PICSE: Procurement Innovation for Cloud Services in Europe

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Abstract: This document provides a state of the art analysis of how public research organizations procure ICT services and identifies the challenges when the procurement is focused on cloud services. The document also reports what public sector organizations are doing to procure cloud services and how cloud service providers are responding to the demand-side. Finally it presents the basic structure on which the PICSE procurement model for cloud services will build on.

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DISCLAIMER

PICSE (644014) is a Coordination and Support Action funded by the EU Framework Programme for Research and Innovation Horizon 2020. The PICSE Procurers' Platform will give access to a unique repository of information supporting the move from outright purchase to 'pay-per-usage' made possible by the arrival of cloud computing. It builds on the Helix Nebula collaboration between supply and demand of which the three PICSE partners are key members.

This document contains information on PICSE core activities, findings and outcomes and it may also contain contributions from distinguished experts who contribute to PICSE. Any reference to content in this document should clearly indicate the authors, source, organisation and publication date. The content of this publication is the sole responsibility of the PICSE consortium and cannot be considered to reflect the views of the European Commission.

CHANGE LOG

Issue	Date	Description	Author/Partner
V0.1	2 February 2015	Internal release to the partners	Sara Garavelli, Nicholas Ferguson (Trust-IT Services)
V0.2	10 February 2015	Review from CERN	Rachida Amsaghrou, Bob Jones (CERN)
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V0.7	25 February 2015	Integration of the PICSE Task Force feedback and addition of Executive Summary and Glossary	Sara Garavelli (Trust-IT Services)

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Executive Summary

The public procurement of Information and Communications Technology (ICT) is important for a number of reasons. **Public sector organisations are a large consumer of ICT, and via their procurement power can have significant influence on innovation and competitiveness in the ICT market**. The procurement of ICT by public organizations also represents a significant source of the expenditure of public funds. For example, it was estimated that total EU government expenditure for public procurement of ICT was €94 billion in 2007. Estimates of IT spending in the UK public sector in 2010, (estimated as the highest spender in the EU with 23% of EU IT expenditure) are approximately €18 billion per year (Source: Guidelines for Public Procurement of ICT Goods and Services, SMART 2011/0044, 2012).

It is therefore, paramount that public bodies know how to procure ICT efficiently and responsibly, promoting competition and innovation in the ICT industry and making the best use of public funds.

With the advent of cloud computing, the delivery of ICT services is going through a fundamental change. However, while cloud technology service options continue to evolve, **procurement processes and policies have remained firmly rooted in historical practices that are no longer effective. This applies to governments and also to public research organisations, including libraries.** In order for public research organisations of all sizes to take advantage of the best cloud market currently has to offer, **a more flexible and agile procurement model must be identified and implemented.**

A procurement model is a document designed to be used as a template. It describes all the steps of the procurement process necessary to purchase goods and services. In this context, **cloud services.**

To create a procurement model suitable for cloud services, **it is necessary to understand how public research organizations are currently purchasing ICT services** and what their internal policies and procurement rules are. The standard steps of a procurement process of ICT services for public research organizations can be summarized as follows:

1. **Planning & Preparatory phase:** The first step to initiate a procurement process for ICT goods or services is the identification of the ICT need, i.e. what has to be procured. The major tasks of the preparatory phase are the definition of the technical, legal and procurement specifications, the definition of the budget and the pre-procurement market engagement (a market consultation phase that enables the procurer to understand what the market has to offer).

2. **Selection of the most suitable procurement approaches and procedures:** The first question to answer before starting a procurement process of ICT solutions is: What is the market availability of the solution?

   If the solution is off-the-shelf, a standard commercial procurement process can be initiated. If the solution doesn't exist a procurement of R&D is needed (the so called Pre-Commercial Procurement, PCP).

   If it is available on the market with very few adoption cases, Public Procurement of Innovative solutions must be put in place.

   For big and complex procurement initiatives, a best practice adopted by many public research organisations is joint procurement. Joint procurement means combining the procurement actions of two or more contracting authorities.

   Once the procurement approach has been identified, the procurers should decide the procurement procedure to adopt. This selection usually depends on a number of issues such as the type and size of the procuring organization and the value and complexity of the services to procure, etc. Procurers should also ensure that the procurement procedures conform to relevant national and EU laws, which constrain the extent to which procurers can restrict their engagement to small numbers of individuals or firms. Different procurement procedures for public sector exist.

   The most common procurement procedures adopted by public research organizations interviewed in the first consultation phase of PICSE are firstly, **Request for Quotations (RFQ),** a procurement procedure that is used for small value procurements of readily available off-the-shelf goods and services that does not require the preparation of tender documents. Secondly, **Invitations to Tender (ITT)** when contracts are above a certain threshold. Once the procurement documents are ready, the procurers invite suppliers to submit their offers.

3. **Tender/Request Evaluation:** Tender/Request evaluation has to be fair, impartial and in accordance with the evaluation criteria defined in the tender documentation. During this phase, the procuring organisation has to exploit all the market knowledge acquired during the pre-procurement market engagement.

4. **Contract Award & Negotiation:** Usually contracts and purchase orders are awarded to the supplier, which makes the lowest price offer, complies with the contractual, technical, delivery and performance requirements. Once the supplier has been selected, it is notified of the successful outcome, and the contract is compiled.

5. **Contract & performance management/monitoring:** This phase is key to ensure the contractor is adhering to the terms and conditions of the contract and providing the required services/products that meet the expectations of the purchase.

So how is cloud computing impacting the standard process for procuring ICT services?

The main challenges to be addressed in a procurement process of cloud services can be summarised as follows:

- As with all the purchases of new innovative technologies, procuring innovative services requires new skills and competences.
- Organisation/cultural barriers to cloud adoption are very important, especially when the organization is purchasing cloud for the first time.
- Financial issues may arise due to the new way to evaluate costs in moving to the cloud.
- Legal-organisational issues may be encountered due to the cloud service deployments particularities, e.g. applicable law, data location restrictions, data protection, etc.
- Security, including network security, data protection, privacy, data and service portability, and interoperability are all elements to be considered when identifying the cloud solutions to purchase.
- Vendor lock-in (dependency on the vendor) and vendor viability have to be considered.
- Dynamic and changing cloud services must be monitored to ensure proper performance and benefit realisation. Service level agreements (SLAs) must be drafted and managed properly.
- Vendor contract negotiation is complicated and critical. There are no standard contracts for cloud.
- Contract termination conditions need to be carefully evaluated. Porting data to another cloud or non-cloud solution may involve high costs. Cloud escrow is also missing.

These challenges impact the five steps of the procurement process. There is a clear impact on skills and knowledge required. IT managers within public research organizations should have a clear understanding of the new technology being purchased, but it doesn't stop there. IT managers are not the only ones who need to know about the new technology. **The procurement initiator** should understand what it means to adopt cloud services; how to identify the benefits and evaluate the costs and the impact on the institution; ways of contracting cloud services; and how to evaluate suppliers' Terms of Services. **Financial officers** must have a complete understanding of how to allocate costs. And finally, the **legal officer** should be much more involved in all the steps of the procurement process to ensure that legal implications are in line with the institute's requirements.

Procuring cloud services also has a direct impact on the traditional steps and procedures that are part of the procurement process:

- ✓ *In some public research organisations, there are policies that are not aligned with the procurement of cloud-based services*
- ✓ *Different skills involved at different times (relevant role of the legal experts, even at an early stage)*
- ✓ *Moving from a detailed requirements gathering phase to a service requirement matching phase*
- ✓ *Considering the need for a pilot phase*
- ✓ *As cloud services evolve rapidly, short procurement processes are envisaged*
- ✓ *Evaluation based on Terms of Service*

- ✓ *New types of contracts oriented towards service and performance*
- ✓ *New ways of purchasing*
- ✓ *Service billing and metering*
- ✓ *Cloud providers regularly revise their service offerings, and the changes automatically flow to all customers*
- ✓ *Data Retention*

In resolving the above mentioned issues and speed up the purchase of cloud services, a series of initiatives from the demand and supply sides are emerging in Europe for the public sector.

G-Cloud is an iterative framework that allows UK government departments and organisations to buy cloud services from a list of pre-approved vendors. Cloud for Europe is a project co-funded by the European Commission. The project involves five European ministries who have come together to start a procurement action of cloud services in order to address issues encountered when purchasing cloud services as single customers. A tender recently published by DG DIGIT which aims to secure about 2500 Virtual Machines and 2500 Terabytes of storage for up to 4 years to the EU Institutions is another example. Finally, from the supply side, cloud marketplaces are emerging such as the Helix Nebula Marketplace and the Deutsche Börse Cloud Exchange. The Helix Nebula Marketplace is a European Cloud Marketplace service that is compliant with EU regulations and legislation, created through collaboration between commercial providers and public e-Infrastructures. The Deutsche Börse Cloud Exchange meanwhile, is a marketplace for IaaS resources both for private and public sector.

The result of this analysis has allowed PICSE to put together a first draft cloud procurement schema describing the procurement steps in a cloud environment. The procurement model will be the basis for developing a template that can be used by public research organisations for the **self-assessment** and evaluation of their procurement procedures; and creating **a decision support tool** that can guide procurers via a series of multiple choice questions to identify suitable options and highlight key aspects that should be taken into account during the procurement process (the so called *PICSE Procurement Wizard*). The PICSE procurement model will be released in June 2015.

1. Glossary

Term	Definition
Tenderer[1]	The economic operator that has submitted a tender
Bid (same as Offer, Proposal, Quotation and Tender)	A response from a supplier, contractor or service provider to a solicitation request that, if recommended for award, would bind the supplier, contractor or service provider to perform in accordance with the contract.
Commercial Procurement	The act of purchasing goods and services available on the market.
Invitations to Tender (ITT)	For contracts above a certain threshold, public research organizations have to set up a tender procedure.
Joint Procurement	Joint procurement means combining the procurement actions of two or more contracting authorities. The key-defining characteristic is that there should be only one tender published on behalf of all participating authorities.
Pre-commercial Procurement (PCP)[2]	PCP is an approach for procuring R&D services, which enables public procurers to: • Share the risks and benefits of designing, prototyping and testing a limited volume of new products and services with the suppliers, without involving State aid; • Create the optimum conditions for wide commercialization and take-up of R&D results through standardization and/or publication. • Pool the efforts of several procurers.
Procurement (or Procurement Process):	Procurement is the acquisition of goods, services or works from an external source. It is favourable that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the acquirer in terms of quality and quantity, time, and location[3]. Procurement is the process which creates, manages and fulfils contracts. Procurement can, as such, be described as a succession of logically related actions occurring or performed in a definite manner and which culminate in the completion of a major deliverable or the attainment of a milestone. Processes, in turn, are underpinned by methods (i.e. a documented, systematically-ordered collection of rules or approaches) and procedures (i.e. the formal steps to be taken in the performance of a specific task), which are informed and shaped by the policy of an employer[4].
Procurement document[5]	Any document produced or referred to by the contracting authority to describe or determine elements of the procurement or the procedure, including the contract notice, the prior information notice where it is used as a means of calling for competition, the technical specifications, the descriptive document,

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[1] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014L0024&from=IT

[2] https://ec.europa.eu/digital-agenda/en/innovation-procurement

[3] Weele, Arjan J. van (2010). Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice (5th ed. ed.). Andover: Cengage Learning. ISBN 978-1-4080-1896-5.

