposes. Companies who can either be suppliers or buyers of technology also need to manage risks in their own procurement process, in particular when they buy research services in the context of research cooperation. In this case their attitude very much depends on the expectations, prospects and negotiation power of both sides. Finally, recently development hybrid structures, created to intervene between procurers and suppliers and promote new approaches are the most interesting case as they develop tools to serve two masters.

In more detail:

Banks are characterised by a conservative profile (credit crunch origins excluded) but they sometimes finance their clients when they supply innovative products responding to public tenders. When a client applies for such a financial agreement the banks reduce risk through internal and external valuations; the valuation cost is carried by the bidder, who usually (second and third bidder) gets compensation from the State. Expert advice is crucial; best global experts are selected, who do not risk their credibility. Loans include a

"stand-by loan" for potential cost overruns (same or marginally higher interest rate). Insurance coverage is mandatory against all events (third party, deferred income). In general banks request as many guarantees of all kinds as they can get. However abnormal insurance is more likely to be covered by state responsibility otherwise the loan premium would make the cost prohibitive. Exchange rate fluctuations may also be covered by the state; since it is a matter of public policy (by the same token risks related to changes in the regulatory framework identified in the case studies would be justified to be covered by the State). The risk management costs is not assessed in detail, there is no tag to each project but a "go-stop scorecard", where risks are perceived and questions get binary responses (yes/no) are used to decide whether the bank is interested in a project or not.

The Dutch hybrid structure CROW, a specialised organisation in the construction sector, has i.a. a mandate to bridge the gap between procurers and innovation perceptions presented how to make practical knowledge directly applicable to technology procurement. Their emphasis was in the shift from the traditional concept of procurement to an integrated concept: the procurer sets performance requirements and gives and increasing freedom of choice of design and specifications to the contractor. But this brings additional methodological problems with it. The more innovative the procurement the more inhomogeneous are the tenders, hence the higher the difficulty to select. A new tool is needed in this case to measure quality against cost in order to homogenise the tenders. To do that procurers need to get training to adopt the notion of functionality and shift the risks where they see the rewards. This is a case, which seems to have very positive results in the Dutch construction sector.

The UK Technology Platforms are an instrument announced late 2005 by the Technology Strategy Board. The concept was to pull together policy, business, government procurement and research perspectives and resources to generate innovative solutions to these kinds of problems and make a real difference. The first two pilots focused on how to develop a more efficient transport system, and how to guarantee personal security in the new Internet age. Under the titles of Intelligent Transport Systems and Services and Network Security, they involve the Technology Strategy Board working with the Department for Transport and the Home Office respectively to address these two important underlying challenges facing modern society. More recently, the Technology Strategy Board has announced more Innovation Platforms - Low Carbon Vehicles, Assisted Living, Low Impact Buildings and Detection and Identification of Infectious Agents - each again addressing a specific societal challenge. By addressing these challenges now, and harnessing the innovative capabilities of UK businesses, it is believed not only to solve the

problems for the UK, but also give businesses based here a strong advantage in addressing these same challenges in the other countries - which would then be export markets[8].

As already pointed out in Chapter 2 the main focus of risk management in ***companies*** is to maintain and enhance profitability. For them procurement is part of this process and they procure innovation mainly in the form of contract research either in the framework of a larger, publicly-subsidised consortium or for internal purposes. For this reason companies are by definition liberated from certain risks, as they procure for their own account and do not depend on users or society as a whole (they do then for their own products but these are risks related to their own business and not the procurement itself). Their approach to risk focuses on the careful selection of suppliers, who should all be certified (ISO or otherwise, depending on the contract). Steering committees and project teams are used to closely monitor progress and there may be risk engineering inspections. Risk sharing then is also a matter of negotiation power in those fora, but the negotiation needs to be built on clear understanding of carrier, source of risk and distribution of benefits of the innovation.. Bigger private companies use standard contracts with the clauses to be respected from their research partners. Insurance is requested and clauses for delays can be very hard requesting full reimbursement. In addition IPR is a crucial issue in the risk-reward debate in the private sector, whereas it is almost excluded in the public sector, as the procurer is hardly interested to exploit new technology.

Risk sharing facilities are increasingly offered by public and private organisations. **The joint Risk Sharing Finance Facility (RSFF)** is a new type of instrument providing strong additional support to research, development and innovation. It is part of the EU's 7th Framework Programme for Research (FP7), and the EIB's Innovation 2010 Initiative. RSFF creates an additional capacity up to EUR 10 billion of higher risk financing in support of research, technological development, demonstration and innovation activities (RDI). RSFF is a joint instrument of the European Commission and the European Investment Bank, which prioritises sectors identified as key drivers of excellence in European research and innovation and present significant lead market potential for Europe (renewable energy technologies, biotechnology, engineering, manufacturing and automotive, information and communication technology projects, as well as European research infrastructures. The RSFF facility targets sharing part credit risk related to these operations. This will increase

[8] http://www.innovateuk.org/ourstrategy/innovationplatforms.ashx

the capacity of banks and other financial intermediaries to support research, development and innovation activities[9].

RSFF is an innovative financing mechanism to foster increased private investment in research by improving access to loan finance and offer risk-sharing between the Community and EIB to allow for a larger volume of risky lending to R&D and financing of riskier, but creditworthy projects. The facility is unique in its nature because it is a debt based instrument; it is neither a grant nor venture/equity capital. It addresses companies or projects mature enough to demonstrate capacity to repay and service debt on the basis of a credible business plan. Hence, unlike public procurement the RSFF finances not only companies but research organisations as well (for mature projects). It gives loans or guarantees either directly to the promoter of the project or to the commercial bank which is financing it (Krzyzanowska 2009). Like in public procurement cases the RSFF addresses both bigger and smaller projects, different types of innovation and all sizes of companies. In that sense it is an instrument that procurers can keep in mind as a risk sharing mechanism.

5. Conclusions and recommendations

This Chapter summarises the lessons learned from the concept paper, the case studies and the third parties. By putting them together we compare what is theoretically available with ways risks are perceived and managed practically. By doing this we draw some general conclusions for the processes and the management of innovation procurement, the risks involved and the way they are implicitly or explicitly addressed. Based on these conclusions we then recommend ways to better manage risks, expecting that this will facilitate the procurement of innovation and increase its volume.

[9] http://www.eib.org/about/press/2007/2007-095-risk-sharing-finance-facility--rsff-contributes-eur-359-million-to-research-and-innovation,-with-strong-focus-on-renewable-energy-technologies.htm

5.1 Conclusions for the management of risk in the procurement of technology

The literature review, the conceptualisation and the 12 case studies have helped deal with two preconceptions about the use of public procurement as instrument to promote innovation: the hurdles imposed by the Procurement Directives and the potential connection of the procurement of innovation with national protectionism. The cases show that it is possible to procure innovative products and services in compliance with the Directives and there are cases where foreign suppliers win the bids. Although this does not eliminate a potential preference for national companies it demonstrates that this is not always the case.

