

**FUNCTIONAL REQUIREMENTS FOR
CONDUCTING ELECTRONIC PUBLIC
PROCUREMENT UNDER THE EU
FRAMEWORK**

VOLUME I

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EXECUTIVE SUMMARY

The new public procurement directives set the legislative framework for public eProcurement in Europe, which should be adopted by all Member States by 31 of January 2006. To assist public administrations in building eProcurement systems in compliance with the new directives, a public eProcurement project was launched in 2003, under the Interchange of Data between Administrations programme (IDA) with a twofold objective:

- to develop functional requirements and suggest technical solutions for the implementation of electronic public procurement systems in compliance with the new legislative framework
- to create eLearning demonstrators simulating the public eProcurement functionalities described by the new directives, allowing administrations and suppliers to familiarise themselves and to experiment with it

The development of guidelines and demonstrators followed an iterative approach, starting with a conceptual design of an eProcurement system and then the elaboration of static and dynamic models for individual contracts, dynamic purchasing systems, framework agreement systems and electronic auctions. In this respect, the present Functional Requirements report has gone through a number of validation cycles, incorporating feedback received by the European Commission and Member States, ensuring that all information included is accurate.

This report analyses procedural aspects of the eProcurement procedures described by the new directives and includes functional and non-functional requirements for implementing them electronically. In addition it provides technical solutions for their implementation, enriched with good practices resulting from the two deliverables of the “analysis phase” of the project:

- State of the Art case studies on European electronic public procurement projects
- Description of electronic public procurement systems in non-European countries.

An overview of possible technical specifications is also presented in the current report, comprising the proposed conceptual model for an eProcurement system supporting all required procedures and a Use Case analysis. Functioning as a mechanism for further projects, the report also incorporates a section documenting several “open issues” related to Public eProcurement, as discussed in various IDA workshops where the current report was presented.

The report is structured in two volumes.

- **Volume I:** the current document, presenting information and activity flows for all eProcurement procedures, functional requirements, non-functional requirements, an overview of technical specifications with a conceptual model and high-level Use Cases, and open issues related to eProcurement
- **Volume II:** presenting an in-depth technical analysis (Use Case analysis) for the main actors and functionalities of an eProcurement system supporting all eProcurement procedures. It also provides scenarios for interested parties to experiment with the dynamic demonstrators, developed in the context of the current project, so as to further understand the concepts described in the Functional Requirements report.

Abbreviations / Acronyms

Abbreviation or Acronym	Term
API	Application Program(ming) Interface
CA	Certification Authority
COTS	Commercial Off-The-Shelf
CPV	Common Procurement Vocabulary (European Community)
CSV	Comma Separated Values
DMZ	Demilitarised Zone
DPS	Dynamic Purchasing Systems
DTD	Document Type Definition (markup languages)
ERP	Enterprise Resource Planning
EU	European Union
FA	Framework Agreement
FAQ	Frequently Asked Questions
FReq	Functional Requirements
FTP	File Transfer Protocol
GUI	Graphical User Interface
HTML	Hyper Text Markup Language
HTTP	Hyper Text Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure
J2EE	Java 2 Enterprise Edition
LDAP	Lightweight Directory Access Protocol
MEAT	Most Economically Advantageous Tender
MS	Member States
OJEU	Official Journal of the European Union
OSS	Open Source Software
PC	Personal Computer
PDF	Portable Document Format
PIN	Prior Information Notice
PINB	Prior Information Notice (Buyer Profile)
PKI	Public Key Infrastructure
RDBMS	Relational Database Management System
RTF	Rich Text Format
RUP	Rational Unified Process
SLA	Service Level Agreement
SMIME	Secure Multipurpose Internet Mail Extensions
SMS	Short Message Service
SPSC	Standard Products and Services Codes
SSL	Secure Sockets Layer
TED	Tenders Electronic Daily
TSA	Time Stamping Authority
TXT	Text
UCEC	Universal Content Extended Classification
UTF	Unicode Transformation Format
XML	eXtensible Markup Language
XSL	eXtensible Stylesheet Language
XSLT	Extensible Stylesheet Language Transformations

GLOSSARY

Term	Description
Authentication	Proving a user's identity. To be able to access a Website or resource, a user must provide authentication via a password or some combination of tokens, biometrics and passwords.
Authorisation	The act of granting approval. Authorisation to resources or information within an application can be based on simple or complex access control methods.
Browser Based	This term describes software that does not require any client software to be installed or configured on users' systems, except of the commercially supported Web-browsers (IE, NS, Mozilla, Opera, etc). Unlike a browser plug-in, browser based applications do not require manual download and execution of an installation program prior to Web site access; Unlike an ActiveX control or some Java applets, browser based applications do not force the user to agree to potentially confusing security warning dialogs. Unlike other client applications, browser based applications do not have a noticeable download time. In fact, download is transparent to the end-user.
Call	Call for Tenders
Certificate	An electronic "passport", typically contain a user's name and public key. A CA authorises certificates by signing the contents using its CA signing private key.
Certificate validation	The process of checking the trustworthiness of a certificate. Certificate validation involves checking that the certificate has not been tampered with, has not expired, is not revoked and was issued by a CA you trust.
Certification Authority (CA)	The system responsible for issuing secure electronic identities to users in the form of certificates.
Electronic signature	Data in electronic form which are attached to or logically associated with other electronic data and which serve as a method of authentication
Encryption / Decryption	To encrypt a file is to apply a mathematical function that transforms character(s) in the file into some other character(s). Encryption renders the file unreadable. This means no one, including the actor, can read the file until it is decrypted. Only authorised recipients can decrypt the file.
Identification	see Authentication
Private key	The portion of a key pair that is kept secret by the owner of the key pair. Private keys sign or decrypt data.
Public key	The portion of a key pair that is available publicly.
Public Key Infrastructure (PKI)	A system that provides the basis for establishing and maintaining a trustworthy networking environment through the generation and distribution of keys and certificates. This is also the foundation technology for providing enhanced Internet security.
Secure Sockets Layer (SSL)	A secure session protocol used to maintain data confidentiality only between Web-browsers and Web servers. This is a fundamental component of basic Internet security.
Time Stamping	The validity of storing the official date and time a business transaction has occurred.
Web Portal	A Web portal is a single doorway for employees, customers and partners to access an organisation's content, data and services online. Also known as Enterprise portals, Web portals make it possible to establish online relationships by providing personalised content to different individuals and entities. Organisations are building portals not only to increase loyalty, but also to create competitive advantage, strengthen relationships, speed access to services and satisfy regulatory requirements. Portals also make it possible to increase revenue, efficiencies and cost savings by moving business processes online.
XML	XML is the standard messaging format for business communication, allowing companies to connect their business systems with those of customers and partners using the existing Internet infrastructure. Similar to HTML, XML uses tags (words bracketed by '<' and '>') and attributes (of the form name="value") to help place structured data into text files. XML is different from HTML in that it is a meta-language (a language for describing languages) and, therefore, does not define specific tags and attributes.

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1 INTRODUCTION

This report may concern anyone who is interested or involved in implementing systems for electronic public procurement in the EU. It was commissioned by the European Commission and seeks to assist interested parties to avoid problems and prevent the emergence of “e-barriers” by clarifying the functional and non-functional requirements for public eProcurement systems, as they result from the specific provisions of the new European public procurement directives.

The new public procurement directives set the legislative framework for public eProcurement in Europe, which should be adopted by all Member States by 31 of January 2006. To assist public administrations in building eProcurement systems in compliance with the new directives, a public eProcurement project was launched in 2003, under the Interchange of Data between Administrations programme (IDA) with a twofold objective:

- to develop functional requirements and technical solutions for the implementation of electronic public procurement systems, in compliance with the new legislative framework
- to create eLearning demonstrators, simulating the public eProcurement functionalities described by the new directives, allowing administrations and suppliers to familiarise themselves and to experiment with them

The development of guidelines and demonstrators followed an iterative approach, starting with a conceptual design of an eProcurement system and then the elaboration of static and dynamic models for individual contracts, dynamic purchasing systems, framework agreement systems and electronic auctions.

In a first phase, the project focused on the analysis and assessment of existing European and international eProcurement systems and the deduction of interesting eProcurement practices that could enhance the operation of new eProcurement systems. These findings are presented in detail within the:

- state of the Art case studies on European electronic public procurement projects
- description of electronic public procurement systems in non-European countries

Based on the new public procurement directives, and taking into account the findings of the reports above, the functional requirements to be respected by fully integrated eProcurement systems were identified. This should provide a conceptual framework for the technical implementation of electronic public procurement systems in compliance with the new legislative framework.

The report describes the functional system requirements and pre-requisites derived from the legal framework and presents the different actors participating in eProcurement systems, as well as information and activity flow diagrams for all eProcurement procedures. In addition, a technical overview for the creation of such system and some non-functional requirements are also presented.