[4] https://www.iso.org/obp/ui/#iso:std:iso:10845:-1:ed-1:v1:en

[5] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32014L0024&from=IT

	proposed conditions of contract, formats for the presentation of documents by candidates and tenderers, information on generally applicable obligations and any additional documents.
Procurement Model (or Schema):	A procurement model is a document designed to be used as a template. It describes the procedures necessary to purchase goods and services.
Procurement Principles	The primary values that govern the procurement process. They also guide the conduct of procurement practitioners and other actors and stakeholders involved in the procurement process.
Procurement Procedures[6]	Procurement procedures are the methods used to purchase goods and services. Examples of procurement procedures are open procedure, restricted procedure, negotiated procedure, competitive dialogue, etc. (See Annex 2).
Public Procurement[7]	Public procurement is the procurement of goods and services on behalf of a public authority, such as a government agency.
Public Procurement of Innovation (PPI)[8]	Public Procurement of Innovative solutions can be used when challenges can be addressed by innovative solutions that are nearly or already in small quantity on the market and don't need new R&D.
Request for Quotations (RFQ)[9]	• It is a procurement procedure that is used for small value procurements of readily available off-the-shelf goods and services. This procurement procedure does not require the preparation of tender documents. The invitations are not complex and this method is considered non-competitive because the procuring entity determines which contractors, suppliers or service providers, to request quotations from as long as a minimum of three are invited.
Total Cost of Ownership (TCO):	Total cost of ownership (TCO) is a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system. Usually it is composed by: • **Acquisition costs** - the direct costs incurred to bring the product/service into operation • **Operational costs** - costs likely to be incurred throughout the lifetime of the ICT product or service, such as maintenance and updates, staff training and project management costs **Exit costs** - costs required to migrate to another ICT product, service or supplier. In the context of avoiding lock-in, exit costs are very important)

[6] https://www.iso.org/obp/ui/#iso:std:iso:10845:-1:ed-1:v1:en
[7] http://en.wikipedia.org/wiki/Government_procurement
[8] https://ec.europa.eu/digital-agenda/en/innovation-procurement
[9] This procurement method is also known as invitation to quote.

2. Introduction

The public procurement of Information and Communications Technology (ICT) is important for a number of reasons. Public sector organizations are a large consumer of ICT, and via their procurement power can have significant influence on innovation and competitiveness in the ICT market. The procurement of ICT by public organizations also represents a significant source of the expenditure of public funds.

For example, it was estimated that total EU government expenditure for public procurement of ICT was €94 billion in 2007. Estimates of IT spending in the UK public sector in 2010, (estimated as the highest spender in the EU with 23 per cent of EU IT expenditure) are approximately €18 billion per year[10].

It is therefore paramount that public bodies know how to procure ICT efficiently and responsibly, promoting competition and innovation in the ICT industry and making the best use of public funds.

With the advent of cloud computing, the delivery of ICT services is going through a fundamental change.

> **Cloud-based services are replacing traditional local — or on-premise — software and infrastructure installations for many public sector organisations. This applies to government but also to public research organizations, including libraries, which currently deal with the big data explosion and the need of additional computing capacity.**

Cloud computing has revolutionized employees' ability to access data, software, computing power and collaboration strategies, disrupting the traditional notions of information technology.

> While technology service options continue to evolve, however, **procurement processes and policies have remained firmly rooted in historical practices that are no longer effective.** In order for public research organisations of all sizes to take advantage of the best the market now has to offer, **a more flexible and agile procurement model must be identified and implemented.**

What is a procurement model?

"Procurement is the acquisition of goods, services or works from an external source. It is favourable that the goods, services or works are appropriate and that they are procured at the best possible cost to meet the needs of the acquirer in terms of quality and quantity, time, and location. Corporations and public bodies often define processes intended to promote fair and open competition for their business while minimizing exposure to fraud and collusion."[11]

A procurement model is a document designed to be used as a template. It describes all the steps of the procurement process necessary to purchase goods and services. In this context, cloud services.

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[10] http://cordis.europa.eu/fp7/ict/ssai/docs/study-action23/d2-finalreport-29feb2012.pdf
[11] http://en.wikipedia.org/wiki/Procurement

This deliverable is the interim release of deliverable D2.1 Research Procurement Model (M9). It analyses the current state of the art of procurement procedures adopted by public research organizations for the purchasing of ICT services and describes how cloud is impacting existing procurement procedures and the main challenges identified. The document also provides an analysis of the state of the art procurement models adopted by public research organizations and governments to buy cloud services. Finally, the document proposes a first draft cloud procurement schema describing the procurement steps in a cloud environment.

The information included in this deliverable will be key to the development of:

- ✓ A simpler procurement model of cloud services for public research organizations;
- ✓ A template that can be used by public research organizations for the self-assessment and evaluation of their procurement procedures;
- ✓ A decision support tool that can guide procurers via a series of multiple choice questions to identify suitable options and highlight key aspects that should be taken into account during the procurement process (*PICSE Procurement Wizard*).

The final release of this document, D2.1 Research Procurement Model (M9), is due in June 2015.

The achievement of this milestone (MS2 Procurement model interim release) is important in moving towards the completion of the PICSE procurement model (D2.1 Research Procurement Model (M9)) and to start validating the state of the art analysis[12] and the new proposed model included in this document through the PICSE Case Studies (D2.2 Research Procurement Case Studies).

So far, ten public sector organizations and initiatives operating in the field of procurement of cloud services (CERN[13], Cloud for Europe[14], DG DIGIT[15], ECMWF[16], EMBL[17], ESA[18], ESRF[19], Europeana[20], GRNET[21], Umeå University[22]) have been contacted and interviewed on their current practices in the procurement of cloud services through the drafting initial case studies. In the coming months, they will be asked to provide feedback on this document (MS2 Interim procurement model) to validate the information included and provide additional feedback. This will allow PICSE to proceed with the finalisation of the case studies. In addition, once the procurement model is ready, they will be asked to test the Procurement Wizard and the self-assessment tool. Feedback on this will be included in D2.2 *Research Procurement Case Studies.*

Besides the above mentioned organizations, new public research organizations will be contacted including libraries and international organizations. This will further give PICSE a fuller picture of the current

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[12] Please note that the results of D3.1 Procurement barriers will be useful to consolidate chapter 3.

[13] home.web.cern.ch/

[14] www.cloudforeurope.eu

[15] http://ec.europa.eu/dgs/informatics/identity_en.htm

[16] http://www.ecmwf.int/

[17] http://www.embl.de/

[18] http://www.esa.int/ESA

[19] http://www.esrf.eu/

[20] http://www.europeana.eu/

[21] https://www.grnet.gr/

[22] www.umu.se

landscape. Two interviews are already planned with UCL Library Services[23] and FAO, the Food and Agriculture Organization of the United Nations[24].

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[23] http://www.ucl.ac.uk/library
[24] www.fao.org/

3. Procurement of ICT services in public research organisations

Procurement of ICT services in public research organizations involves different stages covering the establishment of a needs request for the ICT solution with specifications, a tendering/request process and an objective evaluation and decision-making process based on rules and regulations of the procuring entity prior to selection and contract with suppliers.

Each public research organization has its own rules and procedures, which are usually dictated by the type of organisation:

- *European intergovernmental organisations* (e.g. CERN[25], ECMWF[26], EMBL[27], ESA[28], etc.) usually are large-scale scientific organisations governed by member states and subject to their own legislation[29]. Member states decide the overall procurement strategy of the organization and also establish the threshold for public tender. They usually have a procurement office in charge of the procurement action and strict, formal rules. They are often equipped with a supplier database that includes all the eligible suppliers. Suppliers entering this database have to pass a formal evaluation process in which they demonstrate their compliance with the rules of the organization. Criteria include geographical constraints (usually only suppliers belonging to the member states funding the organization can be considered eligible), size (SMEs are often considered as risky supplier), and certifications, etc.

- *National research institutes* (e.g. Umea University, CNR, etc.) including large/medium and small-scale universities or research centers funded only by the member state in which they are located. These institutes must comply with national legislation and therefore legal implications on procurement procedures are simpler. A procurement office may be within the institution although it depends on the size of the organization. In smaller institutes this role is often covered simply by a legal expert who together with the technical officer is in charge of the procurement action. As for inter-governmental organisations, each institute has its own procurement rules and procedures.

Besides these differences, a high-level general procurement process to procure ICT services can be identified[30].

In all public research organizations, guiding procurement principles are defined. They are aimed at providing overall guidance on how procurement should be conducted and values that must be maintained during the process such as **transparency, fairness, efficiency, and equality.** This is entrenched in internal

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[25] home.web.cern.ch/

[26] http://www.ecmwf.int/

[27] http://www.embl.de/

[28] http://www.esa.int/ESA

[29] Innovation and Public Procurement. Review of Issues at Stake. Study for the European Commission. Fraunhofer Institute Systems and Innovation Research, PREST, University of Manchester, Lund University, University of Athens and Center for Economic Research and Environmental Strategy, December 2005. The study analyses existing rules and current practices of public innovation procurement in a large set of countries and provide also examples of good practices for concrete procurement activities and the current legislations related to procurement.
D2.1. Legal implications on cloud computing, Cloud for Europe, May 2014

[30] The high-level procurement process identified in this section is the result of a first consultation with public research organizations and of the analysis of the reference documents reported in chapter 8.

control measures. **These guiding principles are usually a fundamental part of a procurement process and are shared by public research organizations of all sizes.**

Public procurement is also usually structured operationally around a **categorization of procedures** based on the estimated cost of the goods or services, with a concomitant and increasing level of authorization and formality. Public procurement generally **involves competitive bidding procedures, to ensure that best quality, conditions and market prices are offered under equal and fair conditions.** Nonetheless, the higher the value or risk of the operation, the more formal the control measures are for competitive bidding procedures. This ensures proper risk management and control.

Procedures reflect the guiding principles applying to the different steps throughout the procurement process. There will hence be procedures for appropriate definition of specifications, receipt of offers, evaluation, etc. covering the complete procurement process operationalizing corresponding principles.

Guiding principles and procedures are usually supported by **best practice approaches**, based on benchmarking, analysis, experience and lessons learnt, which contribute to efficiency and effectiveness.

The figure below outlines the five steps that are part of the standard procurement process adopted by public research organizations to procure ICT services and goods:

Figure 1: The five steps of a procurement process

3.1 Planning & preparatory phase

The first step to initiate a procurement process for ICT goods or services is the identification of the ICT need.