The first preconception, that the European Community Directives on Public Procurement[10] hamper real innovation to be developed through public procurement, can be severely qualified. Already in the Fraunhofer study (Edler et al., 2005) there is an extensive description how innovation procurement can take place in the current legal framework. The cases identified in this study simply confirm that procurers who wish to organise such a process are not only able to do it but they can use a variety of processes without infringing the directives. Although in some cases there may be need for clarifications or initiatives the current framework can be used for stimulating innovation procurement.

The second preconception, namely the concern that procurement of innovation would necessarily favour national suppliers, did not materialise in the studied cases. In the cases of the ethanol-fuelled trucks, the Växtkraft Project, the GigaPort Next generation and the Rio Bridge foreign companies and foreign subsidiaries were awarded procurement contracts. Obviously, the selection of cases does not suffice to demolish the protectionist argument and more often than not the suppliers are national companies. However, the cases do demonstrate that public bodies, once dedicated to procure innovation they may (and sometimes do) open up to foreign suppliers. Thus, one may even reverse the argument and claim that in contrast to standard products and services, the conscious demand for innovations in public procurement may occasionally facilitate cross border investments and solidify rather than fragment the Internal Market.

But there is still a long way to go and significant problems to overcome before a large European internal market for the procurement of innovation is created. As pointed out in the conceptual analysis the real challenge remains the change of mindsets and the adoption of a new culture. More than that, the cases suggest that risk taking and innovation seeking need to be embedded in the strategy of procurement and the culture

[10] Directives 2004/17/EC and 2004/18/EC of the European Parliament and of the Council

of the procurers. For that, the whole array of procurement procedures can and should be mobilised to bring in innovation. Depending on the type of innovation asked for, this can be done in the traditional procedure by formulating functional specifications and allowing variance and/or it can be supported by sophisticated procedures such as competitive dialogue. In all those different procedures, risk management remains a cornerstone and its future development and application is the most important element that may trigger a change in the future. Discussing the issues, suggesting management tools, disseminating good practices and addressing risk management are all part of a new approach, which, it is hoped, will eventually (even if gradually) lead to changing mindsets.

5.1.1 Conclusions for the procurement of innovation

Procurement of innovation has high social returns on investment; however, because it involves risks and uncertainties the volume of investment in innovation procurement is sub-optimal. But in selected sector and through the utilisation of the tools promoted by the amended Directives there is now visible progress.

Procurement of innovation is growing in Europe and, when successful, it is beneficial: Individual success stories, the creation of specialised agencies in some member states, the role of platforms and lead-used initiatives at national and European level as well as the cases reported suggest that there is increasing interest and practice in the topic. Targets are often met; by-products and spillovers leading to higher social return on investment than expected were observed. As to the latter point, in several cases, the benefits were visible for the supplier's profitability, productivity and in selected cases social achievements. In addition, three cases which started as pure public procurement triggered an expanding market.

Certain sectors and countries lead the way: The cases identified were in compliance with the literature, as they are mainly in areas with high diffusion potential, namely ICT and the energy-environment complex. It also seems that there are many cases known in the Nordic countries, the UK and the Netherlands. There is no systematic evidence for that but there is a strong feeling that in some countries there is a history of technology procurement (Nordic), in others recent policies are encouraging and facilitating it (UK, Netherlands, Germany), whereas in most member states procurement of innovation is an exception – or at least less visible.

There is no pre-defined set of conditions as the only ones, for which procurement of innovation is appropriate: Procurement of innovation is possible in all ranges of budgets, types of actors, projects and innovation. It is not exclusively used for larger, medium or smaller projects only; it can be designed and implemented by any type of public actor interested in procuring products and services that do not yet exist in the market. Suppliers

can also be of any size or nationality. In bigger projects the contractors are larger consortia; many well-known multinational companies were among them in the case studies; more often than not (but by far not exclusively) the supplier (or the consortium leader) were national companies or local subsidiaries of multinationals. Bigger companies and SMEs, national, foreign and multinational companies can win tenders for procurement of innovation. Finally all types of innovation can be addressed. At that stage the innovations in the procurement process are mainly incremental or the based on integrating complex projects. Demonstration and diffusion are important components of the innovation process. But this does not preclude procuring radical innovations as some examples demonstrate.

There are no pre-defined approaches of implementation. All types of procurement (direct, catalytic, cooperative) can be used and many accompanying support tools or incentives can be combined with procurement to increase the likelihood of success or to target higher spillovers. Many procedures and ways for intelligence gathering can be used: breaking down the procurement into more stages, engaging in dialogue, hiring experts and consultants

Procurement of innovation can prove very useful but it is neither a panacea for innovation policy nor an easy task for procurers. Despite growing evidence and potential to enhance competitiveness, procurement of innovation is still risky and not generally applicable. There are tradeoffs and they have to be respected and carefully weighted before a decision to go for it be taken. The various techniques used (intelligence gathering, breaking down the procurement into more stages, engaging in dialogue, hiring experts and consultants) all request time and funds. Lock-ins are possible. Hence a well-defined "go-stop" procedure helps to take the right decision. For these decisions experience matters. Learning occurs and once public officials get acquainted with procurement of innovation they are more willing to repeat it, as during the process they familiarise and learn to confront rather than avoid risk.

As the most important element for this "stop-go" decision is the appraisal of risk and the most appropriate way to deal with it the following section focuses on conclusions regarding risk management.

5.1.2 Conclusions on risk and risk management when procuring innovative products and services

By definition the generation and adoption of innovation entails risk, risk entails uncertainty and no matter how risk is dealt with, things 'can go wrong'. However, as risk can be managed this uncertainty should not deter innovation in public procurement. Risk can be identified, assessed and partly mitigated with appropriate tools and with inevitable costs

associated with it. The concepts used in this report, the cases selected and the presentations from other areas all converge to seven important conclusions related to risk dimensions and management:

Risk is a significant (but manageable) hurdle for the procurement of technology. Procurers are aware of risks and are, as a rule, risk averse. They have a lot to lose and little to gain, if things go wrong. So the initial way to face risk was through political commitment. Risk management may often exist but implicitly, without formal structure or using the name. Plus, as time goes by, more systematic ways to deal with risk emerge.