Some of the functional requirements identified are direct legal requirements, while others are functional prerequisites for implementing those legal requirements in a fully integrated eProcurement system. The report should be understood as a set of indicative guidelines aimed at assisting Member States in transposing the EU framework and in setting up and managing eProcurement systems that are compliant with EU public procurement legislation. Its purpose is to serve as a reference for designing new eProcurement systems or for adapting existing ones, as well as for guiding standardisation activities at all levels.

The report has undergone several review cycles, improving the earlier versions and incorporating additional information about public eProcurement. The reviews were performed by European Commission services, as well as, the IDA eProcurement expert group bringing together delegates from all Members States of the European Union and other countries participating in the IDA programme.

1.1 Structure of the report

The report is split into two volumes. The structure of the report is described below:

- **Volume I:**
 - **Section 1:** introduction
 - **Section 2:** analyses the eProcurement procedures regulated under the new directives, namely individual contracts (open and restricted) and repetitive contracts (DPS, framework agreement). Furthermore, extensions for both individual contracts and repetitive procedures are analysed (eAuction). This section includes eProcurement information flows, outlining the different steps involved in each procedure, and activity diagrams, clearly showing all different tasks, subtasks, branches, etc, that are related to the eNotification, eTendering, and eAwarding phases of each procedure
 - **Section 3:** provides potential technical solutions for the implementation of a fully integrated eProcurement system capable of supporting the procedures required by the new directives
 - **Section 4:** details non-functional requirements of an eProcurement system, as they emerge from the new EU eProcurement legislation, categorised into five main areas: usability, reliability, interoperability, scalability and security
 - **Section 5:** provides an overview of technical specifications, through a conceptual model and high-level Use Cases for eProcurement systems supporting individual contracts, repetitive procedures and electronic auctions
 - **Section 6:** documents “open issues” related to eProcurement, as they have been discussed in several fora
 - **Section 7:** outlines main conclusions

- **Volume II:**
 - **Section 1:** Provides an in-depth Use Case analysis for all main actors and functionalities of an eProcurement system supporting *individual contracts*
 - **Section 2:** Provides an in-depth Use Case analysis for all main actors and functionalities of an eProcurement system supporting *Dynamic Purchasing Systems*
 - **Section 3:** Provides an in-depth Use Case analysis for all main actors and functionalities of an eProcurement system supporting *Framework Agreements*
 - **Section 4:** Provides an in-depth Use Case analysis for all main actors and functionality of an eProcurement system supporting *eAuctions*
 - **Section 5:** Provides scenarios for interested parties to experiment with the dynamic demonstrators, which were elaborated in the context of the current project, so as to gain further understanding of the concepts discussed in the report

1.2 Business framework

The analysis performed for all eProcurement procedures is based on the EU public procurement Directive 2004/18/EC on the coordination of procedures for award of public works contracts, public supply contracts and public service contracts. All functional requirements and activity flow diagrams presented are independent from the technical implementation of an eProcurement system.

The modelling of these procedures was based on the following assumptions.

- One or more contracting authorities offer online eProcurement services, using a commonly accessible electronic platform. This platform operates as a single access point for users (e.g. procurement officers, economic operators, etc). For instance, such a platform might be a web-portal, openly accessible via the Internet.
- It is assumed that contracting authorities already make use of a number of existing information systems (e.g. back-office, legacy, etc.). The integration of the eProcurement platform with such systems can further assist contracting authorities to efficiently perform eProcurement. Whenever in the current document such an integration with existing information systems is discussed, it is assumed that the communication channel between these systems and the eProcurement platform is technically feasible, secure and reliable.
- Notices concerning Calls for Tenders are officially published on the Tender Electronic Daily (TED) website of the EU. This is a service offered by the EC Publications Office, which receives on a daily basis notices for all contracts covered by the Directives and provides facilities for the online searching, retrieval, visualisation, and downloading of notices.
- The functional analysis carried out for this document is based on requirements deriving from the EC public procurement Directive 2004/18/EC. It does not cover other aspects of the procurement cycle that contracting authorities may choose to implement electronically, in order to enhance their systems, such as electronic ordering or invoicing.
- Finally, it is also assumed that contracting authorities may have to adhere to national, regional and/or local legal requirements, depending on the field of their operation.
- The analysis presented in this report does not consider the negotiated procedure, as well as, competitive dialogues.

2 DESCRIPTION OF EPROCUREMENT PROCEDURES

This chapter presents an analysis of the procurement procedures described in the new EU directives. The procurement procedures for awarding public contracts are classified according to the following contract types:

- **Individual contracts**
 - **Open procedure:** whereby any interested Economic Operator may submit a Tender
 - **Restricted procedure:** whereby any Economic Operator may request to participate. Only those Economic Operators invited by the contracting authority may submit a Tender
- **Repetitive contracts**
 - **Dynamic Purchasing System (DPS):** constitutes a fully electronic process for contracting authorities for making commonly used purchases, which are generally available on the market and meet the requirements of the contracting authority. The duration of a DPS should not exceed 4 years and should be open throughout its validity to any Economic Operator satisfying the selection criteria and having submitted an indicative Tender compliant with the specification
 - **Framework Agreement:** is an agreement between one or more contracting authorities and one or more Economic Operators, the purpose of which is to establish the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, the quantity envisaged
- **Extensions**
 - **Electronic auctions:** are repetitive processes involving the use of an electronic device for the presentation by tenderers of improved offers for a specific Call for Tenders (i.e. the submission of new prices revised downwards, and/or new values concerning certain elements of tenders, thus allowing the use of automatic evaluation methods). This occurs after an initial full evaluation of the Tenders. eAuctions can be used with contracts for works, supplies or services for which the specifications can be determined/quantified with precision. This excludes non-quantifiable elements of a tender, as well as, certain service and work contracts having as their subject-matter intellectual performances. Electronic auctions can be utilised as an extension to the awarding phase of a tendering procedure. They do not constitute a complete eProcurement procedure for awarding contracts.

2.1 Individual Contracts

This section considers the procedural aspects of the procurement processes that Contracting Authorities need to follow for procuring electronically under individual contracts. Individual contracts can be procured following any of the three public procurement procedures, namely: open, restricted and negotiated (with and without advertisement). In the subsequent sections, only the two main procedures, e.g. the open and the restricted procedures are analysed. The report describes the exact flows of events that need to be followed, and deduces functional requirements for the realisation of a fully integrated eProcurement system that would be compliant with the new EU public procurement legislation.