In public research organizations this task is usually the responsibility of a so-called "initiators". They are nominated by the Director or the Head of Department or Head of Division, and have a technical background so that they can identify technical competences and manage the procurement budget. The initiator has a complete understanding of the ICT needed and of the users of the ICT solutions. Users in public research organizations are usually researchers, scientists or employees. The initiator is supported by technical, procurement, financial and legal experts (See Annex 1: Procurement actors). Before initiating the procurement process, the initiator is also in charge of verifying that there is a corresponding approved programme (the ICT strategy) and budget within its organization. The major tasks of the preparatory phase are:

1. **Establishment of what has to be procured;**
2. **Definition of the technical, legal and procurement specifications**: the specification is the "heart" of all procurement transaction as it defines the user needs and requirements, what has to be procured and the legal, procurement and performance requirements that the organization has;
3. **Definition of the budget:** It is important that during the ICT procurement planning phase a consideration of the business case around the new technology to procure is done. This includes the calculation of the Total Cost of Ownership:
   o **Acquisition costs** - the direct costs incurred to bring the product/service into operation
   o **Operational costs** - costs likely to be incurred throughout the life of the ICT product or service, such as maintenance and updates, staff training and project management costs
   o **Exit costs -** costs required to migrate to another ICT product, service or supplier. In the context of avoiding lock-in, exit costs are very important)
4. **Pre-procurement market engagement:** It enables the procurer to consult the market and to examine alternative solutions in the market place by obtaining early feedback on the feasibility of the project. It serves to understand what the market can deliver now and in the future: if the gap between needs and capabilities is too great, the procurement action may encounter some issues. Transparent market engagement can encourage the participation of a wide range of firms, and can help the procurer develop options that are feasible and best meet the ICT need. In addition, market engagement coupled with research into the available standards is an important step in assessing which standards are the best to include in terms of their market support and quality. Successful procurement actions demonstrate that it is fundamental that the procuring organization has a very good technological knowledge.

3.2 Selection of the most suitable procurement approaches and procedures

A public research organization can select different procurement approaches involving different procurement procedures. They should be decided by the procurement officer. However, input will be needed from IT managers as the type of procurement approach could be influenced by the ICT need. The

first question to answer before starting a procurement process of ICT solutions is: What is the market availability of the solution?

On the basis of the answer the following options are available:

Procurement Approach	Description	When is appropriate?
Commercial Procurement	The act of purchasing goods and services available on the market.	When procuring services and products off the shelf
Pre-commercial Procurement (PCP)[31]	PCP is an approach for procuring R&D services, which enables public procurers to: • Share the risks and benefits of designing, prototyping and testing a limited volume of new products and services with the suppliers, without involving State aid; • Create the optimum conditions for wide commercialization and take-up of R&D results through standardization and/or publication. • Pool the efforts of several procurers.	When procuring R&D services
Public Procurement of Innovation[32]	Public Procurement of Innovative solutions (PPI) can be used when challenges can be addressed by innovative solutions that are nearly or already in small quantity on the market and don't need new R&D.	When procuring innovative solutions that are nearly or already in small quantity on the market

Table 1: Procurement approaches

For big and complex procurement initiatives, a best practice adopted by many public research organizations is joint procurement. Joint procurement means combining the procurement actions of two or more contracting authorities. The key-defining characteristic is that there should be only one tender published on behalf of all participating authorities. Usually, there are several very clear benefits for contracting authorities engaging in joint procurement arrangements:

- Lower prices – Combining purchasing activities leads to economies of scale. This is likely to lead to more attractive offers from suppliers. Particularly for small contracting authorities these advantages can be quite significant.
- Administrative cost savings – The total administrative work for the group of authorities involved in preparing and carrying out one rather than several tenders can be substantially reduced.
- Skills and expertise – Joining the procurement actions of several authorities also enables the pooling of different skills and expertise between the authorities.

Once the procurement approach has been identified, the procurers should decide the procurement procedure to adopt. This selection usually depends on a number of issues: the type and size of the

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[31] http://ec.europa.eu/digital-agenda/en/pre-commercial-procurement
[32] http://ec.europa.eu/digital-agenda/en/public-procurement-innovative-solutions

procuring organization; the value and complexity of the procurement action; the budget and the competences available to conduct the procurement; and the urgency of the need and the internal procurement rules. Procurers should also ensure that the procurement procedures conform to relevant national and EU laws, which constrain the extent to which procurers can restrict their engagement to small numbers of individuals or firms.

Different procurement procedures for public sector exist (See Annex 2). The most common procurement procedures adopted by public research organizations interviewed in the first consultation phase of PICSE are:

1. **Request for Quotations (RFQ)**[33]: It is a procurement procedure that is used for small value procurements of readily available off-the-shelf goods and services. This procurement procedure does not require the preparation of tender documents. The invitations are not complex and this method is considered non-competitive because the procuring entity determines which contractors, suppliers or service providers, to request quotations from as long as a minimum of three are invited. Quotations received in response to a request for quotation should be first evaluated to determine compliance with the technical specifications or scope of work of the requirement and also for compliance with administrative requirements of the request for quotations. Only after the administrative and technical compliance determination, can a price comparison be made between firms found to be compliant. Following this, a purchase order is signed with the bidder submitting the lowest price quotation within the stipulated delivery or completion date.

2. **Invitations to Tender (ITT):** For contracts above a certain threshold public research organizations have to set up a tender procedure. The threshold is usually defined by the members of the council governing the public research organization[34]. This is included in the internal procurement procedures of each public research organization. The most common tender procedures are:
   a. **Open tendering**[35] is the preferred competitive public procurement procedure used for acquiring goods and services. It is executed in accordance with established procedures set out in the procurement guidelines and detailed in the standard bidding documents. The fundamental requirements of open tendering are:
      i. openness to all qualified and interested bidders,
      ii. local advertising (and internationally, when required),
      iii. Neutral and clear technical specifications,
      iv. Clear and objective evaluation criteria, and
      v. Award to the provider offering the lowest costs, without contract negotiations.
   Some disadvantages of the open tendering process are lengthy timeframe for completion of the procurement process, strict adherence to procedures and competences are required, the focus on the least-cost solution.
   b. **Restricted tendering**[36] is a procurement procedure that limits the request for tenders to a selected number of suppliers, contractors or service providers.

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[33] This procurement method is also known as invitation to quote.

[34] Usually public research organizations are governed by a council. Member states are usually part of the council. As funders they have decisional power.

[35] Open tendering is also known as open competitive bidding, open competition or open solicitation.

[36] Restricted tendering is also called Limited Bidding and Selective Tendering.

All the above described procurement procedures require the capacity to write clear and precise requirements that should fit in an Invitation to Tender (ITT) or Request for Quotation (RFQ). Writing of tenders/requests for quotations is a collaborative effort involving different actors at different stages. IT managers should be in charge of technical specifications; procurement officers are responsible for completing the general aspects of the tender documents and of contractual specific requests and legal experts should be involved to provide indications related to the legal framework. Some ITTs/RFQs, especially in the ICT field, usually mention an amount which corresponds either to a guideline for the preparation of the price submission, or to an absolute budgetary limit of the funding available. This latter element represents a substantive requirement of the ITT/RFQ, and tenderers should never exceed it if they do not want to see their offer rejected ab initio. It is also a good practice to provide a draft contract that enables tenderers to know the 'rules of the game' when they prepare their offers, and minimizes or avoids the subsequent effort of negotiation of the contract terms. Procurement documents should also include the list of evaluation criteria and the list of eligibility criteria for suppliers. Eligibility criteria can include the geographical location of the supplier, the supplier company size, the compliance with certifications required by the procuring organization, the belonging to the supplier database of the organization, etc. Management of risk is another important piece of information to be included in the tender.

All these rules are detailed in the procurement rules of the procuring organization.

Once the procurement documents are ready, the procurers invite suppliers to submit their offers.

3.3 Tender/ Request evaluation

Tender/Request evaluation has to be fair, impartial and in accordance with the evaluation criteria defined in the tender documentation. During this phase the procuring organization has to exploit all the market knowledge acquired during the pre-procurement market engagement. The evaluators need competences in evaluating the technical, operational and economic requirements defined in the evaluation criteria. The general good practice is to have expert committees with multidisciplinary skills and representing all the stakeholders.

Usually evaluation criteria are based on the following criteria:

- Background and experience of the company and staff (general and related to the ICT field)
- Understanding of the technical requirements
- Quality of the technical proposal
- Adequacy of the management approach
- Compliance with the tender requirements, in particular costing and planning (and acceptance of contracts conditions where specified in the tendering phase).

3.4 Contract award and negotiation

Usually contracts and purchase orders are awarded to the supplier **which makes the lowest price offer, complies with the contractual, technical, delivery and performance requirements**. Once the supplier has been selected it is notified of the successful outcome, the contract is compiled.

3.5 Contract & performance management/monitoring

The purpose of contract management & monitoring phase is to ensure the contractor is adhering to the terms and conditions of the contract and providing the required services/products that meet the expectations of the purchase. Contract management & monitoring begin when a signed contract is received and the project negotiates a start date with the contractor. Contract management & monitoring end when the all contracted services & products have been delivered, accepted and paid for; and all associated contract paperwork and files have been archived. Managing contract delivery also provides important opportunities for gathering information and conducting appraisal analysis to draw lessons for future projects.

4. Main challenges in procuring cloud services

The dynamic nature of cloud computing often presents **a challenge for procurement and purchasing officials**, whose practices and contracting vehicles were designed to help managers provision hardware and software, not on-demand services like the cloud. The main challenges to be addressed in a procurement process of cloud services can be summarized as follows[37]:

- As with all the purchases of new innovative technologies, procuring innovative services requires new skills and competences. IT managers within public research organizations should have a clear understanding of the new technology being purchased, albeit not the only ones needing to know about the new technology. The procurement initiator should also understand how cloud will impact the institution, the benefits and the costs. Financial officers must have a complete understanding of how to allocate costs. Procures should be aware of the ways of contracting cloud services and of how to evaluate suppliers' Terms of Service. And finally, the legal officer should be much more involved in all the steps of the procurement process to ensure that legal implications are in line with the institute's requirements.

- Organisational/cultural barriers to cloud adoption are very important and should be taken into consideration especially when the organisation is purchasing cloud for the first time. Change management strategies and the set-up of new governance mechanisms should be taken into account already at the time of procurement, as they may incur additional costs.

- Financial issues associated with the new way of cost evaluation in moving to the cloud may arise. It is both important and also challenging to carry out a business case in order to understand how cloud computing fits or doesn't fit with strategic business goals of the organisation. Short-, medium- and long-term costs savings and efficiency gains should be considered.

- Legal-organizational[38] issues may appear due to the cloud service deployments particularities:
  - Applicable law
  - Data location restrictions refer to explicit or legal requirements to keep data on site or within national borders (this is particularly relevant in case of cross-border procurement);
  - Data protection is the major barrier when processing personal data;
  - Lawful access has two dimensions – ensuring that data is accessible on court order, at the same time not having data seized by foreign authorities on the grounds of physical location of data.
  - Procurement issues arise from the current procurement law not matching "take-it" or "leave-it" paradigm of cloud contracts.