The case studies confirmed that the proposed typology of risks is appropriate: The typology suggested in the conceptual Chapter, namely technological, organisational, market, financial risk and turbulence, proved a good approach. Procurers and suppliers can respond to this jargon. Overall, actors tend to be more worried about technical and financial risks and they reduce the former by information and shifting them (to the extent possible) to suppliers, whereas they deal with financial risks through guarantees, insurance and adequate payment modalities. Societal, organisational and market risks were not so explicitly dealt with in the case studies in terms of ex ante allocation but awareness was at some point used to reduce them.

The basic functions of risk management, namely identify, reduce, mitigate and allocate risk make sense but are difficult to implement. The identification is actively pursued through studies, information and hiring of expertise. Initial information may point at the need for additional knowledge to further reduce risks. Mitigation of risk was less explicit in the cases studied, whereas allocation seemed to follow a pattern where technological and supply risks were carried mainly by the suppliers; societal, organisational and demand risks were (implicitly it seems) dealt with by the procurer. Of course neither is a rule: direct benefits for the procurer and profit expectations of the supplier may shift the allocation either side. As turbulence risks were not discussed in detail in the case studies we assume they they were (implicitly) carried by the political authorities. In other words, highly improbable events seem not to be insured.

There are many trade-offs when managing risks, which need to be carefully addressed. For instance too many actors may reduce risks but increase delays, too stringent functionalities may reduce the innovative potential of a project, while too broad ones may jeopardise its success; explicit and detailed risk management increases time and cost, the cost of no risk management may however be much higher; additional information reduces risk but increases cost, there is a moment where intelligence gathering needs to stop and action start. Because, while the literature shows a consensus that risk management pays off, the monetary benefit of risk management is hard to quantify or optimise and one cannot prescribe exactly when to stop.

Several tools exist and can help procurers in the pre-procurement phase. It seems that procurers manage risk mainly through political backing, pre-procurement intelligence gathering and an effort to shift technological risks to suppliers, without using sophisticated contracts, specific tools or carefully planned stakeholder involvement and awareness raising. They use the tools stipulated by the EU Directives and occasionally find additional ways to reduce risks by combining the procurement with additional elements of public or private support. But they deal with risk more implicitly than explicitly and the tools used are more generic than in explicit risk management in sectors experienced in practicing it (banking and insurance). However, a variety of tools do exist, in terms of specific contract conditions, technological foresight and awareness raising.

The major condition to manage risk is a change of attitude. Once a conscience process of risk management along the basic functions is designed and implemented, risk in public procurement can be de-mystified, all actors involved can reduce their risk aversion and thus increasing the inclination of procuring innovation.

The above conclusions suggest that there is still a long way to go to make procurement of innovation a generally used tool in the EU. Some recommendations on how to facilitate and speed up this process follow:

5.2 Recommendations on the way forward for risk management for public procurement of innovation

The ideas, organisations and tools found in the literature, developed in Chapter 2 or used in the case studies are presented hereafter according to the type of user to whom they are addressed: policy makers intervening on the broader organisational set up and the principle political decisions on investments and procurers wishing to better manage risks associated with their tenders. The recommendations are neither one-dimensional nor mandatory. They are presented as suggestions, sometimes as alternatives, including their strengths and weaknesses. They constitute ideas for policy makers and procurers to fathom, think through and select. Their character is not binding but is thought to facilitate the procurement of innovation.

Moreover, these recommendations need to be read with the deep understanding that the procurement of innovation is not costless, it needs investing in organisation, intelligence gathering, close monitoring and last but not least it is associated with opportunity costs occurring in delays for an appropriate design. However, if *appropriately* used innovation procurement may trigger adequate benefits, which more than amortise the additional investment needed. The word appropriately is important to avoid a situation where the pendulum would swing to the other side: not all procurements can or should be organised as innovation procurement. Much will remain a standard procurement. The challenge is to

correctly identify where innovation is necessary and feasible. This will mainly be where future provision of public services would not be possible without some innovation development (technological or otherwise) which would be unlikely to take place without a specific demand for it from procurement agencies.

5.2.1 Recommendations to policy makers

Recommendations to policy makers (both those responsible for research and innovation and those responsible for procurement) address the issue of better organisational set ups to encourage and facilitate the procurement of products and services not yet in the market and manage the associated risk. The recommendations are distinguished into those relevant at the member state level (operational) and the EU level (concerning the internal market and the benefit of pooling resources).

Recommendations to be implemented at the national level

1. A *change of attitude and organisational culture to* establish clear awareness and principles as to *the three functions of risk management* can be the starting point of all efforts: identification, reduction of likelihood of risks to occur and mitigation. Once a conscience process of risk management along those three basic functions is designed and implemented, risk in public procurement can be de-mystified, all actors involved can reduce their risk aversion and thus increase the inclination of procuring innovation

2. In more concrete terms *policy makers can create a structure, which will help the administration identify on time its future needs and the likelihood to cover them*. Two potential kinds of supporting structures can be distinguished.

    - One would be to support long term planning and exchange information about maturing technologies. This needs to be done in close interaction between the administration and companies using technology foresights and other forward looking studies or instruments. Attempts in this direction are tested in the UK innovation platforms, which also include public administrations and representatives of society. Innovation platforms, obviously, are no panacea and entail potential drawbacks such as technological lock-in. To avoid the drawbacks platforms need to be designed in a way to offer alternative solutions and *not reduce variety but reduce technology risks* through information, transparency and lowering resistance.

- Another kind of support would be targeted at the concrete procurement process, to support procurers and commissioning bodies throughout the procurement cycle. Most of existing cross-administration procurement agencies focus on efficiency rather than innovation. One example in the construction sector in the Netherlands (CROW) has demonstrated that specialised support for procuring of innovation does work. CROW's role ends there and there is no active involvement in training procurers, but they have the advantage that they can very easily expand beyond the national borders and offer systematic new knowledge emerging at the global rather than the national level. A specialised organisation - in contrast to a platform approach - has probably a more limited potential for advising on future needs and their feasibility but is able to combine the future needs with the next recommendation, namely coaching and training.

3. *Help procurers think in terms of functionality rather than product or service procurement.* Adopting the utilisation of "Performance-Based Procurement" contracts is one way to do so. This is a process that can be applied to standard as well as innovation procurement. Using sectoral associations, highly experienced in specific technologies, to draw functional requirements and mediate in procurement in the specific sectors is another. Additionally it can be done through coaching and training by a specialised organisation, which can work with the procurers on specific cases and/or can organise dedicated training for different procurers or parts of the public administration that are expressing their needs, even if not preparing the tender documents themselves.

4. On an ad hoc basis*, for countries where there is no experience with the procurement of innovation policy can launch a once*-off call for proposals for procurers who wish to experiment with the idea and offer subsidies for their first-time exposure. Since the conclusion of this report is that learning matters and experience demystifies risk management one can hope for spill over effects.