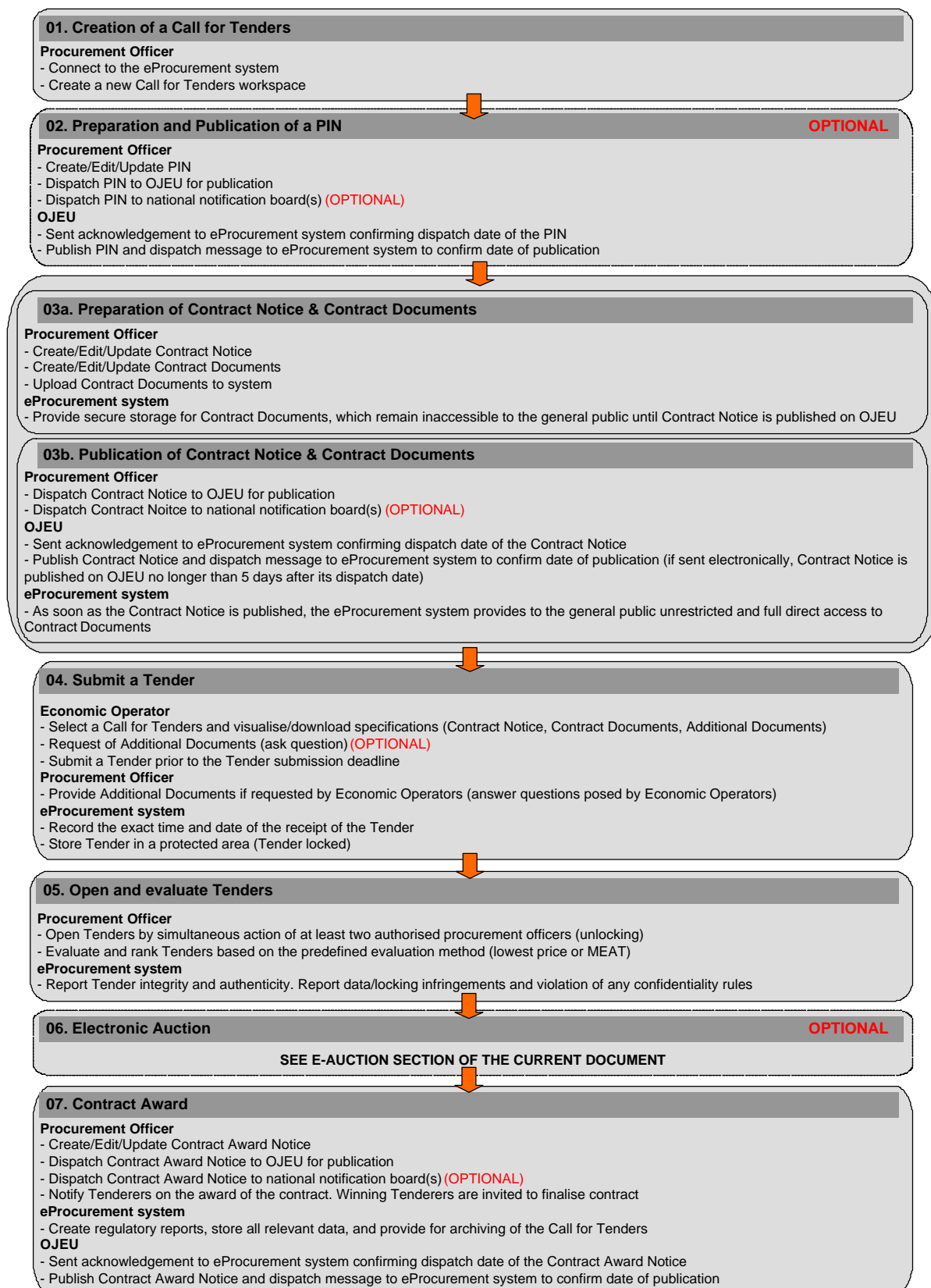
2.1.1 Open Procedure

The open procedure is a procedure whereby any interested Economic Operator may submit a Tender in response to a call for tender. It is the only procedure for the procurement of individual contracts in which any interested Economic Operator can participate by submitting a Tender, without the Contracting Authority performing a prior selection and/or dispatching an invitation.

2.1.1.1 Information Flow Diagram

Figure 2-1 depicts the different steps of the open procedure, focusing on the actions performed by all parties involved.

Figure 2-1: Information Flow Diagram for the Open Procedure



2.1.1.2 Functional requirements for the Open Procedure

This section presents the functional requirements emerging from the legislation for the realisation of eProcurement systems capable to support the open procedure. All functional requirements are associated with one or more steps of Figure 2-1.

Step 01. Creation of a Call for Tenders

This step refers to the preparation of a virtual workspace in an eProcurement system where all information related to a specific call for tenders can be stored. In order to create and manage a Call for Tenders in an integrated eProcurement system, an isolated storage area is necessary where Notices, Contract Documents, Additional Documents, Tenders, etc. are safely kept. Furthermore, other information about the Call, like the associated persons involved, name of the specific Call for tenders, description, opening/closing dates, etc. are also stored in the Call for Tenders workspace.

The functional requirements identified for this step comprise:

Functional Req. 1. User registration

This functional requirement allows for the user registration of new Procurement Officers and Tenderers/Economic Operators to the eProcurement system. The registration process must ensure the confidential transfer and storage of all personal information of users. Furthermore, mechanisms may be put in place for the validation of the information provided by new users of the system. Hence, the registration process may be performed in two phases. One phase can allow new users to apply for registration to the system, and another phase can allow authorised personnel to validate the submitted information and approve or reject a registration application.

Functional Req. 2. User profiling

This functional requirement relates to the ability of the eProcurement system to store personal information of its registered users. Users can update their personal information if required. This personal information can be used for several other functionalities of the system, including reporting, automated notifications, etc. Also, each user is associated to a unique identifier, which can be used by the audit trailing facility of the system, in order to record all user activities, and to identify the initiator/actor of each activity.

Moreover, user profiling can allow users to setup their preferences when using the system, in terms of how data is searched, displayed, etc.

Functional Req. 3. User authentication

This functional requirement allows users to identify themselves to the eProcurement system. This is necessary for the system to display the appropriate data to users, as well as, to make available the appropriate activities to be executed according to a user's role in the system.

Functional Req. 4. User authorisation

Each user in the system is commonly associated with a certain role. As presented in more detail in section 5.2, users can undertake and perform different roles, like Call administrators, Tender opening staff, Tender evaluating staff, etc. User authorisation can enable the eProcurement system to be aware of the role of a user. Depending on the user rights for each user, the system can control which activities a user can perform, as well as, what data a user should have access to.

Functional Req. 5. Tender workspace creation

When creating a Call for Tenders, the eProcurement system can make available to the Procurement Officers a virtual workspace for storing all Call-related information. This virtual workspace allows authorised users to provide core information about the Call, like its name, description, estimated value, etc., and provides the functionality for uploading documents, like Notices, Contract Documents, Additional Documents, etc.

Moreover, the Tender workspace can be used as the area for storing Tenders submitted by Tenderers, and all logically related data of a Call.

A Tender workspace needs to be well integrated with the User authorisation of the system (**Functional Req. 4: “User authorisation”**), as information stored in a Tender workspace should be accessed and/or manipulated by authorised users only. Furthermore, some activities should only be possible when certain events have already taken place (e.g. accessing the details of a Tender should only be possible for authorised personnel after Tenders are securely opened, following the four-eye principle).

Step 02. Preparation and Publication of a Prior Information Notice (PIN)

This step comprises the preparation of a Prior Information Notice (PIN). Contracting authorities should prepare and publish a PIN as early as possible, at the beginning of their budgetary year covering the awarding of the envisaged supplies and services contracts during the subsequent 12 months. For works contracts, a PIN may be published at any time. The use of a PIN is at the discretion of a contracting authority. Its use can shorten the time-limit for receipt of tenders to 36 days.

The functional requirements identified for this step comprise:

Functional Req. 6. Preparation of a Prior Information Notice

Procurement Officers may be assisted in creating a PIN by using an application for the preparation of the Notice to be published in the Official Journal. Such an application, commonly known as “Form Filling Tool”, can be a part of the eProcurement system itself, or an external application integrated to the eProcurement system.

Document templates or electronic standard forms shall be used to prepare a PIN.

Procurement Officers can be further assisted in preparing a PIN by automatically utilising Call information already provided to the system within the Tender workspace, during STEP 1 of the procedure. The Form Filling Tool may obtain all pre-defined Call information from the eProcurement system, and automatically pre-fill as many fields in the PIN template as possible.

Functional Req. 7. Use of the Common Procurement Vocabulary (CPV) classification standard

The new Public Procurement Directives require contracting authorities to use the CPV to advertise their procurement needs. The CPV constitutes a European classification standard specifically tailored to describe goods, services or works purchased by public authorities by numerical codes. The CPV exists in the 20 official languages of the EU. Thanks to this classification, Economic Operators can easily identify the goods/services/works a contracting authority wishes to procure, irrespective of the language of the PIN and to perform specific searches on the TED database.

An eProcurement system can prompt Procurement Officers to make use of the CPV classification standard when creating a PIN.

Functional Req. 8. Publication of a Prior Information Notice

Once the PIN is created, Procurement Officers can be assisted to dispatch an appropriate electronic message to the OJEU, containing all information of the PIN, to request for its publication. The eProcurement system should be in position to store the dispatch date of the PIN to the OJEU.

Step 03a. Preparation of a Contract Notice & Contract Documents

This step comprises the preparation of the Contract Notice and Contract Documents for a specific Call for Tenders. The objective of the Contract Notice is to openly advertise to the general public the intention of the contracting authority to procure, as well as, to provide the core requirements for the contract. Contract Documents define more precisely the requirements/specifications of the contracting authority for the goods/services/works to be procured.

The main activities for the preparation of the Contract Notice are the same as those for the preparation of the PIN, the only difference being the content of the corresponding form. Hence, the basic functional requirements for the preparation of the Contract Notice are the same as those for the preparation of the PIN (**Functional Req. 6: "Preparation of a Prior Information Notice"** and **Functional Req. 8: "Publication of a Prior Information Notice"**). In addition, the preparation of a Contract Notice imposes some additional requirements.

Functional Req. 9. Nomenclature of Territorial Units for Statistics (NUTS) classification standard

The Contract Notice may specify the NUTS codes for the contract to be procured. NUTS is a classification standard for geographic regions, which uses numerical codes to define the location of the goods/services/works to be procured. Similarly to the CPV, the inclusion of NUTS codes in a Contract Notice allows Economic Operators to easily identify the locations to which they will be required to deliver the goods/services/works of the contract irrespective of the language of the Contract Notice.

An eProcurement system can prompt Procurement Officers to make use of the NUTS classification standard when creating a Contract Notice. This functional requirement is not legislated by the EU public procurement legal framework, nevertheless can significantly increase the services that can be offered by an eProcurement system (e.g. searching, reporting, system integration, etc.)