- Security, including network security, data protection, privacy, data and service portability, interoperability are all elements to be considered when identifying the cloud solutions to purchase.

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[37] The list of challenges has been put together by analyzing all the sources mentioned in Chapter 8. This chapter will be integrated with the outcomes on the survey of the procurement barriers. D3.1 Procurement Barriers Report (M6). It has to be noted that challenges may vary depending on the cloud services that the user wants to purchase. Specific challenges related to the cloud services that the user is purchasing will be defined in the final release of the procurement model.

[38] D4.1 Services Catalogue, Cloud for Europe, 28/03/2014
http://www.cloudforeurope.eu/documents/10179/15444/D4.1+Services+Catalogue.pdf/8080a024-5770-4d32-b77f-7f54c517f797

- Vendor lock-in (dependency on the vendor) and vendor viability are aspects that have to be considered.
- Dynamic and changing cloud services must be monitored to ensure proper performance and benefit realization. Service level agreements (SLAs) must be drafted and managed properly.
- Vendor contract negotiation is complicated and critical, and there are no standard contracts for cloud. Therefore legal issues, combined with compliance and regulation requirements, compound the challenges of cloud computing.
- Contract termination conditions need to be carefully evaluated: porting data to another cloud or non-cloud solution may involve high costs. Cloud escrow is also missing.
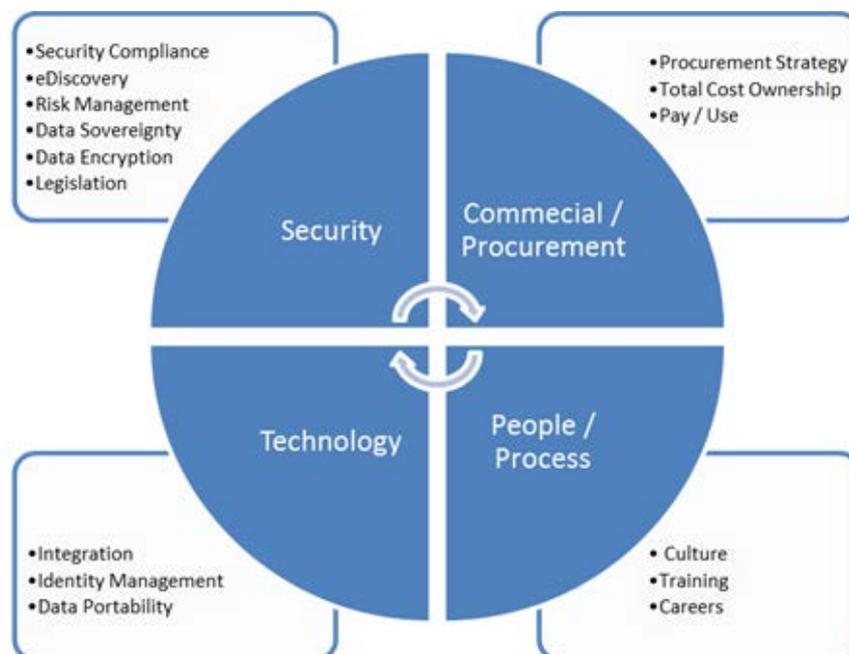

Figure 2: Cloud Transformation Framework - Procurement

The procurement team should carefully assess all the challenges mentioned above.

5. How cloud is impacting the standard procurement procedures

> **The basic value proposition of cloud computing is those resources (e.g., virtual CPUs, storage, network, services, applications, etc.) can be purchased when they are required (pay-per-use model).**

Current procurement procedures for ICT services need to be changed for the procurement of cloud services. **Traditional procurement policies foresee the purchasing of facilities, hardware and software, at a precise and easily estimable cost. However, procurement procedures for on-demand services are less clear, with costs allocated on consumption. In addition, when procuring cloud services it is vital that Terms of Service (ToS) are considered rather than simple Service Level Agreements (SLAs) when the evaluation of suppliers and performance measurement is carried out. Current procurement policies do not foresee procedures for this.**

Changes are required in all five steps of procurement of ICT Services as the table below shows. Some changes are related to the need for new skills and competences which impact on all procurement steps, from the definition of objectives and specifications, to the evaluation of the suppliers. Others have direct impact on the procurement process.

The 5 steps of the procurement process of ICT services	What's different when procuring cloud?	
	Impact on skills & knowledge required	Impact on the procurement process
1. **Planning & Preparatory Phase**	✓ *Identification of the procurement objective* ✓ *Definition of the services that have to be procured* ✓ *Definition of technical requirements* ✓ *Definition of legal requirements* ✓ *More complex cost benefits analysis* ✓ *New ways to evaluate the budget (pay-as-you-go model with minimal or no upfront cost)*	✓ *Different skills involved at different times (legal experts contribute even at an early stage)* ✓ *Moving from a detailed requirements gathering phase to a service requirements matching phase*
2. **Selection of the most suitable procurement process**	✓ *Preparation of the tender / request documentation* ✓ *Definition of the evaluation / suppliers' eligibility criteria*	✓ *Considering the need of a pilot phase* ✓ *Cloud services evolve rapidly. Short procurement processes are envisaged.*
3. **Tender/Request Evaluation**	✓ *Suppliers' selection & evaluation based on comparison of Terms of Service that don't have a standard format and include parameters different from those that appear in the traditional ICT services purchases*	✓

		(lock-in, data privacy).	
4.	**Contract Award & Negotiation**		✓ ✓ *New types of contracts oriented to service and performance* ✓ *New ways of purchasing*
5.	**Contract & performance management/monitoring**	✓ *Different performance monitoring systems*	✓ *Service billing and metering* ✓ *Cloud providers regularly revise their service offerings, and the changes automatically flow to all customers* ✓ *Data Retention*

5.1 Impact on skills & knowledge required

As explained in chapter 2, before starting any procurement action it is fundamental to identify **what is driving the purchase**. This is particularly true in the case of cloud computing. When considering a move to cloud computing, public research organisations need to carefully identify the most suitable cloud application to meet their needs. The type of application will dictate the cloud deployment model that is used (private, public, and hybrid[39]), addressing specific security, privacy and availability requirements for that application. Public research organisations must also consider the cloud service model[40] (IaaS, PaaS, SaaS or XaaS) that best addresses their business requirements. In many cases, SaaS, with its pay-per-use business model will be the most attractive economic option, especially for small organisations, since the need for full-time IT personnel is eliminated along with capital expenses associated with system hardware, operating systems and software. PaaS is a viable option for larger institutions that have the resources to develop their own cloud based solutions. For research organizations seeking a more scalable infrastructure, IaaS offers a cost-effective turn-key solution that provides scalability with security, flexibility, defined SLAs, built-in backup and data protection.

> **The use of cloud services requires the adoption of new skills**

All these considerations can only be addressed by skilled and competent IT managers that have a clear understanding of the new technology being purchased. But it doesn't stop there. IT managers are not the only ones who need to know about the new technology. The procurement initiator should understand what it means to adopt cloud services, how to identify the benefits and evaluate the costs, the impact on the institution; ways of contracting cloud services and of how to evaluate suppliers' Terms of Service. Financial officers must have a complete understanding of how to allocate costs. And finally, the legal officer should be much more involved in all the steps of the procurement process to ensure that legal implications are in line with the institute's requirements.

The table below identifies additional competences that the actors described in chapter two require to successfully complete a procurement of cloud services. It is the responsibility of the organisation to properly train the actors involved in the procurement process of cloud services.

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[39] See Annex 3: Cloud deployment models
[40] See Annex 4: Cloud service models

Role	Additional skills
Procurement initiator	As overall coordinator of the whole procurement process and main strategic leader of the procurement action, the initiator should be well aware of what it means to adopt cloud services including how to identify the benefits and evaluate the costs and impact on the organisation. It is suggested that the initiator establishes a change of management strategy.
Technical Officer	The technical officer is responsible for defining technical specs and having a clear view of services available on the market. They should have a complete understanding of the new platform, how services are deployed and managed, how they are patched and how they are monitored. There may also be a need to learn new provisioning and orchestration tools to successfully manage the new cloud services. Finally, to enable granular control, monitoring and integration with existing administration tools, developers and administrators should learn how to use the new cloud provider's Application Programming Interfaces (API). Finally, the technical officer is responsible for evaluating suppliers and the SLA items related to technical performance.
Procurer	The procurer is responsible for the identification of potential suppliers and the procurement process. They should be aware of the different ways of contracting cloud services, how to estimate the economic benefits and how to evaluate a supplier and items related to contract, pricing and payments that are included in the SLA.
Financial Officer	The Financial Officer must have a complete understanding on how to allocate the cloud costs.
Legal Officer	The Legal Officer should be updated with the legal implications brought by cloud computing.
ICT vendor	The ICT vendor is the cloud service provider (CSP).

Table 2: Additional skills required for a successful procurement of cloud services.

New skills and competences play a pivotal role in the following steps:

- ✓ Identification of the procurement objectives
- ✓ Definition of the services that have to be procured
- ✓ Definition of technical requirements
- ✓ Definition of legal requirements
- ✓ More complex cost benefits analysis
- ✓ New ways to evaluate the budget (pay-as-you-go model with minimal or no upfront cost)
- ✓ Preparation of the tender / request documentation
- ✓ Definition of the evaluation / suppliers' eligibility criteria
- ✓ Supplier selection based on SLAs comparison
- ✓ Different performance monitoring systems

5.2 Impact on the procurement process

Procuring cloud services also has a direct impact on traditional steps of the procurement process:

- ✓ **Current procurement policies.** In some public research organisations there are policies that are not aligned with the procurement of cloud based services. This is especially true in the purchase SaaS. These policies allow public research organizations to only purchase hardware and software or anything which has upfront cost. The policies do not foresee procedures for procuring an on-demand service, with costs allocated on consumption.

- ✓ **Different skills involved at different times (relevant role of the legal experts, even at an early stage).** When procuring cloud services there should be closer collaboration with the initiator, the IT

manager, the procurers, the financial officer and the legal officers. If in traditional purchases of ICT services the process was more sequential (the IT manager defines the technical specs which are then revised by the procurers and the financial officers. The legal expert then evaluates the contract). Cloud services require immediate collaboration between all actors. This is partially due to the fact that no standard frameworks are in place, and also to the fact that the definition of the service is mainly a check of what different providers propose. The role of the legal expert becomes prominent right from the start. A preliminary assessment to understand technical, legal and procurement needs and restrictions, limitations or regulatory requirements, which may shape the type of service required is a fundamental factor. The requirements often include features of the cloud service; performance and service levels; data security; data location; service provider support; and end of contract data transition. Each requirement will differ according to the nature of the data, the industry and any regulation and purpose for using the service. In addition, cloud services entail issues on data ownership, intellectual property (IP) and data location.