Recommendations to be implemented at EU level

5. The EU already plays an important role in the gathering of information and the *systematic collection* and *dissemination of good practices,* precisely where thinking and practice up to know is hampered by the pre-conceptions discussed above. This may be further strengthened. One thing that the cases proved is that "*learning matters*", as interviewees confirmed that the experience was helpful to allow them to design similar future activities. Support for first time launches

(accumulation of experience) is recommended to be offered at the national level. *Learning from other procurers* is the next best alternative and can be organised at a higher level. While until now it was in the context of individual studies that cases were identified and studied the situation is maturing for a permanent portal (wiki-type) reporting innovation procurement and the way risks were dealt with. Using existing networks of procurers can help this exercise become more inclusive and ambitious, but all this must be done on a grand scale, visible and meaningful, and not confined to an avant-garde community which is already well on its way to procure innovation. .

6. Another area of intervention for the EU could be *the collection of information beyond the European territory* to help learning from other countries. It is often assumed that parts of the US administration (defence, health) have been the pioneers and most effective innovation procurers. Learning more about them, but possibly also countries like Canada, Brazil and beyond, or initiating a discussion for global experience gathering in the context of the OECD could complement the dissemination function mentioned above.

7. The dissemination activities can take a concrete form in the *production of a Guidebook for risk management*, which can be used for general training and decision support purposes. The guidebook would ideally include a toolbox with dimensions and examples when to use procurement of innovation (as opposed to standard procurement or different types of subsidy?), how to structure the bid and most importantly which tools are more appropriate for risk management depending on the type of innovation, size, functionality etc. Making risk management explicit at such a level of detail will also serve the demystification purpose.

8. The innovation and risk dimensions across Commission Services dealing with R&D&I can be *proactively coordinated* with the target to increase the role of the procurement of innovation in enterprise, environment, energy and regional policies.

    - Intervention for networking: An important step in this direction is undertaken by the Lead Market Initiative. Existing procurers' networks at European level are at the moment hardly concerned with the idea of procuring innovation. Support to sensitise such networks and train their members in the topic and in particular on how to address risk management is an area to consider. The OECD Sigma may be an appropriate channel for the new member states.

- Intervention to link R&D support with procurement. In the context of the OMC or ERAnet one can investigate ways to link innovation procurement to research subsidies. Special horizontal calls for instance can be launched to complement at national level agencies procuring solutions to common problems thereby facilitating emergence of standards. The idea is to support research needed to either complete or extend contracts already granted.

- The Commission could consider incorporating instructions for the adoption of innovation procurement policies in connection with the Structural Funds' encouragement to promote research and innovation. This could take the form of specific organisational set ups (platforms or hybrid structures), direct cooperation with research policies and risk management practices for dissemination and adaptation.

9. Finally, the national supporting structures would benefit from support for networking at various levels. This can include better linking procurer networks/platform and tech platforms, but also the creation of a European network of procurers of innovation (based on their experience and not any kind of formal criteria).

5.2.2 Facilitate risk management for procurers

For innovation procurement there are ways to better identify and assess associated risks: information, analyses, expert advice, strategic intelligence, dialogue, decomposition into more stages, (more) complete contracts including complex clauses, ex ante IP management, supply management. When risks are identified, the likelihood of their occurrence can be reduced, mitigated and shared; their management can be integrated into the whole procurement process.

There are some general principles which help procurers:

- *Risk has to be managed as explicitly and as professionally as possible* keeping in mind that it can never be eliminated entirely.

- The principle that a certain amount of *additional cost* needs to be earmarked for intelligence gathering and progress monitoring. The precise cost of risk management is difficult to quantify and allocate but it is self-evident that it is there. Access to more information, expertise, time delays (as opportunity cost) and insurance are the most obvious costs but it is not possible to distinguish

them exactly from standard procedure intelligence gathering and insurance and hence to allocate it to the innovation process.

- Acceptance of *certain delays* in the whole process of procuring future oriented products and services, compared to the decision to buy off-the-self. In all the cases a delay in the tender and more often than not a delay in the delivery were identified. However, the outcome often pays off, and the delays tend to shorten with increasing routine of risk management practices.

- The principle to *link risks to reward rather than to capabilities* (risks better be carried by those more likely to benefit or cause the appearance of a problem, rather than by those who have the capability to carry it) provided that this will not create excessive costs.

Some recommendations follow on how to manage risks, broken down by the categories used in the conceptual framework: identification, reduction, mitigation and sharing of risks. Unlike the generic principles, which are universally valid, the recommendations are not about formalising or suggesting strait jackets. Neither are they trying to substitute trust with formalised contracts and increases in transaction costs, taking into consideration that such an approach may also aggravate principal-agent problems. On the contrary they are ideas to be used for a case-by-case risk management design with a good-enough (not optimal) mix of legal obligations and informal but effective cooperation routines.

Identify and deal with risks

10. As early as possible in the decision making process the various types of risks *have to be identified ex ante* as far as possible- albeit we need to stress that even the most thorough attempt will not ensure a full coverage of all potential risk, and uncertainties will remain. It is important to think of risks all along the innovation cycle and procurement cycle, understand the stages and spot when and which risks are more likely to occur. While the conceptual issues in Chapter 2 identify five different categories of risks and interviews point out that in many cases all these risks were possible, analyses of the case study processes suggest that during the negotiation it was mainly technical and financial risks, which were made explicit and shifted to suppliers via insurance, fines for time overruns or payment schedules. But while risk is defined and managed as early as possible, decisions in relation to risk are made during the entire procurement process.

11. For radical innovations or in cases where in-house expertise is not sufficient, the identification of *technical risks* before the launch of the bid can be facilitated by internationally recognised experts trusted by the state (e.g. academics in the

corresponding fields) and independent consultants. At the implementation stage experts can take the role of technical advisers monitoring progress. The more they have a good reputation the more likely it is they would not jeopardise it and (inevitably) the higher their cost.

12. *Organisational and societal risks,* i.e. the risk of insufficient expression of needs or insufficient adoption of the innovation within the organisation or within society (to which the innovation in public service is finally geared), are best identified with early discussions with all stakeholders. The emphasis is on "all", because even when dialogues are organised they tend to limit their scope. Stakeholders are various members of the administration, not only the direct beneficiary, groups of users (as in the case of cooperatives for waste management) or individuals (as in the case of the EID card and eVoting). A dialogue going well beyond information gathering is necessary to see to what extent stakeholders adopt the idea and are ready to invest (physically or mentally) in its implementation.