Functional Req. 10. Tender Evaluation Mechanism

Contracting authorities shall conclude a competition by performing the full evaluation of Tenders received, and the awarding of a contract. The evaluation of Tenders is based on one of the following two Tender evaluation models: either lowest price or Most Economically Advantageous Tender (MEAT). In both cases, the evaluation model to be used must be specified in the Contract Notice or the Contract Documents. In the latter case, this fact must be stated in the Contract notice. If the evaluation is based on the Most Economically Advantageous Tender, contracting authorities are required to define the exact evaluation criteria to be used, as well as to indicate their weightings either in the Contract Notice or in the Contract Documents. In the latter case this reference to the Contract Documents must be stated in the Contract Notice. In duly justified cases where the weighting cannot be established, contracting authorities must be able to give reasons, and indicate the descending order of importance of all criteria.

When the evaluation parameters of a Call based on MEAT can be established with precision, a contracting authority may decide that the award of the contract shall be preceded by an electronic auction. The intention of using an electronic auction as part of the awarding procedure needs to be mentioned in the Contract Notice of the Call.

To accommodate the above, an eProcurement system can prompt Procurement Officers to define the evaluation mechanism to be used, as well as automatically include the details of the evaluation mechanism in the Contract Notice and/or Contract Documents.

Step 03b. Publication of Contract Notice & Contract Documents

This step comprises the publication of the Contract Notice and Contract Documents of a Call for Tenders. This operation involves the dispatch of the electronic message of the Contract Notice to the OJEU, as well as, the publication of the Contract Documents to the general public.

The functional requirements identified for this step comprise:

Functional Req. 11. Interface with the OJEU

Once the Contract Notice of a Call for Tenders is completed, it needs to be made publicly available. For contracts above the EU thresholds, as defined in the EU public procurement directives, the Contract Notice needs to be published to the Official Journal of the European Union (OJEU).

The EU Publications Office, responsible for the daily publication of the Official Journal, offers several methods by which a notice can be published on the OJEU. An eProcurement system can offer the functionality for automating or semi-automating the publication of notices in the OJEU. This does not only simplify the processes a Procurement Officer needs to follow, but also allows to shorten the time-limit for the submission of Tenders.

Functional Req. 12. Publication of Contract Documents

The preparation of Contract Documents involves an “approval” lifecycle for documents (and possible notices), comprising their creation, validation, approval and publication. The “approval” lifecycle depends on the internal procedures of the contracting authority, and may involve multiple Procurement Officers. An eProcurement system can provide a functionality for modelling these internal workflows which can assist Procurement Officers to comply with the internal workflows of their contracting authority in a more efficient and time-effective manner. While a document is in “not-published” state, it is accessible only to the Procurement Officers associated with it.

The finalised Contract Documents approved by the contracting authority shall not be made publicly available until the Contract Notice is dispatched to the OJEU for publication. Once the Contract Notice has been published by the OJEU, it may also be published at the national level, and all interested parties should be given unrestricted and full access to the Contract Documents.

Once a Contract Document is made publicly available, it should not be possible for anyone to remove and/or modify this document.

Step 04. Submit a Tender

This step constitutes the eProcurement phase for the submission of Tenders by Economic Operators, commonly referred to as eTendering. During this phase, Economic Operators gain access to all publicly available information of a Call, may request Additional Documents, and submit their Tenders.

The functional requirements identified for this step comprise:

Functional Req. 13. Search Calls mechanism

At this step, the Call for Tender is considered “open”, as it is publicly available. An eProcurement system may provide a search Calls mechanism to any interested party, so that it can search through all publicly “open” Calls and locate interesting ones, for which s/he might wish to participate.

Functional Req. 14. Visualise/Download Call for Tenders specifications

Any interested party should be provided with the functionality to access all publicly available information of a Call, comprising PIN, Contract Notice, Contract Documents, Additional Documents, etc. An eProcurement system may require interested parties to provide some personal information, so that they are notified if and when new information about the Call is published (Additional Documents, new Contract Documents, etc.)

The eProcurement system should ensure that full and unrestricted access to all publicly available information is provided equally to all interested parties.

Functional Req. 15. Request for Additional Documents

Any interested party may be provided with the possibility to request Additional Documents about a Call (i.e. ask a question to the awarding authority). This may be provided only within a predefined time period (i.e. accept questions posted before a certain date). All requests for Additional Documents and the Additional Documents themselves need to be made publicly available to all interested parties, and in due time before the end of the time-limit for submission to ensure non-discrimination and equal treatment of Economic Operators. The identities of Economic Operators posting requests for Additional Documents should not be disclosed, neither to the general public nor to other Economic Operators.

Functional Req. 16. Automated Notifications

An eProcurement system may support an automated notification mechanism, which can automatically notify its users of interesting events. For instance, Economic Operators that requested an Additional Document (i.e. posted a question) may be automatically notified when an Additional Document is published by the contracting authority (i.e. the contracting authority has provided an answer to the posted question). As described in Functional Requirement 15, such a notification mechanism must ensure equal treatment of all Economic Operators and operate within the time-limit for submission of tenders.

Functional Req. 17. Submission of Tenders

Economic Operators interested in a Call shall have the possibility to submit electronically the Tenders that they have prepared through generally available, non-discriminatory, and interoperable means of communication. Contracting authorities examine whether the Tenders received are compliant with the requirements defined in the Tender specifications.

Economic Operators that have submitted a Tender should be provided with the possibility to update their Tender until the Tender submission deadline.

The eProcurement system must ensure that all Tenders for a Call are stored in a secure environment and cannot be accessed until authorised Procurement Officers authorise their opening following the four-eye principle. If access prohibition is infringed, it should be reasonably ensured that the infringement is clearly detectable.

Official time-stamping facility can ensure the exact submission date and time of a Tender is recorded, guaranteeing there are no misconceptions about the submission time of a Tender (see relevant non-functional requirement in section 4.3.3.2).

Security arrangements for all data transmitted to/from the eProcurement system and stored in the eProcurement system should ensure the integrity of the Tenders, as well as, the authenticity of the Economic Operators that have submitted them (see relevant non-functional requirements in section 4.5).

Step 05. Open and evaluate Tenders

This step refers to the opening and evaluation of electronic Tenders. Opening and evaluation take place once the Tender submission period has ended (i.e. eSubmission is complete). The secure opening of Tenders must involve at least two authorised procurement officers who proceed to open the Tenders received through simultaneous action following the so-called four-eye principle. Following this operation authorised procurement officers perform the evaluation of Tenders based on the pre-defined Tender evaluation mechanism and establish the ranking of Tenders.

Functional Req. 18. Four-eye Principle

An eProcurement system needs to ensure that access to Tenders cannot be obtained by anyone, until authorised procurement officers proceed to the opening of Tenders following the four-eye principle. To “open” or “unlock” Tenders, two or more authorised procurement officers need to perform simultaneous actions.

The opening of Tenders shall only be performed after the Tender submission deadline.

It is considered as best practice for the opening of Tenders to be performed in phases. Hence, for instance, proof documents are opened first, followed by the opening of technical document, and lastly the opening of financial offers. In all Tender opening phases, the Four-eye Principle can be applied.

Functional Req. 19. Tender Confidentiality

Once Tenders are opened, they can only be accessed by authorised personnel, ensuring that the confidentiality of Tenders is not violated.

Functional Req. 20. Tender Evaluation

An eProcurement system may assist procurement officers to perform the evaluation of Tenders, either in an automated or semi-automated manner. Initially, all Tenders should be evaluated in order to ensure that participating Tenderers satisfy the Conditions for Participation stated in the Contract Notice or Contract Documents of the Call.

This is followed by the full Tender evaluation according to the pre-defined evaluation mechanism stated in the Contract Notice or Contract Documents of the Call.

Step 06. Electronic Auctions

If the specifications of a Tender can be defined with precision, the contracting authority may choose to award the contract using an electronic auction. In this case, tenderers are given the opportunity to improve aspects of their Tenders through a repetitive bidding mechanism, increasing their possibility to win the competition. The evaluation of auction Bids is performed according to some or all of the evaluation criteria mentioned in step 3.

Electronic auctions can be used in an eProcurement competition only if this is clearly stated in the Contract Notice of the Call. The details regarding the steps involved in the execution of electronic auctions, as well as, related functional requirements are discussed in section 2.3.

Step 07. Contract Award

Once the awarding procedure is complete, the contract is awarded to the tenderer having submitted the lowest price or the Most Economically Advantageous Tender, as concluded by applying the evaluation methodology (defined in step 3). The contracting authorities are required to publish a Contract Award Notice, which informs all interested parties of the results of the competition. The procedure for creating and publishing a Contract Award Notice is the same as that for creating a PIN and a Contract Notice. Hence, **Functional Req. 6: “Preparation of a Prior Information Notice”**, **Functional Req. 8 “Publication of a Prior Information Notice”** and **Functional Req. 11: “Interface with the OJEU”** are also necessary for creating/publishing a Contract Award Notice.

In addition, contracting authorities shall contact the participating tenderers to inform them of the award decision. Upon request of the tenderer, the contracting authority should usually give the reasons for rejection. . An eProcurement system may assist in this process by automatically or semi-automatically preparing appropriate notification messages, which can inform tenderers accordingly. **Functional Req. 16: “Automated Notifications”** can assist in this process.