- ✓ ***Moving from a detailed requirements gathering phase to a service requirement matching phase.*** Typically, a software development lifecycle (SDLC) starts with a detailed requirements gathering phase, followed by the design of the solution architecture. The solution is then built and tested, and finally delivered into production where it is operated and maintained. Since many types of cloud services, such as Software as a Service (SaaS), are already pre-built, the classic SDLC approach may not be suitable when procuring cloud services.

- ✓ ***Considering the need for a pilot phase.*** Moving traditional ICT to the provision of cloud computing will involve significant uncertainties. The change of platform and provision will affect efficiency, and hence the amount of resources required, and cost. However, before the tasks are run it is impossible to predict the performance implications. Running benchmarks on cloud systems also has a cost implication itself. Starting small is one of the key success factors of a procurement action of cloud services. The inclusion of a pilot phase in the procurement action is something that has to be considered in an agile procurement model of cloud services.

- ✓ ***As cloud services evolve rapidly, short procurement processes are envisaged***

- ✓ ***Suppliers' selection & evaluation is based on comparison of Terms of Service*** *that don't have a standard format and include parameters different from those that appear in the traditional ICT services purchases (lock-in, data privacy).* The greater flexibility of a cloud computing service as compared with a traditional ICT contract is balanced by less certainty for the customer in terms of the location of data placed into the Cloud and the legal foundations of any contract with the provider. All these aspects need to be carefully evaluated during the suppliers' selection and evaluation phase.

- ✓ ***New types of contracts oriented towards service and performance.*** Procuring ICT services traditionally involves one-off purchases of expensive hardware or software with additional support and maintenance costs. Cloud service models avoid up-front costs in exchange for recurring and

often variable service charges. Cloud and other 'as-a-service' offerings combine many indirect costs into a single service payment based on use. This means that there may be a wide range of financial implications that need to be considered when comparing on-premises solutions with cloud services. These include energy consumption, resourcing needs, data centre resources, capital costs for infrastructure and asset maintenance. The organisation's financial procedures and funding arrangements must be able to address the on-demand model, which often involves a move of funds from CapEx to OpEx.

✓ **New ways of purchasing.** Cloud services are usually available via online catalogues. PaaS or SaaS can be set up in minutes via an online sign-up process. The simplicity and apparent lack of formality of cloud procurement can lull customers into treating cloud contracting as just another 'click-through' exercise to which very little attention is paid.

✓ **Service billing and metering.** As cloud services are billed regularly based on usage, the user should establish processes review and approve the billing and metering of cloud services. This will ensure that billing items and usage are directly matched. Some cloud services providers offer cost forecasting tools or usage notification services. The user should take advantage of such services if they are available.

✓ **Cloud providers regularly revise their service offerings, and the changes automatically flow to all customers.** Cloud providers regularly revise their service offerings, and the changes automatically flow to all customers, whether they are requested or not. This makes procurement uncomfortable because there is uncertainty over whether services will always be available. For example, in an IaaS context, a change such as an upgrade of operating system, the service provider should inform users of the changes and provide an environment for the affected users to test whether there are adverse impacts brought by the change.

✓ **Data Retention.** When terminating cloud services, the user has to decide on how the data stored in a cloud platform should be handled. Options include deleting the data, migrating the data to another provider or archiving data with the original CSP. Before terminating the contract, the user should ensure all data are deleted.

6. The latest public sector trends which facilitate the procurement of cloud services

This chapter describes the latest trends in procuring cloud services in the public sector in Europe.

6.1 An iterative framework for the UK government: G-Cloud

The UK Government G-Cloud[41] is an initiative which aims to **ease procurement by public sector bodies in departments of the United Kingdom Government**. G-Cloud is part of a **"cloud-first" policy** encouraging the use of cloud services models over and above traditional computing services.

G-Cloud is essentially an iterative framework that allows government departments and organisations to buy cloud services from a list of pre-approved vendors. Suppliers who want to offer their services through G-Cloud have to submit their service details via the G-Cloud framework when an Official Journal of the European Union (OJEU) is open. On average, an OJEU will be open for 6 weeks, every 6 to 9 months. Once the submission has been processed, buyers will be able to find services live on the Digital Marketplace.

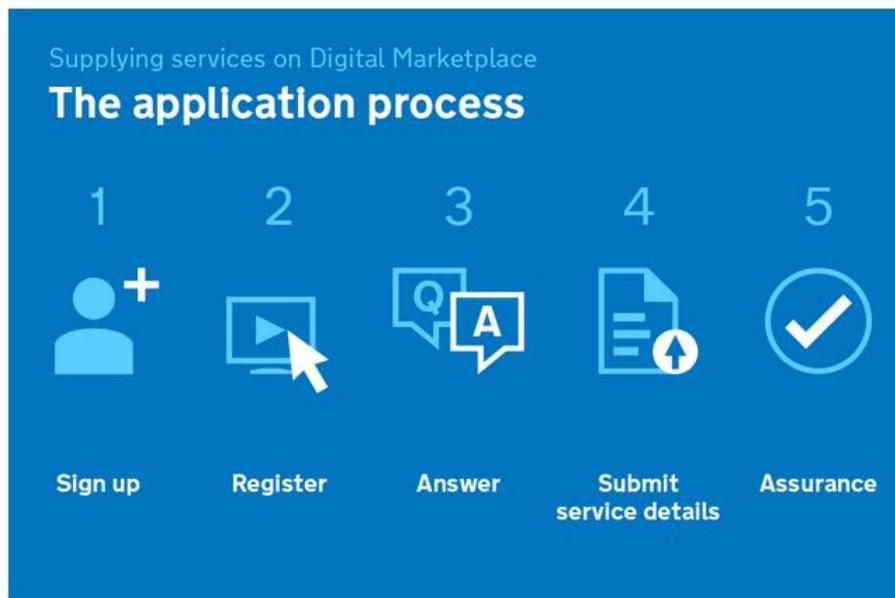Picture below describes the supplier application process:

Figure 3: Supplying services on Digital Marketplace[42]

The application process foresees five mandatory steps:

- Sign up to the Crown Commercial Service (CCS) eSourcing Portal[43].

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[41] https://www.gov.uk/digital-marketplace
[42] https://www.digitalmarketplace.service.gov.uk/suppliers-guide
[43] https://crowncommercialservice.bravosolution.co.uk/web/login.shtml

- Register expression of interest on the CCS eSourcing Portal when the OJEU opens.

- Answer the invitation to tender (ITT) questions on the CCS eSourcing Portal. Services need to meet the definition of cloud computing services as described in the official recommendations of the National Institute of Standards and Technology (NIST)[44].

- Submit company and service information to the Digital Marketplace using the service submission portal (SSP). Information includes a short service description, key product features and benefits, pricing details and terms and conditions[45]. Each service needs to fit into one of 4 categories, or 'lots': Lot 1 - Infrastructure as a Service (IaaS); Lot 2 - Platform as a Service (PaaS); Lot 3 - Software as a Service (SaaS); Lot 4 - Specialist Cloud Services.

- Wait for assurance checks to be made on the submitted information.

G-Cloud aims to promote transparency with all supplier products and companies listed side by side in an online catalogue; and introduce new suppliers. Most suppliers signed up to the framework are SMEs.

> The G-Cloud consists of:
>
> - **A series of framework agreements with suppliers, from which public sector organisations can call for services without needing to run a full tender or competition procurement process**
>
> - **An online store - the "Digital Marketplace"** (previously "CloudStore" https://www.gov.uk/how-to-use-cloudstore) that allows public sector bodies to search for services that are covered by the G-Cloud frameworks

This framework has taken agile, iterative techniques into procurement with regular refreshes and updates of the framework. A new version of the G-Cloud framework is released about every 6 months. Each version of the framework runs for 12 months so frameworks will overlap. This can have both advantages and disadvantages. **New suppliers can regularly join the framework** and **gradually adapt to meet the changing needs.** However, it can also create **uncertainty and higher costs for suppliers**. When suppliers are small the cost of keeping up-to-date with ever changing frameworks can be expensive and make up a high percentage of their revenues thus becoming a disincentive to enter the public sector.

There have been several calls of contracts since the service was launched in 2012. By May 2013 there were **over 700 suppliers 80% of which were small and medium enterprises**. £18.2 million (US$27.7 million) of sales were made by April 2013. With the adoption of a Cloud First policy in the UK in February 2014, sales have continued to grow, reportedly hitting over **£50M in February 2014**. These are based on procurement of some 1,200 providers and 13,000 services, including both cloud services and (professional) specialist services as of November 2013.

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[44] http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf

[45] Please note that they are fixed: they can't be changed during the lifetime of the framework.

G-Cloud currently accounts for monthly sales of £20-£30m with the majority of this spent on central government. Approximately three quarters of the monthly expenses are for the acquisition of professional services.

6.2 Joint pre-commercial procurement for better cloud adoption in the public sector: Cloud for Europe

Cloud for Europe[46] is a project co-funded by the European Commission under the Framework Programme for Research and Innovation (FP7) that aims to support public sector cloud use as collaboration between public authorities and industry.

Supported by stakeholders from the public sector, industry and standardisation bodies, the main objectives of Cloud for Europe are to:
- Identify obstacles for cloud use in the public sector
- Define services that overcome these obstacles
- Procure research from industry to find innovative solutions for cloud services

The Cloud for Europe project addresses the objectives of the European Cloud Partnership and helps partners to adopt a well-defined European Cloud Computing Strategy for the public sector. The project started in June 2013 and runs until November 2016. Cloud for Europe gathers 24 partners from 12 countries[47].

The following public entities came together to start a procurement action of cloud services aimed to research and demonstrate solutions to overcome obstacles for the adoption of cloud computing by the public sector namely, the Agency for Digital Italy (Italy), the Ministry of Finance and Directorate General for Tax Administration (the Netherlands), the Ministry for Public Administration (Portugal), the National Institute for Research & Development in Informatics - Ministry for Information Society (Romania) and the Ministry of Finance (Slovakia). Their objective was to **address issues encountered in trying to purchase cloud services as single customers.**

The main reason why these organizations wanted to procure cloud services was to lower the Total Cost of Ownership (TC0) and the fixed financial costs. More importantly, they wanted to **shorten the procurement and service provisioning process and purchase services that meet their needs**.

The following issues in purchasing as a single customer were identified:

- Imbalanced negotiation power between CSPs and Customers (especially with big cloud providers). Services cannot be customised according to customer needs and usually no price negotiation is allowed;
- The number of services available / offered is limited or the services that customers want to buy are still immature;

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[46] www.cloudforeurope.eu

[47] http://www.cloudforeurope.eu/partners

- There is a lack of confidentiality assurance in IPR management and a lack of service interoperability;
- SLAs are unclear, badly defined and cannot be compared;
- There are stringent legal and regulatory requirements.