13. *Market risks* on the demand side (spill over to private demand for innovation) and the supply side (supply chain issues) are loaded with more uncertainty. Therefore, it is better for them to be treated with a dialogue process with selected groups in the supply chain and potential users of new applications. It is important to gain knowledge about potential bottlenecks or incompetence in the supply chain early on. By the same token procurers have to identify lead users or representatives of potential users and find out whether they will be willing to buy/use the product/service, when available and under which conditions.

14. *Financial risks* are easier to identify but not so easy to quantify. Internal cost calculation, review panels and scoring mechanisms can be used to create an overview of financial needs and worst case scenario. If loans are needed for the completion of the supply the parties could insist to look at the calculations of the bankers and insurers involved in the loan. Additional calculations need to be done for potential increases in the cost of money and cost overruns.

15. Finally *turbulence risks* need to be identified using discoursive and brainstorming techniques. As stressed throughout this report, turbulence risks by nature are least predictable and thus a broad and all inclusive brainstorming exercise seems most appropriate, so that different parties involved understand potential dangers of others and how those might effect their own contributions. As far as possible the potential consequences of those risks need to be assessed with neutral experts, suppliers and policy makers. In cases in which turbulence is associated with changing regulatory and economic policies (as all ICT and environmental technologies pointed out in the case studies) it is important to stage discussions with sectoral ministries and agencies, often totally detached from the bid at its

initial stage. Thinking of who might be a stakeholder is a challenge and it will be beneficial to involve as many stakeholders as necessary (better too many than too few).

16. The identification and assessment of the various types of risks and the differentiation for the various stakeholders involved will then eventually lead to the decision whether to proceed with innovation procurement or not. "*Go-stop" scorecards* constitute a good tool for this decision.

The "go-stop" will however be affected by the possibility to reduce, mitigate or share initially identified risks. The next three categories of recommendations address these aspects:

Reduce the likelihood of a risk to occur

17. Technical risks, especially with radical innovations designed for a long term application, can be reduced by combining the long term procurement process *with research grants, so that a potential supplier shares the risk with a public funding organisation in coordination with the procuring body.* Market risks (triggered by the supply chain) may be reduced if *combined with venture capital* investing in new-technology-based firms participating in public bids.

18. Lock-in risks can be reduced by using getting technical information from different sources, so that interoperability is possible at a later stage. If the *second and third bidder get compensation* for their costs for improving or proving the technical dimensions of their bid the technological information increases and lock-ins can be better judged.

19. Information increases and uncertainty diminishes as time passes. So it is good to split the process if high risks are identified. *Disentangling* the first stage from the rest of the procurement cycle is expected to reduce risks. With better knowledge, which can only be gained after the first stage (e.g. prototype creation) one takes informed decisions and diminishes risks. Breaking up the process in two separate contracts helps looking at the necessary information each time and better manage time and cost. However, to make the process attractive to suppliers it needs some form of continuity (like the US SBIR programme, where a second phase follows automatically if the first is successfully completed and the conditions for the second are met). Only then will suppliers see that they have a potential to address a larger, profitable market.

20. The disentangling is particularly important *in the case of radical innovation, where a pre-commercial procurement stage may be necessary*, including R&D services or design contests before the project bidding process.

21. If during the risk identification process societal risks appear too high it is important to mobilise the stakeholders on who the project depends and if necessary and feasible *sign binding contracts with potential private lead users to guarantee an early adoption of a first batch of innovations*. They can have the benefit of price reductions as early adopters facilitating the go-stop decision (this could be the case for the first rents in the passive houses, if tenants would be ready to sign a contract before the houses were completed).

22. Market risks coming from insufficient private demand can be reduced, if the public procurer joins forces at national or international level to help attract new clients to the new market (thereby enlarging the public market and increasing the likelihood of the private market to follow). Alternatively it is possible to help the supplier (through research or other grants) to benefit from technological spillovers. This is then not catalytic procurement but a simple effort to offer more prospective rewards to the supplier, who would in turn be willing to accept more risks.

23. A similar approach can be used for projects where the procurer has multiple shareholders (as in the case of the GigaPort) or the expected early adopters (as in the case of the Manchester waste treatment). It helps if c*ontractual obligations* are explicit or very close monitoring if contracts are incomplete, due to the uncertainty associated with the innovation.

24. If diverse offers are brought to common denominators by attributing weightings to functions this can clarify the cost-benefit ratio of different components of the offer and help procurers select suppliers who present less risks in the functions of major interest. Training procurers to work with *functionalities* rather than product specifications and organise the evaluation of bids in this way can help the dissemination of the particular attitude.

25. *Sensitisation, awareness raising and education* for society as a whole can also help to eliminate resistance and reduce societal risks.

26. *Explicit risk analysis* is more important for mega-projects. Worse-case scenario can be part of the exercise. It would also be beneficial, if the analysis included alternative ways of funding to facilitate selection and reduce financial risks.

Mitigate against the consequences of an unwanted event (if it occurs)

27. If risk is well identified then *a Roadmap, a "Risk Mitigation Strategy*" can be adopted by consensus at an early stage, based on the feed-back from experts and stakeholder dialogue. The strategy needs to include slack (redundancies) for service provision if things go wrong and take into account the risk – reward allocation (see below).

28. The provision of *stand-by loans* already at the initial financial agreements with suppliers or banks in a reasonable share of the budget and a reasonable (the same or slightly higher) interest rates help eliminate cost-overrun risks. The mobilisation of bank consortia through syndication can diminish the cost and risk of lack of funding.

29. Trusted committees, composed of experts in different disciplines (technical, financial, social) and from different stakeholder groups can be used for *monitoring and early warning* to at least give procurers/suppliers the possibility to intervene as early as possible when problems start occurring. Toll gates to understand how the contract evolves can be introduced for better monitoring.

30. Finally *insurance* is the most effective way of mitigating financial risks and can be abundantly used. However, one needs to keep in mind that in some cases insurers may refuse to insure too uncertain projects or the insurance becomes too costly.

Allocating and sharing risks

So far the recommendations have been neutral as to the allocation of costs, efforts and consequences associated with risk management and occurrence. All risks identified and ways to reduce or mitigate them must be allocated to individual actors or any kind of combination. Risk allocation is a horizontal issue but it is differentiated here for practical purposes. One general principal in allocation of risk is that the allocation of risk always needs to be guided by the risk-reward relation for the various actors as well as the costs of allocating those risks. Thus risk is not only allocated according to its source, but also according to the potential benefit, should the procurement be successful. The following recommendations are formulated based on this principle:

31. Technical risks can be shifted to the supplier whenever the suppliers see excellent market prospects, and thus perceive the public procurement as a kick start of a private market they identify with. Companies may be ready to take a high share of the risk when they expect the result to lead to adoption of industry standards, to improve their credentials or be first mover in a prospective market. When this is

the case procurers should insist for suppliers to carry more risks. Late and reduced payments as well as fines are instruments to shift risks to the supplier. A typical solution is to make payments depending on reaching certain milestones and deliverables (Use Key Performance Indicators). On the other hand one has to take into consideration that the procurement of innovation is a means to share risks with innovative companies; going too far would practically cancel the stimulating role of public procurement for innovation.