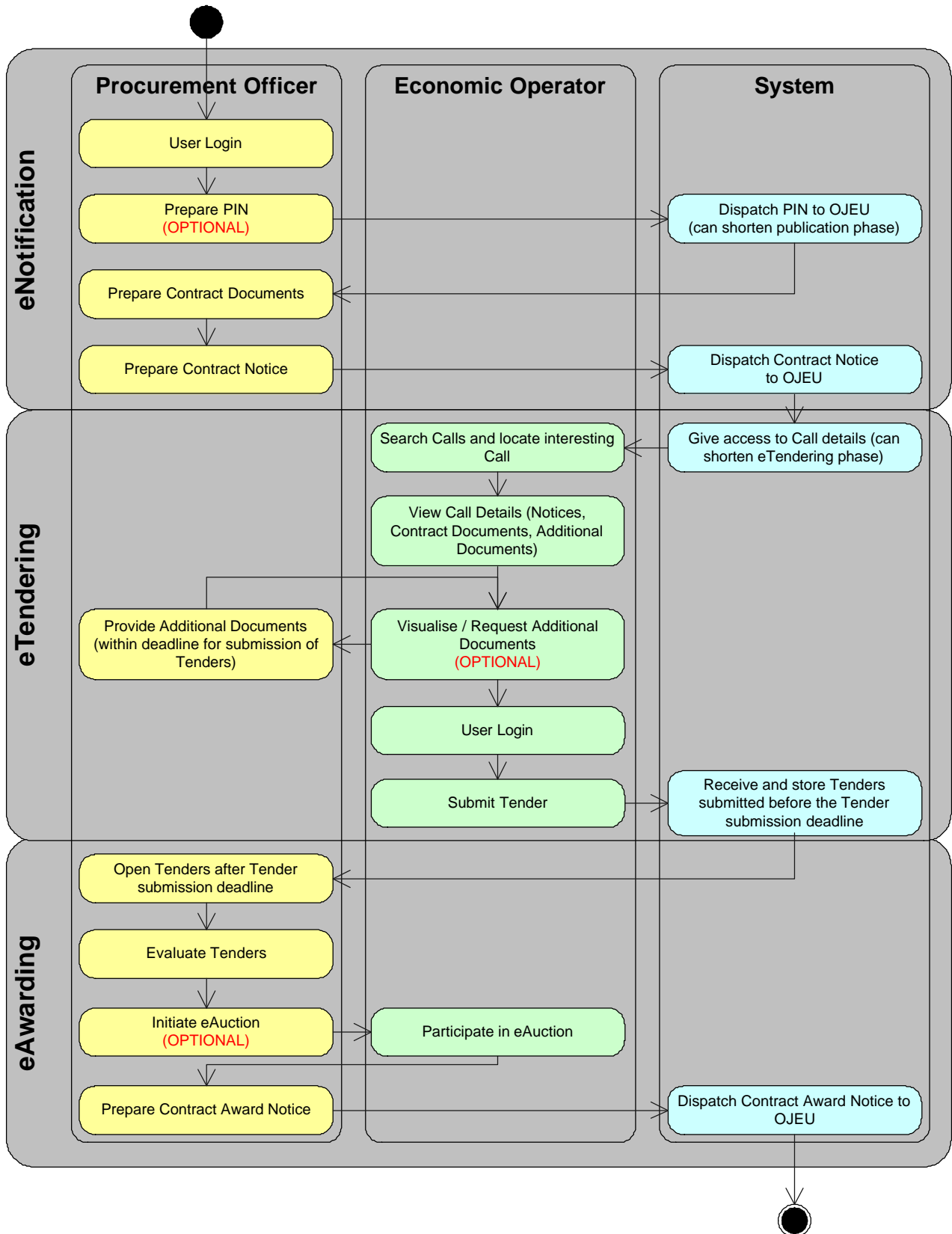
Functional Req. 21. Creation of Mandatory Reports regulated by the legislation

Another requirement of the legislation is related to the capability of the contracting authority to prepare regulatory reports, which provide information on all aspects of the competition. Such reports include information about the tenderers that participated in the competition, the successful tenderer(s), the reasons for their selection, etc. The contracting authority may be assisted in this process by an eProcurement system which, utilising all information created/stored in it during the competition, can automatically or semi-automatically produce such reports.

2.1.1.3 Open Procedure Activity Diagram

Figure 2-2 presents at granular level the open procedure, clearly displaying all activities that are being performed by the main actors (procurement officers, economic operators and an eProcurement system) in the different eProcurement phases: eNotification, eTendering, and eAwarding. The activity diagram groups in phases and serialises all activities that need to be performed in the whole procurement process. Some tasks are subject to legislated time-constraints that need to be respected by Contracting Authorities. Thus, the whole procurement process for a contract following the open procedure may require significant time.

Figure 2-2: Activity diagram for the open procedure



2.1.2 Restricted Procedure

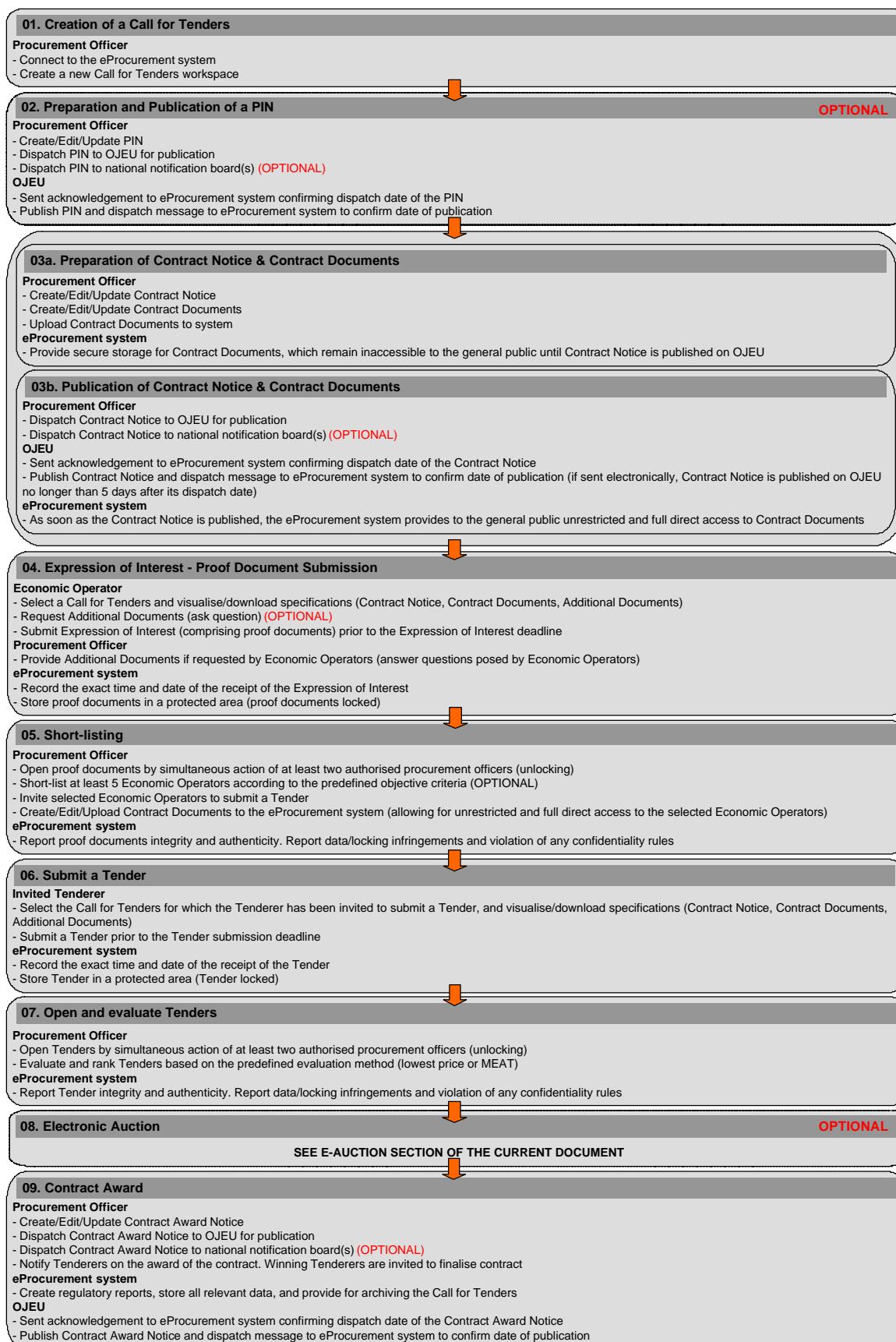
A Restricted procedure is a procedure in which any Economic Operator may request to participate and whereby only those Economic Operators invited by the contracting authority may submit a Tender. Following this procedure, contracting authorities issue a Contract Notice for advertising the contract. Any Economic Operator may express interest to participate by submitting an appropriate request for participation to the contracting authority.