In the Cloud for Europe project, a **joint pre-commercial procurement** (PCP) was considered the best way to procure. **PCP lets industry develop R&D innovative cloud services that best meet public sector needs, and also provides public procurers with the possibility to jointly discuss the potential of cloud services with industry.**

In PCP, **dialogue with industry** is an important task. It allows cloud customers (the public procurers) to run a comprehensive market analysis and is helpful in obtaining an overview of the state of the art and of the technologies available.

The PCP process itself is composed of three phases. Each phase is open for competitive solutions provided by bidders. The phases comprise solution exploration, prototyping and test implementation. After each phase, bids are evaluated to find the best solutions.

The work of Cloud for Europe will be carried out in three distinct competitive phases over a total of 18 months: Phase 1: Solution design; Phase 2: Prototype development; Phase 3: Original development of a limited number of first products or services in the form of a test series.

The main result of a PCP action is a pilot to test the solution. A second procurement action is then needed to purchase the product. This can be carried out as a commercial procurement or as a public procurement of innovation (PPI) action.

In December 2014, Cloud for Europe published its tender[48] for the joint PCP of research and development in cloud computing services. Running for two months, the purpose of the tender is to research and demonstrate solutions to overcome obstacles in the adoption of cloud computing by the public sector. The Cloud for Europe PCP invites **suppliers to bid for any or all of three services** (lots), each of which provides a framework agreement for the realisation of research and development services.

The lots are:
1. Federated certified service brokerage
2. Secure legislation-aware storage
3. Legislation execution

For each lot, several bids will be awarded a framework agreement. After each phase, results will be evaluated and bids will compete for assignments in the subsequent phase.

The total budget available for the contract awards **is four million euro**. The deadline for submission is February 2015.

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[48] http://ted.europa.eu/udl?uri=TED:NOTICE:424518-2014:TEXT:EN:HTML&src=0, www.agid.gov.it/cloudforeurope

6.3 A call for tender from DG DIGIT

The mission of DIGIT is to deliver digital services to enable European Union (EU) policies and to support the European Commission's (EC) internal administration. DIGIT as trusted partner has the responsibility to:

- Provide the EC, and whenever appropriate other European Institutions and bodies, with high quality and innovative:

    o Workplace solutions (creating new ways of working and collaboration for staff)

    o Business solutions (delivering information systems supporting rationalised business processes within the framework of the corporate IT Governance strategy)

    o Infrastructure solutions (providing reliable, cost-effective and secure infrastructure and services)

    o Effective solutions (aligning IT investments with business priorities, facilitating relationships with our strategic partners, balancing risk with business value for the Institution);

- Support the modernisation of public administrations by promoting and facilitating interoperability so that European public administrations can work seamlessly together across boundaries – Interoperability solutions.

Depending on their security and data qualifications, information systems can be deployed either in a private cloud operated for EC and EU Institutions only, or in a public cloud operated for external customers too. This hybrid approach allows the EC to get the most effective solution under different circumstances to meet the EU changing needs.

DG DIGIT has just launched a call for tender[49] that aims to secure about 2500 Virtual Machines and 2500 Terabytes of storage for up to 4 years to the EU Institutions. 75% of the volume will be reserved for the European Parliament, Council and other EU institutions and agencies. The volume for the EC represents a maximum 15% of its current in-house IT capacity.

The call for tender is fully in line with the European Cloud Computing Strategy[50], adopted by the EC in September 2012, which aims at speeding up Cloud uptake across Europe. In this strategy, the EC calls upon Member States to embrace the potential of cloud computing.

In this first call for tender for cloud services, security and data protection are specifically addressed.

All data and infrastructure are deployed on EU territory only, for essential security and data protection reasons and to be compliant with EU data handling requirements. It also builds on the most recent developments in security standards, such as the latest framework on IT security from ENISA[51] (European Network and Information Security Agency). Security requirements for the tender are presented in a questionnaire which is compatible with EU internal rules and the high number of security standards.

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[49] https://etendering.ted.europa.eu/document/document-file-download.html?docFileId=7469
[50] https://ec.europa.eu/digital-agenda/en/european-cloud-computing-strategy
[51] https://resilience.enisa.europa.eu/cloud-computing-certification/cloud-certification-schemes-metaframework

Deadline date for submission of offers is the 1st April 2015.

6.4 Implementation of an on premise cloud infrastructure: DICTU Cloud

The DICTU Cloud project falls within the Dutch Central Government's Cloud Strategy. In the Netherlands there were 62 public service datacenters. These have been merged into 4 large datacenters that will become the Dutch government's private cloud.

The on premise multi-tenant (multiple Dutch public bodies using the services) cloud infrastructure will be owned and managed by DICTU. The savings expected from this PCP action are €3.5M/year over a 5-year period. The main savings come from personnel savings (DICTU company reorganization).

6.5 A cloud framework for UK education & research: Janet

Janet[52] is a government funded organisation, with the primary aim of managing the operation and development of the Janet network, on behalf of Jisc[53] (the Joint Information Systems Committee) to meet the needs of its research and education communities. Jisc is the UK's expert on digital technology for education and research, its work is guided by its funders, owners (AoC, GuildHE and UUK) and trustees.

Janet has set up a **framework agreement to facilitate the purchase of cloud and data centre services through organisations connected to Janet.**

This framework was procured in accordance with the EU procurement legislation, and runs until 6 February 2016. The templates for the legal contracts are available for use by eligible organisations (Janet, Janet connected organisations, Regional Network Operators, members of the Purchasing Consortia and the Regional Broadband Consortia).

Through the framework it is possible to buy a broad range of co-location, virtual servers and elements of cloud computing services, commonly referred to as "Infrastructure as a Service" (IaaS) and "Platform as a Service" (PaaS). The services are provided by eight equally ranked suppliers.

7. The emerging cloud marketplaces

7.1 A cloud marketplace for science: the Helix Nebula Marketplace

The Helix Nebula Marketplace[54] is a European Cloud Marketplace service that is compliant with EU regulations and legislation, created through collaboration between commercial providers and public e-Infrastructures, including the European Grid Infrastructure (EGI) and the pan-European research and education network (GÉANT). The marketplace is open to new cloud providers that are able to participate competitively in line with European regulations and with a suitable quality of service.

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[52] https://www.ja.net/
[53] http://www.jisc.ac.uk/
[54] http://www.helix-nebula.eu/

The marketplace intends to deliver easy access to a range of commercial Cloud Services through a broker that will be identified within the Helix Nebula Initiative (HNI).

The Cloud services are offered to the global research community, for both publicly-funded and commercial research and technology organisations from diverse sectors, including healthcare, oil and gas, financial, high-tech, and manufacturing. This scope will enable large-scale and High Performance Computing (HPC) deployments from the start.

A pilot phase of the marketplace has been carried out in which flagship applications from CERN, EMBL and ESA were tested. In May 2014 the first Helix Nebula Marketplace product, the HNX[55] platform, was launched and entered its production phase. Customers have been able to use HNX to choose between various suppliers or combinations of suppliers offering independent cloud services, and to buy, use and manage such cloud services seamlessly.

HNI offers a unique environment in which public organisations can discuss freely with commercial and publicly funded cloud service providers. The priority now is to develop agreed and interoperable service management policies, process and procedures for cloud offering in a hybrid federated environment, equitable contractual conditions and market transparency to engage a critical mass of suppliers and convince the demand-side to adopt it as a production environment.

7.2 A cloud marketplace for IaaS: Deutsche Börse Cloud Exchange

Recognising the increased industry investment in cloud technology, Deutsche Börse has decided to use its market expertise to reduce cloud adoption hurdles by developing a vendor-neutral marketplace for IaaS resources. Founded in May 2013, Deutsche Börse Cloud Exchange[56] (DBCE) aims to establish a secure, transparent and liquid spot market for IaaS resources. The exchange is planned to go live in April 2015.

Deutsche Börse Cloud Exchange at a glance:

- Allows multiple IaaS providers to offer resources to consumers in one place.

- Allows buyers to select from a wide range of sellers.

- Provides product consistency throughout the marketplace.

- Provides standardised contracts for all market participants.

- Acts as an independent market operator.

- Provides neutral governance.

- Defines a simple and broad product portfolio for buyers to choose from.

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[55] http://hnx.helix-nebula.eu/
[56] http://www.dbcloudexchange.com/en/

Deutsche Börse Cloud Exchange will offer standardised products, allowing an accredited seller to contract with any registered buyer in a unified market and legal framework. Interoperability between multiple cloud providers will be enabled through standardised interfaces and a thin cloud management layer designed by the innovative cloud software provider Zimory. This will allow buyers and sellers to easily connect to the cloud marketplace.

Benefits for buyers include transparent, flexible and on-demand purchasing of standardised cloud resources, real-time price comparison of different cloud providers, data locations selectable through Governing Regions.

On the other side, sellers will have access to a huge sales channel, as product offering is exposed to all exchange participants and reduced administration burdens as customer billing is managed and processed by the exchange. All standards for the tradable IaaS resources are defined and controlled by the neutral exchange, making it easier for buyers to compare offerings and for sellers to structure and operate their infrastructure. Legal certainty is provided with standardised service level agreements (SLAs)monitored and enforced by Deutsche Börse Cloud Exchange to assure a fair and manipulation-free trading, pricing and billing.

Prior to being admitted to Deutsche Börse Cloud Exchange, each participant is required to undergo the Deutsche Börse Cloud Exchange admission process and must agree to accept and follow specific rules and standards. Availability monitoring and benchmarking will ensure product quality among all registered IaaS providers.

8. The legal background of public procurement in Europe

The Openforum Europe (OFE) Procurement Monitoring Report 2013, published in July 2014 reports the following state of the art for the EU public procurement rules:

Modernisation of the EU Public Procurement rules

A new Directive (2014/24/EU) revising the 2004 so-called "Classic" Directive on Public Procurement was approved in February 2014[57]. However, it will fully come into force in April 2016. The Directive mandates technical specifications of a tender to be "open to competition as well as to achieve objectives of sustainability" and that "technical specifications should be drafted in such a way to avoid artificially narrowing down competition through requirements that favour a specific economic operator by mirroring key characteristics of the supplies, services or works habitually offered by that economic operator"[58].

In 2011 the European Parliament adopted a resolution for the modernisation of Public Procurement[59] recommending that EU rules ensure "transparency and proper use of taxpayers' money". In particular in the ICT sector, these rules should "ensure the interoperability of different systems and avoid lock-in".

Technical Specifications

Public contracts above certain thresholds[60], having as their object the acquisition of software packages or information systems, fall under the remit of Directive 2004/18/EC. From April 2016, they will fall under the remit of Directive 2014 /24/EU[61]; According to Art. 23(8) of the Directive 2004/18/EC, to Recital 74 and Art. 42(2) of the Directive 2014/24/EU, public purchasers may draw up technical specifications, and they must allow procurement to be opened up to competition[62]. The thrust of these rules is to ensure the use of non-discriminatory specifications, which allow all potential contractors, suppliers or service-providers to meet the requirements and prevent artificial restriction of potentially successful tenderers. In this respect, they do no more than confirm the application of the Treaty principles to the use of discriminatory technical specifications[63].