32. Try to identify other instruments, as suggested above (research, VC) to shifts part of the financial risk to other funding sources, external to the procurement process itself.

33. It is reasonable that organisational risks, in particular when standards and long-term economic policy are concerned, be covered by the political authorities (political responsibility), who is in a better position to know of and influence these policies.

34. Turbulence risks are shared between the procurer and the supplier depending on the nature of the turbulence and its potential source. But, because of its uncertain nature, turbulence can be discussed at a higher political level, before the tender process starts.

35. Finally, it helps if all (or almost all of) these risks, independently on how they are allocated, are insured; if insurers accept the liability and the cost is affordable. The allocation then is determined by whether an actor wishes to insure the risk assumed and pay the insurance costs.

Measuring the cost of risk management

The whole process needs to be built up on the assumption that the cost of risk management cannot be exactly measured but procurers need to acknowledge in procurement budgets that it has a cost. It is therefore essential to get a feeling for it, to make sure it is not excessive in terms of information and delays and to keep in mind that the cost of no risk management may be a lot higher. But the one thing that the Expert Group believes has learned from this exercise is that ***for the procurement of innovation someone takes responsibility for a cost that is in a reasonable relation to the benefit of the innovation***.

Appendix 1: Terms of Reference

1. INTRODUCTION AND OVERALL OBJECTIVE

These are the Terms of Reference for an Expert Group set up by DG Research of the European Commission in the context of the follow-up of the Communication on Pre-commercial procurement COM (2007) 799 final which promotes the public procurement of R&D and the earlier Communications "More research and innovation, a common approach", COM (2005) 488 final and on the "broad based innovation strategy" COM(2006)502 final both of which promote public procurement as an instrument to boost demand for innovative solutions.

The objective of this Expert Group is to provide guidance on the management of risks in procurement of technology. The risk of failure of new technology is an important issue faced by supplier companies in different sectors and public administrations which respectively develop and acquire new technology to enhance their operations. The level of risk increases when the R&D itself is part of the procurement. The expert group will also examine how the high level political objective to utilise the purchasing power of public procurers to boost the demand for innovation can be put into practice.

Via a combination of collective and individual work punctuated by several meetings, the group will prepare all necessary material for discussing the key issues and for drawing its conclusions. It will take account of existing expertise and of the major elements stemming from earlier Commission activity in the area of procurement of innovation including the DG ENTR study (Edler at al., 2005)[11] the DG RTD expert group (the Wilkinson report)[12] and the more recent DG INFSO project[13] on public procurement in the ICT sector as well as the

[11] http://cordis.europa.eu/innovation-policy/studies/gen_study13.htm

[12] http://ec.europa.eu/invest-in-research/pdf/download_en/edited_report_18112005_on_pubic_procurement_for_research_and_innovation.pdf

[13] Not yet published

ongoing OMC-net project[14] on public technology procurement and the DG ENTR ST EPPIN project[15] on how standards are and could better be used in public procurement to boost innovation. Where these projects have aimed at identifying cases and good practice in public procurement of R&D services the issue of risk while identified as a barrier has not yet been comprehensively addressed.

2. THE GENERAL CONTEXT

Public procurement is one of the instruments which can boost demand for innovation and innovative goods and services. It is one of the key instruments to promote lead markets. With public procurement accounting for 16% of EU GDP, public authorities are big market players which can stimulate private investment in research and innovation when they procure either products incorporating new technology or the R&D to develop the technology to a point where such products become available.

As called for in the Communication "More research and innovation, a common approach", the Commission has prepared guidelines advising procurers how to promote innovation with practical advice on actions that could be taken at different stages in the procurement life cycle. In the Communication on the broad based innovation strategy, the Commission suggested public purchasers need to become more "intelligent customers" planning what to buy, how to buy and who will buy. The more recent Communication on Pre-commercial procurement which promotes procurement of R&D and raises awareness of a little used instrument which could be used by procurers to intervene earlier in the innovation pathway to help steer development of solutions which better address public needs.

This is the starting point for the work of the expert group in managing risks in public procurement.

The expert group will analyse up to 10 cases of technology procurement and identify the emerging practices in managing risk. The group will also examine how the high level

[14] www.omc-ptp.eu

[15] www.standards.eu-innova.org/Pages/Steppin/Default.aspx

political objective to utilise the purchasing power of public procurers to boost the demand for innovation can be practically implemented overcoming the culture of risk-avoidance.

3. MANDATE, DELIVERABLES AND TIMETABLE

3.1. Overall mandate

The expert group will:

TASK 1) Analyse up to 10 recent cases of procurement of R&D and innovations and identify how the risk of technology failure was addressed. The cases of procurement of R&D may or may not also involve procurement of innovative products.

TASK 2) Identify, from this review, (emerging) practices in public procurement as well as private sector industrial practices which could be recommended to public procurers bearing in mind the similarities and the differences between public and private procurement.

TASK 3) Examine how the high level political will to utilise public procurement to boost the demand side for innovation can be effectively translated into development of technology procurement strategies and changes in procurement practice.

TASK 4) Examine how the culture of risk avoidance could be modified and identify the user needs and business case where technology procurement is an appropriate instrument.

3.2. Specific issues/ questions to be addressed

In task 1, the cases, which may include examples of research projects in the private sector, should be selected following a screening process to identify examples where risk management measures were expressed. These should ideally include cases from three technology sectors and approaches in the financial sector to managing risks in lending to technology projects.

In reviewing cases, the group will identify which other significant barriers had to be overcome to gain approval for the proposed project and their financing. It will also consider related concepts as time constraints, political will, technical capacity/capability, issue of IP and other framework conditions and hindrances as well as the perspective of the supplier managing opportunity perspective.

Task 3 will involve an identification of possible governance structures aimed at encouraging risk taking and better managing of risk throughout the whole procurement and implementation process. The group will produce a conceptual framework to better understand the nature of risk, risk management and its importance within the governance of procurement for innovation. The governance considerations will be focussed on the implication for risk management.

3.3. Deliverables and Timetable

Expert group report

The group deliverable is a final report with the core text not exceeding 75 pages, plus all necessary annexes and bibliographical references.

The core text of the report should be prefaced by a 2-5 pages executive summary.

A full draft final report in English is to be presented by 30 June 2009, and its final version, in a form and quality suitable for publication, shall be ready by 30 September 2009.