The contracting authority may restrict the number of tenderers that will be invited to tender to a minimum of at least five. In this case, the contracting authority must state the objective criteria it will apply for short-listing in the Contract Notice, and only the candidates that are short-listed according to those criteria are subsequently invited to submit a tender. In the absence of such a restriction there is no short-listing. The contracting authority invites all Economic Operators that comply with the minimum capabilities required in the Contract notice to submit a tender.

2.1.2.1 Information Flow Diagram

Figure 2-3 depicts the different steps of the restricted procedure, focusing on the actions performed by all parties involved.

Figure 2-3: Information Flow Diagram for the Restricted Procedure



2.1.2.2 Functional requirements for the Restricted Procedure

The current section presents the functional requirements emerging from the legislation for the realisation of eProcurement systems capable to support the restricted procedure. Certain steps of the restricted procedure are identical to steps for the open procedure, discussed in section 2.1.1. Hence, only new steps, specific to the restricted procedure, are presented in this section. These new steps are Step 04. “Expression of Interest” and Step 05. “Short-listing”.

Step 04. Expression of Interest – Proof Documents Submission

During this step Economic Operators express their interest to participate in a restricted procedure competition. This process is also commonly referred to as “request to participate”.

Following the visualisation of the Call details, in the form of Contract Notice, Contract Documents and/or Additional Documents, Economic Operators may express their interest to participate in the Call, by submitting the necessary proof documents. The proof documents, comprising legal, technical and financial information, are subsequently used by the contracting authority to either invite an Economic Operator to submit a Tender, or reject the tenderer from the subsequent steps of the competition.

An eProcurement system may assist contracting authorities in this process, by providing the opportunity to Economic Operators to express their interest electronically. All functional requirements of Step 04 of the open procedure are also applicable in this step:

- **Functional Req. 13: Search Calls mechanism**
- **Functional Req. 14: Visualise/Download Call for Tenders specifications**
- **Functional Req. 15: Request for Additional Documents**
- **Functional Req. 16: Automated Notifications**
- **Functional Req. 17: Submission of Tenders**

Step 05. Short-listing (Optional)

If a contracting authority has announced in the Contract Notice its intention to limit the number of candidates that will be invited to submit a tender, it proceeds to a short-listing based on the expressions of interest it has received. To this end, it evaluates the received proof documents according to the selection criteria, as defined in step 03a and identifies a minimum number of five candidates to be invited.

All functional requirements of step 05 (Open and Evaluate Tenders) of the open procedure are also applicable in this instance:

- **Functional Req. 18: Four-eye Principle**
- **Functional Req. 19: Tender Confidentiality**
- **Functional Req. 20: Tender Evaluation**

Another activity of the contracting authority during this step is the preparation and publication of Contract Documents. Under the open procedure, Contract Documents need to be prepared and published when the Contract Notice is dispatched to the OJEU..

Functional Req. 22. Invitation to Tender

Once all proof documents have been examined and, where applicable, candidates have been short-listed based on the objective criteria stated in the Contract Notice, the contracting authority invites all or some Economic Operators to submit their Tenders until a defined submission deadline. Rejected Economic Operators should be notified that they will not be invited.

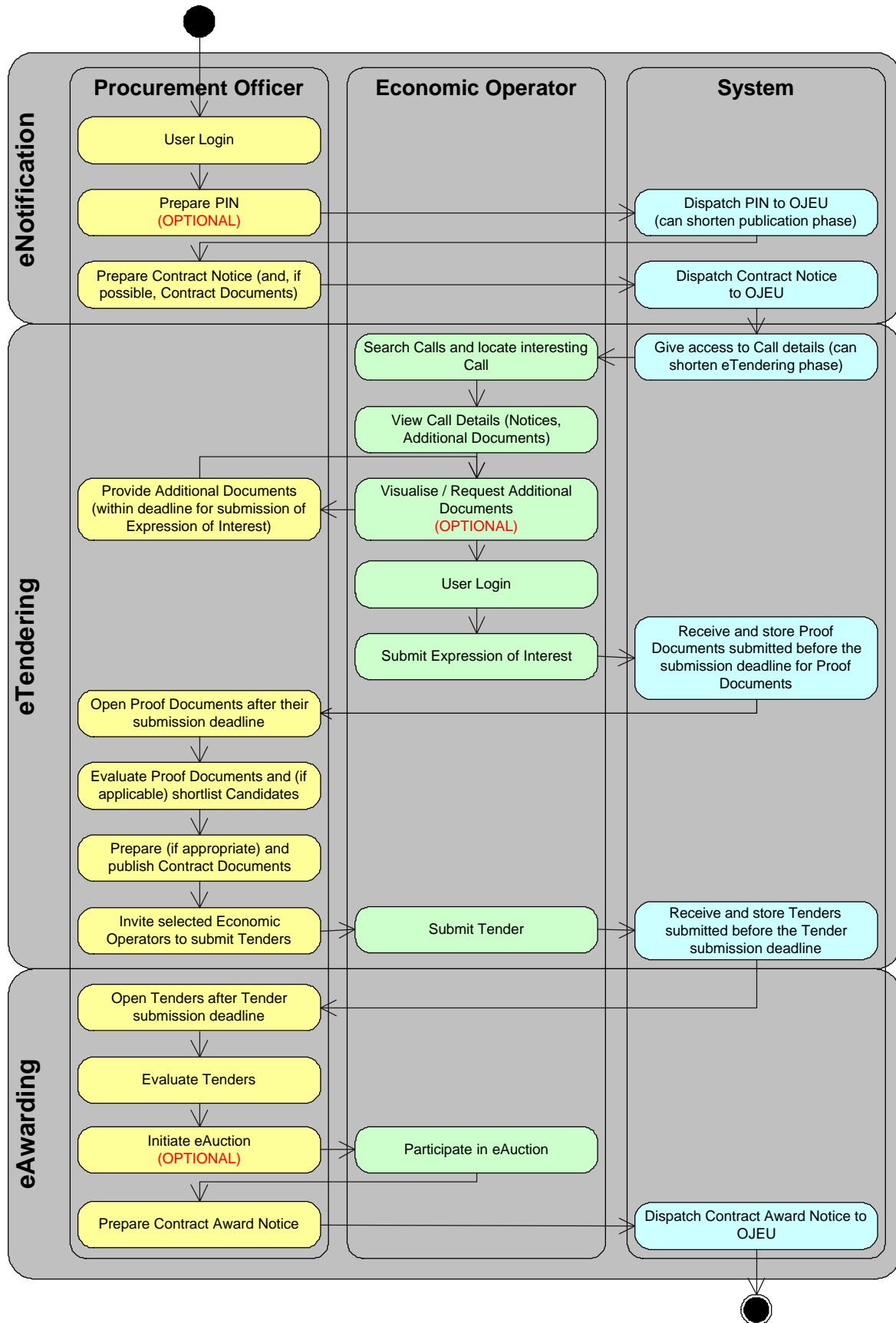
This process can be simplified for contracting authorities by an eProcurement system which can automatically or semi-automatically calculate the deadline for submitting Tenders, as well as, prepare appropriate messages to all Economic Operators involved. The identity of all Economic Operators involved must remain confidential.

From this point onward, all Call related information (comprising Contract Documents and Additional Documents) can be disclosed only to the economic operators selected to submit a Tender.

2.1.2.3 Restricted Procedure Activity Diagram

Figure 2-4 presents at granular level the restricted procedure, clearly displaying all activities that are performed by the main actors (procurement officers, economic operators and an eProcurement system) related to the different eProcurement phases: eNotification, eTendering, and eAwarding. The activity diagram groups in phases and serialises all activities that need to be performed in the whole procurement process. Some tasks are subject to legislated time-constraints that need to be respected by Contracting Authorities. Thus, the whole procurement process for a contract following the restricted procedure may require significant time.

Figure 2-4 : Activity diagram for the restricted procedure



2.2 Repetitive contracts

The EU public procurement legislation introduces two instruments to carry out repetitive purchases electronically, so-called Dynamic Purchasing Systems (DPS) and Framework Agreements. Both procedures aim to establish the terms governing contracts to be awarded over a given period of validity of up to four years, thus allowing contracting authorities to reduce the costs of organising recurrent purchases of standard goods and services.

Framework Agreements establish closed systems, under which contracts are awarded only to those economic operators who have been admitted to the agreement following an initial tendering procedure.

A Dynamic Purchasing System (DPS) provides a fully electronic tendering procedure which remains open to all economic operators throughout its entire period of validity.

In both cases, specific contracts advertised must comply with the terms set out in the Contract Notice or Contract Documents establishing the Framework Agreement or DPS.