The main Treaty provision is contained in Article 34 TFEU (ex. Article 28 TEC). It prohibits all quantitative restrictions as well as any other measures, having an equivalent effect of distorting competition. The definition contained in this article encompasses "all trading rules, or measures, enacted by Member States, which are capable of hindering, directly or indirectly, actually or potentially intra-Community trade"[64].

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[57] http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.094.01.0065.01.ENG
[58] Recital 74 of Directive 2014/24/EU
[59] European Parliament resolution of 25 October 2011 on modernisation of public procurement
http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2011-0454&language=EN
[60] EU requirements do not apply to contracts below certain thresholds, and to certain exempt sectors.
[61] Article 7 of Directive 2004/18/EC and Article 4 of Directive 2014/24/EU
[62] Cf. Recital 29 of Directive 2004/18/EC and Recital 74 of Directive 2014/24/EU.
[63] Cf. Case 45/87 Commission of the European Communities v Ireland [1988] ECR 4929
[64] Case 8/74 Procureur du Roi v Dassonville [1074] ECR 837

This article has been used to challenge the technical specifications set by contracting authorities (e.g., in the UNIX case[65]). According to the CJEU's jurisprudence, only under exceptional circumstances (i.e. where it is not possible to provide a sufficiently detailed and intelligible description of the subject of the contract) references to a specific make or source, or a particular process, or to trademarks, patents, types or a specific origin or production can be made, but they must be accompanied by the words "or equivalent"[66].

To this end, it must be possible to submit tenders which reflect the diversity of technical solutions. Accordingly, it must be possible to draw up the technical specifications in terms of functional performance and requirements and, when reference to standards is not possible, equivalent arrangements must be considered by contracting authorities[67].

In conclusion, the Public Procurement Directives make it explicit that technical specifications shall afford equal access for tenderers and not have the effect of creating unjustified obstacles to the opening up of public procurement to competition. Article 23 of Directive 2004/18/EC and Article 42 of Directive 2014/24/EU specifically prohibit the manipulation of the use of technical specifications in line with the CJEU's jurisprudence in this context.

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[65] Case C-359/93 Commission of the European Communities v Kingdom of the Netherlands (UNIX) [1995] ECR I-157
[66] Article 23(8) of Directive 2004/18/EC and Article 42(2) of Directive 2014/24/EU.
[67] Cf. Recital 29 and Article 23 of Directive 2004/18/EC, and Recital 74 and Article 42 of Directive 2014/24/EU.

9. PICSE Procurement model – draft release

The PICSE procurement model is a document designed to be used as a template by the public research organizations. It guides the procurement team in purchasing cloud services by highlighting the important factors and procedures to consider in the procurement process. The model can be used by the initiator of the procurement action to coordinate the whole procurement process of cloud services or by the main coordinator of the procurement action. The questions in the model require the competences of all the other actors involved in the procurement activity.

All initiators should consider the following recommendations before starting any procurement process:

o   Learn from peers (increase your knowledge of cloud procurement by consulting existing use cases and best practices)

o   Start small (a pilot phase is strongly suggested)

o   Build a skilled and competent procurement team (make sure that all the competences are in your organization otherwise outsource)

o   Monitor very closely (once the procurement is done, monitor both performance & costs)

Procurement Steps	Checklist	Different parameters to evaluate	Outputs	Who should answer the question
Step 1: Assess needs	What is your procurement objective?	• Offer additional services • Reduce Costs • Move to a model aligned with the actual demand (consumption based pricing) • Improve Standardisation • Etc.	Definition of the procurement objectives	Initiator
	What are the expected benefits?	• Costs Savings • Better efficiency • Etc.		
	What cloud services do you want to buy?	• Storage • Computing • Email	Definition of the cloud service model (IaaS, PaaS, SaaS,	Initiator / IT officer

		•ERP systems •Applications •Etc.	combination of the above models)	
	Who are the users of your service?	•Researchers & scientists •Employees •Etc.	Identification of the cloud deployment model (private, public, community, hybrid)	Initiator / IT officer
	Where are your users located?	•National •European •International •Etc.		
	Are there any particular requirements related to the users?	•Data •…		
	What's the availability on the market of the solution that you want to procure?	•Off-the-shelf •Nearly or already in small quantity on the market International •R&D •Etc.	Definition of the type of procurement action (Commercial Procurement, PCP, PPI)	Initiator / IT officer
	Have you calculated the Total cost of Ownership?	• Acquisition costs • Operational costs • Exit costs • When a legacy system is in place – costs for moving the current solution to the cloud	Understanding the ROI	Procurer/IT Officer / Initiator
	What is the value of the procurement action?	•<public research organization threshold •>public research organization threshold	Budget evaluation & Selection of the procurement process	All
	Can the service that you are buying be of interest of other public research organizations?	•Yes •No •Don't know	Evaluation of the possibility of running a joint procurement action	Initiator
	Have you got the	•The procurement team is made up of an initiator, an IT manager, a procurer, a	Assessment of	Initiator

	internal skills to run the procurement action?	legal and financial expert in cloud computing •There is no procurement officer •There is no legal expert •There is no financial expert •Etc.	internal skills	
	What type of funding is available to support the contract?	•i.e. Capital versus operational expenditure	Understanding if the funding model is appropriate	Financial Officer
	Have you secured approval of the procurement business case?	•Yes •No •Etc.	Getting the approval of management	Initiator
Step 2: Assess marketplace	Can one commercial provider meet your needs?	•Yes •No Etc.	Selection of the type of provider (Commercial Providers, marketplace, different initiative)	IT officer
	Does your staff have enough knowledge to understand the technological solutions offered by the market?	•Yes •No •Etc.	Market assessment	Initiator/IT officer
	Have you planned an efficient market consultation?	•Events •F2F meetings with suppliers •Desktop research •Etc.		
	Does the supplier offer the possibility to test the service?	•Yes •No		
Step 3: Write the offer/tender	What is the information included	•Specification of needs •Procurement evaluation process	Preparation of the procurement	All

request	in your offer/tender request?	• Evaluation criteria • Suppliers eligibility criteria • Management of risks			documentation	
	Have you considered the following aspects in defining the technical specifications?	• Interoperability requirements • Risk of vendor lock-in • Legacy System			Definition of the technical requirements	IT officer
		IaaS	PaaS	SaaS		
		• CPUs • Etc.	TBD	TBD		
	Have you considered the following aspects in defining the legal specifications?	• Ownership of data • Control of data • Location of data • Compliance with applicable laws and policies regarding public access to data, record retention and contracts			Definition of the legal requirements	IT officer / Legal officer
	Have you identified clear and objective evaluation criteria	• Qualification of suppliers • Eligibility criteria			Definition of evaluation criteria	All
	Have you incorporated in your procurement process a pilot phase?	• Yes • No • The complexity of the procurement action is low thus is not needed			Definition of a pilot phase	IT Officer
Step 4: Evaluate and award	Who are the evaluators of the tender/offer request?	• External experts • Internal staff • Etc.			Ensuring the right competences are allocated	Initiator
	What are the competences of the evaluating team?	• Technical • Operational • Economics • etc				

	Have you considered these major issues in the contract?	• Pricing • Infrastructure Security/ Right to Audit and Inspect • Data Assurances • Legislation • Service Level Agreements (SLAs) • Outsourced Services • Functionality • Disaster Recovery/ Business Continuity • Mergers and Acquisitions • Compliance with Laws, Regulations, and Other Standards • Terms and Conditions Modification • Contract Renewal and Termination	Assessing contracts[68]	All
	Have you compared SLAs?	• SLA Context/Overview • Service Descriptions (Service Inter-dependencies, help desk, etc.) • Metrics & KPIs (Level of Service Available, Performance Metrics, Quality Assurance, etc.) • Continuity or Outages (Incident Response & Reporting, Disaster Recovery, Outage resolution, etc.) • Security Management (Privacy Guarantees, vulnerability management, data ownership, etc.) • Roles & Responsibilities • Payment, recourse and reward (how payment is made, excluded performance, etc.) • Terms & Conditions • Reporting guidelines & requirements • Service management	Comparing Cloud Computing SLAs[69]	All
	Have you considered contract duration?	• How long is the contract being undertaken for? • What is the likely lifecycle of the solution given marketplace evolution and trends?	Establishing contract duration	Procurer, IT Officer

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[68] Cloudy with a chance of success http://www.businessofgovernment.org/report/cloudy-chance-success-contracting-cloud-government

[69] Cloud SLA Considerations for the Government Consumer http://www.mitre.org/publications/technical-papers/cloud-sla-considerations-for-the-government-consumer

Step 5: Implementation and Performance	Is there a performance monitoring system in place?	• In house system • Provided by the supplier • There is no monitoring system • Etc.	Evaluating contract performance	IT Officer
	Is there a billing monitoring system in place?	• In house system • Provided by the supplier • There is no monitoring system • Etc.	Evaluating contract payments	Procurer/Financial Officer
	How will you regularly assess the provider's performance?	• Periodic audit • Reporting in place • Etc.	Evaluating suppliers	Initiator / Procurer
	How do you improve your procurement process?	• A case study report is drafted after procurement action • Lessons learnt are identified and shared with the team after each procurement action • Etc.	Improving the procurement process	Initiator

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11.　　Annex 1: Procurement actors

It has to be said that not all public research organisations have procurement offices in place. This usually depends on the size of the public research organisations, on the overall procurement strategy of the institution, on the in-house competences and on the needs encountered so far by the organisations.

The table below gives an overall understanding of the actors that usually take part in a procurement process of ICT services.