Meetings

The group will meet as up to seven times over the duration of this agreement. This may include up to two meetings in Brussels or another location with the Chairperson and other experts under contract to review and discuss progress with the work and the draft report.

If for any reason, the expert wishes to travel to a meeting for the execution of his/her tasks from a point of origin other than that mentioned in the Specific Conditions of the Appointment Letter, prior written consent should be obtained from the Commission.

OPERATION OF THE EXPERT GROUP

3.4. Number, identification and selection of experts

The expert group consists of up to 13 (7 private experts with contract and 6 public officials without contract) members, including one chairperson and two rapporteurs, to provide a variety of views and approaches while keeping the size of the group manageable. During the work of the expert group additional experts can be added to the group either to replace members who withdraw or to address new specific tasks.

Expert group members have been selected on the basis of their competence in relation with the issues to be addressed, with an emphasis on different institutional and national/regional viewpoints, and a good mixture of academic, industrial and innovation policymaking backgrounds and professional procurement experiences.

3.5. Working method

The **chairperson** will define the meeting agendas, direct the meetings, organise the work of the members of the group (including discussion of work and written contributions by the group members) and summarise the main conclusions and actions arising before closing each meeting. In particular, at the outset of the group's work, the Chairperson will:

1. Develop an operational work plan for the group.
2. Schedule the meetings of the group.

3. Establish specific tasks and assign responsibilities for them to group members in accordance with main areas of contributions defined in the Annex VI.1. These tasks may be adapted in the course of the work of the group. [NOTE: In case of substantial changes in the repartition of main areas of contributions, such changes, within the limit of the number of days specified for the member concerned, will lead to an amendment of their contract (Annex VI.1). Any changes that lead to an increase in the total number of days allocated to the group, will be subject to prior authorisation of the Commission, and will lead to an amendment of the contract of the members concerned.]

4. Set reporting requirements, format of written deliverables and quality control procedures.

The **rapporteurs** will work closely with the Chairperson. One rapporteur will prepare the meeting agendas in consultation with the Chairperson and will prepare with the Chairperson the interim paper and final report of the group, on the basis of all members' written contributions. The other rapporteur will make best use of the main points of the written contribution presented by experts, create PowerPoint presentations, draft summaries of the key points emerging from discussions held at meetings.

Two members of the group will be responsible for developing a concept for a governance structures which would be conducive to facilitating more procurement of technologically innovative goods and services and the R&D needed to make the technology available.

One member will be responsible as reviewer of this concept and have a leading role in the review of cases.

One member of the group will review the academic literature to identify other possible mechanisms to manage risks.

All other **members** will contribute to the expert group work by:

- Participating in its meetings

- Preparing written individual or joint contributions (circulated in advance of the meetings) in his or her main area of contribution, according to Annex VI.1 below, or on other agreed topics arising from the tasks described in section 3.1. These contributions will be circulated in advance of relevant meetings and presented at the meetings by their authors for discussion. .

- Commenting, as appropriate, on the contributions of the other members.

All members of the group will participate in the screening, selection and analysis of the cases

Place of Work

In addition to the Specific Conditions of the Appointment Letter which foresee that experts perform their tasks on Commission premises and remotely at their home or place of work, the Commission may communicate in writing any other place where the experts may perform their tasks. If for any reason, the expert proposes to perform his/her tasks in another place, prior written consent should be sought from the Commission.

Commission staff responsible for the expert group is in regular liaison with the chairperson and the rapporteur to ensure the smooth running of the group, and they attend the meetings to provide appropriate information and advice. Other Commission services might be invited to attend the meetings and provide information at request of the group. The Commission, within reason, will seek to provide the group with paper or electronic copies of any non-confidential reports or other data which are agreed to be necessary for the conduct of the Expert Group's activities.

Under the chairperson's leadership, the **chairperson** and the **rapporteurs** will **prepare (compile and edit) together the Expert Group report**. The Commission staff responsible for the Expert Group will also offer editorial input to the production of the report.

Appropriate external experts can be invited to participate in one or more of its meetings.

Members of the group are encouraged to contact other experts in their respective contact networks to test ideas and seek their views on specific issues in their area of expertise. However they should not provide information in public fora on the content of the discussion of the group and on its report before the submission of the report and its acceptance by the Commission services, unless authorized by the Commission services in writing.

3.6. Circumstances in which a conflict of interest may exist (notwithstanding the terms of Annex I to the Appointment letter)

A disqualifying conflict of interest exists if an expert is in any situation that compromises his or her ability to carry out his or her task impartially.

A potential conflict of interest may exist, if an expert is in any other situation that could cast doubt on his or her ability to give an advice impartially, or that could reasonably appear to do so in the eyes of an external third party.

An expert must declare any vested interests in relation to the questions upon which he/she is asked to give advice.

3.7. Credits

The physical and intellectual products generated by the expert's assignment will remain the property of the Commission. The published report prepared will acknowledge the authorship and other contributions of the members of the Expert Group.

Appendix 2: Expert Group members and Invited Speakers

Name	Title/Profession
Lena Tsipouri	**Chair** of the Expert Group, Professor, University of Athens
Jakob Edler	Professor, University of Manchester
Elvira Uyarra	Researcher, University of Manchester
Hanneke Bodewes	**Rapporteur** of the EG, SenterNovem, NL
Max Rolfstam	Researcher, University of Southern Denmark
Janne Sylvest	**Rapporteur** of the EG, Ramboll Management Consulting
Tarmo Kalvet	Institute of Public Administration, Tallinn University of Technology
Sven Erik Hargeskog	The Swedish Governmental Agency for Innovation Systems (VINNOVA)
Ditmar Waterman	PIANOO , NL
Doina Banciu	General Director of ICI, RO
Illona Vass	National Office for Research and Technology, HU
Sue Creese	Department for Innovation, Universities and Skills (DIUS), UK
Peter Thevissen	IWT Flanders, BE

Invited speakers for the EG meetings:

Name	Title/Profession
Frances Scarff	OGC, UK
Anne de Moor	EICTA, the European ICT industry association
Demetrios G. Konstantakopoulos	National Bank of Greece (NBG)
Teun van Reeuwijk	CROW, NL
Niels van Ommen	CROW, NL
Marieke van Putten	PIANOO, NL

Appendix 3: A template for case analysis

This template serves to characterise cases the members of the group select to discuss within the group. It should give a quick overview of the type of case, type of procurement, type of risk and major risk management issue. It is linked to the concept paper that is being developed. It limits itself to the major dimensions of this concept paper. For a thorough in-depth analysis of the cases we will have selected we will need more differentiation, but 'less is more' in this stage of the process, as we need to get a mix of cases that together cover the major aspects and types.

Later on, once we have looked at the first selection of cases, we will have a second, enlarged version for the analysis. This is simply to collect the cases and discuss them, not to analyse them in depth.