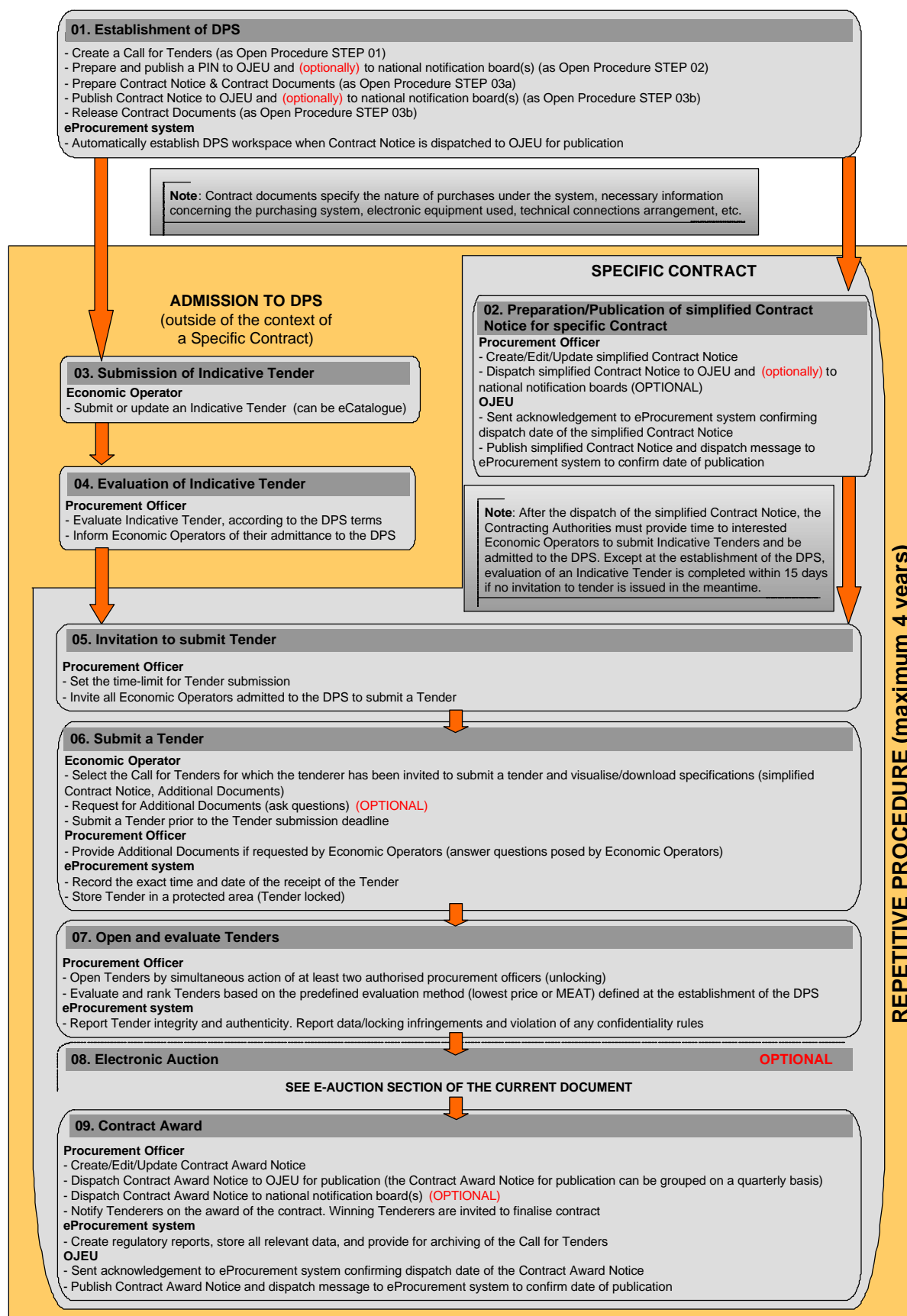
2.2.1 Dynamic Purchasing System (DPS)

The Dynamic Purchasing System (DPS) is a fully electronic process for contracting authorities to make commonly used purchases. A DPS is limited in duration (maximum of 4 years) and open throughout its validity to any Economic Operator satisfying the selection criteria and having submitted an indicative Tender compliant with the specifications for the DPS.

2.2.1.1 Information Flow Diagram

Figure 2-5 depicts the different steps for the establishment of a DPS, as well as, for the procurement of a specific contract under a DPS, focusing on the actions performed by all parties involved.

Figure 2-5: Information Flow Diagram for Dynamic Purchasing System



2.2.1.2 Functional requirements for a DPS

The section presents the functional requirements emerging from the legislation for the realisation of eProcurement systems capable to support a DPS.

Step 01. Establishment of DPS

This step comprises the creation of a suitable workspace for the whole “life” of the DPS. All functional requirements for the creation of a Tender workspace of the open procedure are also applicable to the DPS.

- **Functional Req. 1: User registration**
- **Functional Req. 2: User profiling**
- **Functional Req. 3: User authentication**
- **Functional Req. 4: User authorisation**
- **Functional Req. 5: Tender workspace creation**

Furthermore, an eProcurement system supporting DPS needs to be in a position to automatically or semi-automatically generate reports for the DPS

Functional Req. 23. DPS reporting

The DPS workspace effectively constitutes an “umbrella” for the procurement of specific contracts within it. Hence, authorised Procurement Officers may be provided with the possibility to produce DPS reports, not only reporting details of its establishment (i.e. when it was established, who created it, information of the Contract Notice, etc.), but also information about specific contracts procured within it (i.e. the list of tenderers admitted to the DPS, number of specific contracts procured through the DPS, etc.)

Step 02. Preparation/Publication of a simplified Contract Notice for specific contract

This step comprises the creation of a suitable workspace for the procurement of a specific contract within a DPS. In this step, the contracting authority needs to create and publish a simplified Contract Notice, making publicly available its intention to procure a contract under an established DPS.

The procedure for creating and publishing a simplified Contract Notice through the DPS is identical to the one for creating/publishing a PIN and/or Contract Notice. Hence, **Functional Req. 8: “Publication of a Prior Information Notice”** and **Functional Req. 11: “Interface with the OJEU”** are also applicable here.

The simplified contract notice for the procurement of a specific contract must detail the time-limit for the receipt of Indicative Tenders for admittance to the DPS. This time-limit can not be less than 15 days from the date on which the simplified Contract Notice is sent. Contracting authorities should not proceed with inviting tenderers to submit Tenders for the specific contract, until all Indicative Tenders received by that deadline are evaluated. This process must allow sufficient time for new Economic Operators to be admitted in the DPS and participate in the competition for the specific contract within DPS.

An eProcurement system supporting DPS needs to permit authorised Procurement Officers to create specific contract workspaces for storing necessary information about a specific contract, similar to the open procedure.

Functional Req. 24. Creation of specific contract workspaces within DPS workspace

An eProcurement system can allow the creation of as many specific contract workspaces within the DPS workspace as required by the contracting authority. When creating a specific contract, certain properties of the specific contract must be pre-set as defined in the DPS workspace (like Contract Documents and Tender evaluation methodology). A workspace for a specific contract within the DPS may function in a similar way to the workspace of the open procedure (**Functional Req. 5: “Tender workspace creation”**). It can permit Procurement Officers to store all contract specific information within the workspace, while all Tenders submitted for the specific contract can also be securely stored in this virtual area. Furthermore, an eProcurement system supporting DPS must ensure the confidentiality of all information stored within a specific contract workspace, for example with regard to authorised users of another specific contract workspace of the same DPS.

Step 03. Submission of Indicative Tender

During this step, Economic Operators can submit an Indicative Tender, in order to be admitted to the DPS. All public information about the DPS, comprising the Contract Notice and Contract Documents, are made available to all interested parties to obtain access to. Any Economic Operator may submit a Tender without prior invitation by the contracting authority.

Furthermore, Economic Operators already admitted to the DPS may update their Indicative Tenders.

An Indicative Tender may take the form of an eCatalogue.

Functional Req. 25. Indicative Tenders in the form of electronic catalogues (eCatalogues)

An Indicative Tender may take the form of an eCatalogue. The contracting authority may define the format an eCatalogue should have.

An eProcurement system may assist contracting authorities in defining the format of an electronic catalogue. Furthermore, the system may provide the necessary support for allowing Economic Operators to create their Indicative Tenders in the required format, and/or allow Procurement Officers to visualise eCatalogues in a user-friendly format. Advanced search capabilities, multimedia support (e.g. images, sounds, etc.) and/or tools for comparing eCatalogues from different Economic Operators may also be offered. An eCatalogue is possible to also be used for forming a Tender for an Individual Contract competition. Nevertheless, the eCatalogue needs to confirm to the specifications of the Call for Tender.