Role	Description	Relevance in the procurement process
Procurement initiator	A person nominated by the Director or the Head of Department or Head of Division, usually with a technical background that has the *responsibility, the technical competences and the budget*, to start and handle one (or more) procurement(s). He/she is the coordinator of the whole procurement process and responsible for achieving the support and buy-in of all stakeholders for the procurement process. He/she usually works in close collaboration with technical officers, procurement, contracts, and legal experts. He is charged with verifying that there is a corresponding approved programme and budget within its organization, before starting the procurement action. He/she should have a strategic overview of the needs and of the procurement action.	Full cycle (Steps 1-6)
Technical Officer	He/she is the person who has the ICT background to understand the needs and the different solutions available. He/she usually has also a good understanding of the market and usually plays a role in the suppliers' identification.	1. Technical Specs definition 1. Suppliers selection 3. Evaluation & supplier selection 5. Contract & Performance Management/Monitoring
Procurement Officer	He/she is the person who has a complete understanding of the procurement strategy and procedures of the organization. He/she is responsible for the identification of potential suppliers, the procurement process (tender, price enquiry, etc.), the selection of a preferred supplier, the contract negotiation, the management of a contract, and purchasing processes	1. Procurement Specs definition 2. Selection of the most suitable procurement process 3. Evaluation & supplier selection 4. Contact award & negotiation 5. Contract & Performance Management/Monitoring 6. Exit and renewal
Financial Officer	The Financial Officer is responsible for preparing financial statements, maintaining cash controls and purchasing. He is fundamental to approve the budget of the procurement action and proceed with the purchase once the contract is awarded.	1. Budget definition 4. Contact award
Legal Officer	The Legal Officer usually provides its legal expertise to the procurement process. His/her legal competences are key in the definition of the specifications, especially when the organisation has	1. Legal constraints identification 4. Contract award

	to respond to a particular legal framework and when the products or services purchased foresee the sharing of IPRs or data with the vendor.	6. Exit and renewal
ICT vendor	The ICT vendor is the provider of goods and services	1. Pre-procurement market engagement 4. Contract award & negotiation 5. Contract & Performance Management/Monitoring 6. Exit and renewal
Users	Users in public research organizations are usually researchers, scientists, students or employees.	1. Technical Specs definition

12.   Annex 2: Procurement procedures

Table below reports the standard procurement procedures listed in the ISO 10845-1:2010(en) standard [70]:

	Procedure		Description
1	Negotiation procedure		A tender offer is solicited from a single tenderer.
2	Competitive selection procedure		Any procurement procedure in which the contract is normally awarded to the contractor who submits the lowest financial offer or obtains the highest number of tender evaluation points.
	A	Nominated procedure	Tenderers that satisfy prescribed criteria are entered into an electronic database. Tenderers are invited to submit tender offers based on search criteria and, if relevant, their position on the database. Tenderers are repositioned on the database upon appointment or upon submission of a tender offer.
	B	Open procedure	Tenderers may submit tender offers in response to an advertisement by the organization to do so.
	C	Qualified procedure	A call for expressions of interest is advertised and thereafter only those tenderers who have expressed interest, satisfy objective criteria and who are selected to submit tender offers, are invited to do so.
	D	Quotation procedure	Tender offers are solicited from not less than three tenderers in any manner the organization chooses, subject to the procedures being fair, equitable, transparent, competitive and cost-effective.
	E	Proposal procedure using the two-envelope system	Tenderers submit technical and financial proposals in two envelopes. The financial proposal is only opened should the technical proposal be found to be attain a minimum threshold score.
	F	Proposal procedure using the two-stage system	Non-financial proposals are called for. Tender offers are then invited from those tenderers that submit acceptable proposals based on revised procurement documents. Alternatively, a contract is negotiated with the tenderer scoring the highest number of evaluation points.
	G	Shopping procedure	Written or verbal offers are solicited in respect of readily available goods obtained from three sources. The goods are purchased from the source providing the lowest financial offer once it is confirmed in writing.
3	Competitive negotiation procedure		A procurement procedure which reduces the number of tenderers competing for the contract through a series of negotiations until the remaining tenderers are invited to submit final offers.
	A	Restricted competitive negotiations	A call for expressions of interest is advertised and thereafter only those tenderers who have expressed interest, satisfy objective criteria and who are selected to to submit tender offers, are invited to do so. The employer evaluates the offers and determines who may enter into competitive negotiations.
	B	Open competitive negotiations	Tenderers may submit tender offers in response to an advertisement by the organization to do so. The employer evaluates the offers and determines who may enter into competitive negotiations.
4	Electronic auction procedure		Tender submissions are initially evaluated using stated methods and criteria. All tenderers who submit responsive tenders are invited simultaneously by electronic means to submit new evaluation parameters and have their evaluation scores, but nor their identity, made know to other tenderers. Tenderers may amend their offers up until such time as the auction is closed.

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[70] https://www.iso.org/obp/ui/#iso:std:iso:10845:-1:ed-1:v1:en

13.   Annex 3: Cloud deployment models

The number of users and their location can influence the cloud deployment model and the legal aspects to be considered in SLA with the vendor. Each deployment model differs in terms of who has access to information and resources. These models are essential to understand because they dictate who and how people will access cloud resources.

- **Private cloud.** The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.
- **Community cloud.** The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.
- **Public cloud.** The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.
- **Hybrid cloud.** The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

From the initial analysis of the case studies to be reported in D2.2*: Research Procurement Case Studies*, it appears that the most suitable model for public research organisations seems to be hybrid cloud because it provides the flexibility of multiple models and creates more customized cloud solutions.
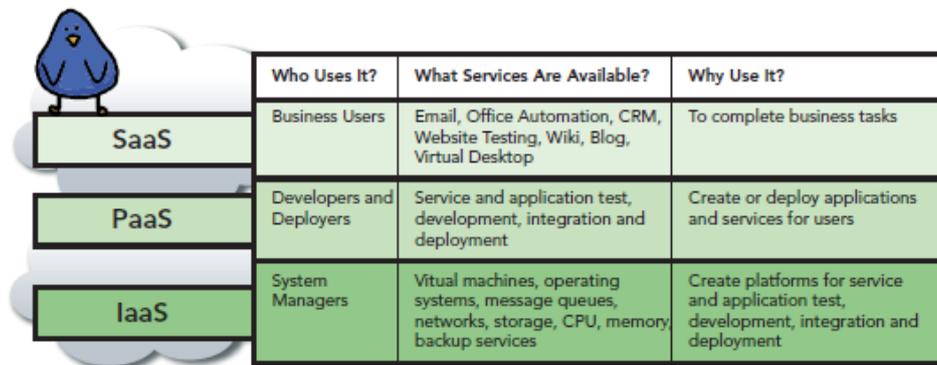
A comparison table for the four deployment models is given below.

Aspects	Public Cloud	Private Cloud	Community Cloud	Hybrid Cloud
Provisioning Model	Provisioned for open use by general public	Provisioned for exclusive use by a single organisation	Shared use by a specific community of organisations	Combination of two or more distinct cloud infrastructures
Costing / mode of payment	Utility pricing("pay-per-use"), no upfront capital costs	Capital investments required for initial setup	Cost contributed by individual organisations	Mix of private and public cloud pricing
Service Level Agreement (SLA)	SLA defined by service provider	SLA defined by the organisation	Shared SLA by participating organisations	Mix of different SLA's
Possible Use	Handling open / non-sensitive data with large variations in demands	Mission critical systems / handling sensitive data	Community of organisations with shared business needs	Mixed business needs

Figure 4: Comparison table for the four deployment models. Source: Practice Guide for Procuring Cloud Services, Published by the Office of the Government Chief Information Officer, UK Gov (November 2013)

14.   Annex 4: Cloud service models

Cloud services are provided according to three different service models: Infrastructure as a Service, Platform as a Service, and Software as a Service.

Figure 5: Cloud Service Models - Typical Case Uses[71]

NIST, the National Institute of Standards and Technology, in its special publication 800-145, "The NIST definition of Cloud Computing"[72] defines the cloud service models as follows:

- ✓ **Infrastructure as a Service:** The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls)[73].

- ✓ **Platform as a Service (PaaS):** The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

- ✓ **Software as a Service (SaaS):** The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure

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[71] Source: CloudComputing for Govies, DLT Solutions, David Blankenhorn, Van Ristau and Caron Beesley.

[72] http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf

[73] Cloud providers typically bill IaaS services on a utility computing basis: cost reflects the amount of resources allocated and consumed.

including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings[74].

The latest trends see the raise of a fourth model, *Everything-as-a-service.* Nearly anything that you would use a traditional computer for – such as e-mail, web browsing or word processing – will be done via the cloud at a lower cost and with increased reliability and productivity.

The service models do not all work the same way. As a result, the three model Terms and Conditions share many common clauses, but those dealing with operational responsibilities (e.g. data protection, security incident or breach notification, breach responsibilities, access to security logs and reports, and encryption of data at rest) vary. For example, a SaaS service provider is responsible for most of the technology stack and for these clauses. The service provider has a bigger and broader responsibility for protecting data and reporting. However, the IaaS service provider is essentially leasing the infrastructure to the public organisation, requiring the public organisation to be responsible for its own data protection, encryption and reporting. Additionally, termination and suspension of service is managed differently for SaaS contracts than for PaaS and IaaS. SaaS contracts specifically require a service provider to maintain data for up to 10 days after a contract expires in accordance with the termination timelines. Finally, clauses dealing with compliance for application accessibility standards and requiring Web services are simply not applicable to IaaS contracts. The picture below gives an overview of the responsibilities associated with the different service models.
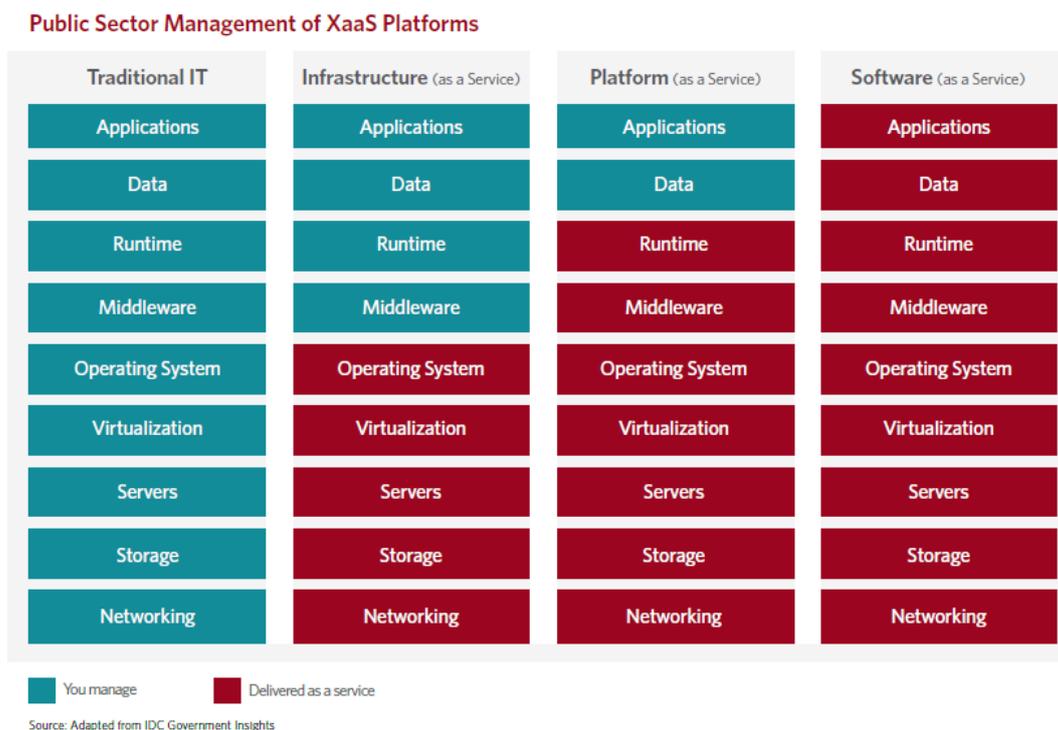

Figure 6: Public Sector Management of XaaS Platforms.

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[74] The pricing model for SaaS applications is typically a monthly or yearly flat fee per user, so price is scalable and adjustable if users are added or removed at any point.