Case delivered by: Date:

Case selection: we select all cases where the product / service are *new* for the buying administration and that have risks that are related to the fact that it is new for the buyer.

Basic Characterisation

Date (period where procurement was carried out)
Name of the case:
Procuring institution, country, region, level (include information about variety of actors in public administrations that have been involved and their roles (if known already):
Supplier: Name, sector:
Description of the product / service procured (catch words):
Level of innovativeness (incremental, radical; new combinations, organisational adaptation), what is new, how new is it; clarify the perspective: whose assessment of innovativeness; ex ante expectations, realisation etc.)

Nature of the procurement: strictly public, cooperative, catalytic (consider here also: does the product / service have potential to spill over in other public or private markets, any diffusion issues, have there been spill-overs realised etc.?)
Benefit / Added value for public administration (purpose, internal use, societal value) Are there different benefits for different actors?
(Expected) Benefit for the supplier (long term supplier for the administration, creating private market (new market, better position, market leader etc.)
Short description of the procurement cycle activities (in bullet points, if known at this stage):
Outcome of the process (does / did it work, any stories, problems etc.)

<u>What kind of risk</u> was involved (fill in relevant boxes) and what are the <u>causes</u>

Please identify – if known – if those risks were anticipated by the actors or not.

Operational risks (supplier cannot deliver): Who carries that risk (within public administration, try to clarify who shares which burden)
Institutional risks (absorption and diffusion in public sector, coordination problems in the process etc.) Who carries that risk (within public administration, try to clarify who shares which burden)
Societal risk (end users do not accept, are not able to use etc.): Who carries that risk (within public administration, try to clarify who shares which burden)

Market risks Subsequent demand in overall, private market,: Supplier market: (e.g. supply chain issues)
Financial risk: Who carries that risk?
Did ‘turbulence’ (unanticipated causes for failure, hindrance) play any role? IF so, how?
Spill over risks in public service:

Risk management issues
Summary: Who carried the main risk(s)
Risk in what phase of the procurement whole cycle?
Perceptions of risks (different actors..)?
Conscious risk management in-built (ex ante), or ex post?
Main measures of risk management (please indicate the procurement phase(s)) (this is the main box later on, please indicate all you need at this point, here we will have to be more differentiated in the second step)
Which actors were dealing with the risk:

Any knowledge on negotiations, on potential tensions between the partners?
Cost of the risk management? Any resources dedicated to it *ex ante*?
What kinds of lessons could we learn?

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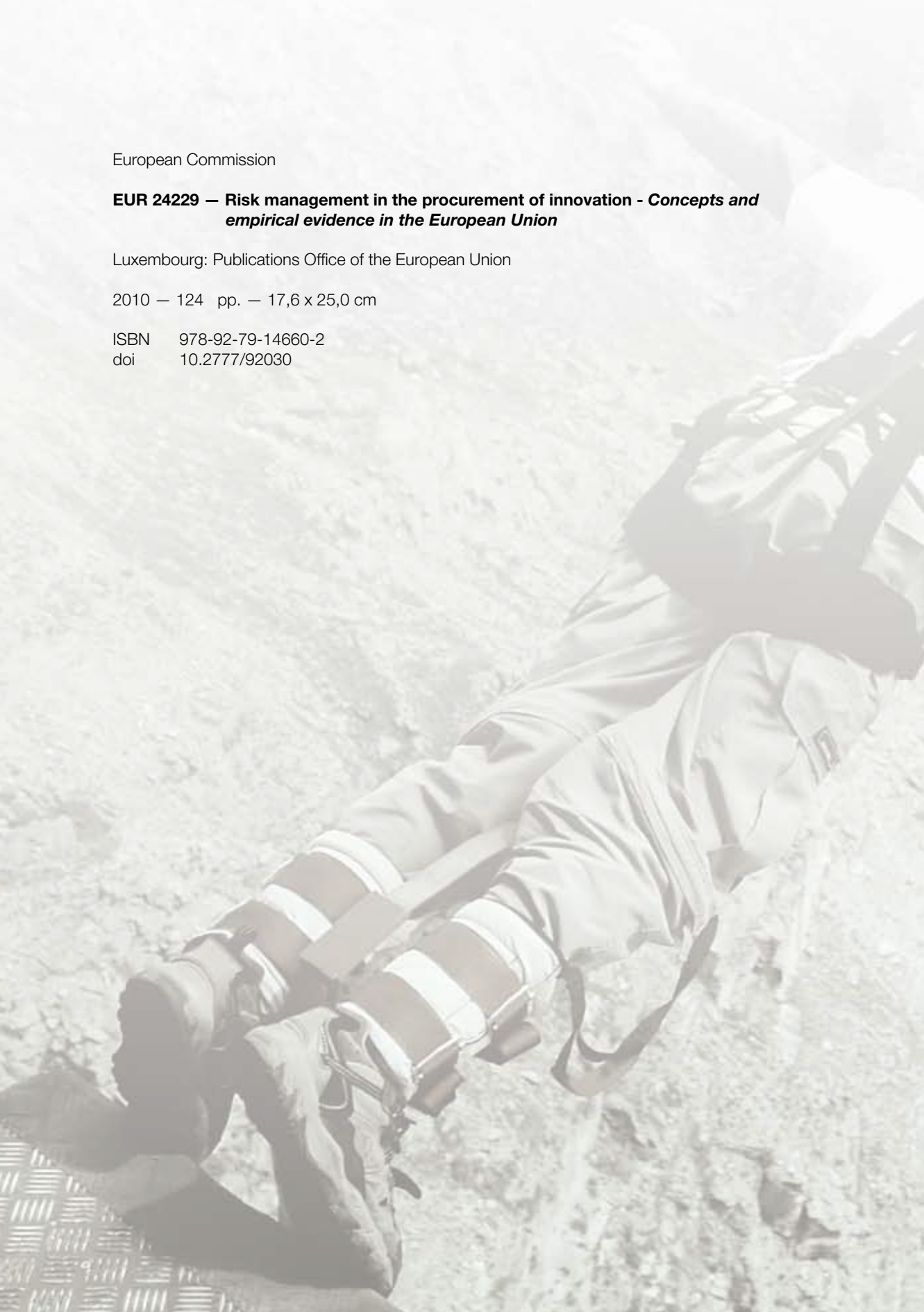

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This report has been produced by an expert group set up by the European Commission Directorate-General for Research. The purpose of the report is to understand the various risks that public procurers face, identify existing risk management practices and derive recommendations that could help overcome this key barrier in the procurement of innovation. The empirical evidence draws on 12 case studies, which were identified by the group as offering interesting lessons for policy makers.

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