Other functional requirements which can assist in the process and are already described in previous eProcurement procedures comprise:

- **Functional Req. 14: Visualise/Download Call for Tenders specifications**
- **Functional Req. 15: Request for Additional Documents**
- **Functional Req. 16: Automated Notifications**
- **Functional Req. 17: Submission of Tenders**
- **Functional Req. 19: Tender Confidentiality**

Step 04. Evaluation of Indicative Tender

During this step, Procurement Officers open Indicative Tenders and evaluate them according to the awarding criteria (price or MEAT) set out in the terms of the DPS. The contracting authority evaluates which of the Indicative Tenders meet the pre-defined criteria for admittance in the DPS, and which do not. New Economic Operators that meet the admittance criteria are admitted to the DPS.

Contracting authorities may be assisted in evaluating Indicative Tenders by an eProcurement system, according to the functional requirements for evaluation under the open procedure.

- **Functional Req. 19: Tender Confidentiality**
- **Functional Req. 20: Tender Evaluation**
- **Functional Req. 25: Indicative Tenders in the form of electronic catalogues (eCatalogues)**

Step 05. Invitation to submit Tender

Once the Invitation to Tender date is reached, as defined in Step 02, Procurement Officers prepare and send “Invitations to Tender” to all Tenderers admitted in the DPS. The invitation defines the time-limit for receiving Tenders, the format of eCatalogues, as well as the evaluation criteria to be used for the evaluation of Tenders. Where applicable, these criteria may be formulated more precisely, in line with the specifications set out for the DPS. Procurement Officers may be assisted in this process by an eProcurement system satisfying the following functional requirements:

- **Functional Req. 12: Publication of Contract Documents**
- **Functional Req. 22: Invitation to Tender**

Step 06. Submit a Tender

All Tenderers admitted in the DPS are invited to provide a Tender for a specific contract. Tenderers interested to participate in the specific contract submit a Tender (based on their initial Indicative Tender or a revised Indicative Tender) before the Tender submission deadline, as defined by the contracting authority in the previous step.

An eProcurement system may assist in the process by satisfying functional requirements described in previous eProcurement procedures:

- **Functional Req. 14: Visualise/Download Call for Tenders specifications**
- **Functional Req. 15: Request for Additional Documents**
- **Functional Req. 16: Automated Notifications**
- **Functional Req. 17: Submission of Tenders**
- **Functional Req. 18: Four-eye Principle**
- **Functional Req. 19: Tender Confidentiality**
- **Functional Req. 25: Indicative Tenders in the form of electronic catalogues (eCatalogues)**

Step 07. Open and evaluate Tenders

All Tenders received for the specific contract are opened and evaluated according to the criteria laid out in the Contract Notice for the establishment of the DPS. An eProcurement system may assist in the process by satisfying functional requirements described in previous eProcurement procedures:

- **Functional Req. 18: Four-eye Principle**
- **Functional Req. 19: Tender Confidentiality**
- **Functional Req. 20: Tender Evaluation**

Step 08. Electronic Auctions

In case the specifications of the DPS, defined during its establishment, state the use of eAuction as an evaluation mechanism, a contracting authority may choose to conduct an electronic auction prior to awarding the specific contract. The eAuction shall be conducted according to the terms defined for the establishment of the DPS. In this case, tenderers are given the opportunity to improve aspects of their Tenders through a repetitive bidding mechanism, increasing their chances of winning the competition.

The details regarding the steps involved in the execution of electronic auctions, as well as, related functional requirements are discussed in section 2.3.

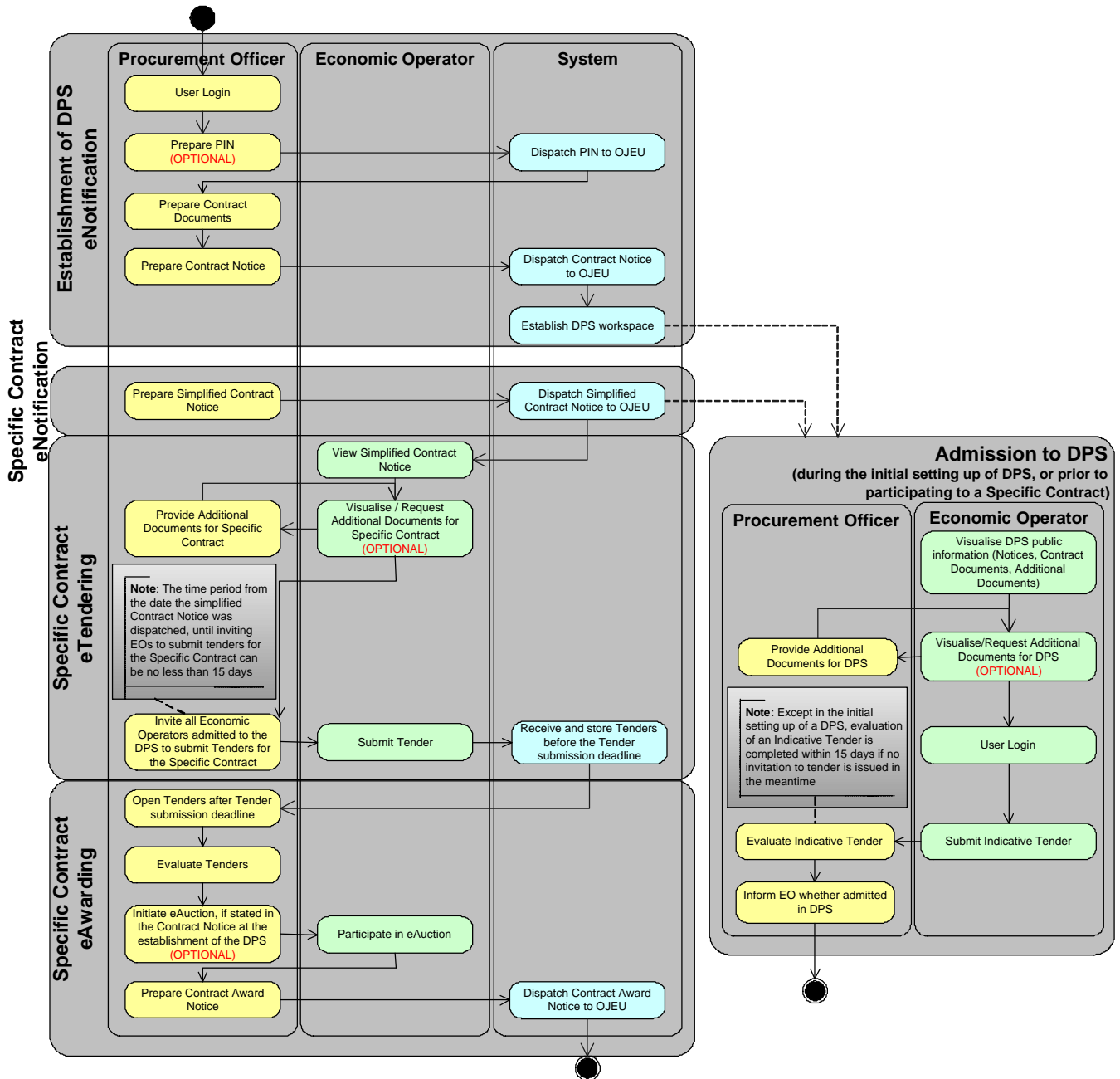
Step 09. Contract Award

Following the steps necessary for concluding a specific contract within a DPS, a contracting authority shall create and publish a Contract Award Notice. The Contract Award Notices for specific contracts under a DPS may be grouped and published on a quarterly basis. In addition, the contracting authority needs to create regulatory reports. An eProcurement system may assist contracting authorities in preparing Contract Award Notices, especially grouped notices, as well as in preparing the required regulatory reports (similar to **Functional Req. 6: "Preparation of a Prior Information Notice"**) and **Functional Req. 21: "Creation of Mandatory Reports"**.

2.2.1.3 Dynamic Purchasing System Activity Diagram

Figure 2-6 presents at granular level the establishment of a DPS, the admission of Economic Operators in the DPS, as well as, the procurement of a specific contract under the DPS. The figure clearly displays all activities that are performed by the main actors (procurement officers, economic operators and an eProcurement system) in the different eProcurement phases: eNotification, eTendering, and eAwarding. The activity diagram groups in phases and serialises all activities that need to be performed in the whole procurement process. Some tasks are subject to legislated time-constraints that need to be respected by Contracting Authorities. Thus, the whole procurement process for the establishment of a DPS and/or a specific contract within a DPS may require significant time.

Figure 2-6: Activity diagram for a Dynamic Purchasing System



2.2.2 Framework Agreements

A framework agreement is an agreement between one or more contracting authorities and one or more Economic Operators, the purpose of which is to establish the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, the quantity envisaged.

For the purpose of concluding a framework agreement, contracting authorities shall follow the rules for procuring an individual contract for all phases up to the awarding of contracts. The parties to the framework agreement shall be chosen by applying the award criteria set in the Contract Notice or Contract Documents of the Call for Tenders.

The term of a framework agreement may not exceed four years, save in exceptional and duly justified cases.

Contracts awarded under a framework agreement shall comply with the terms set out for that framework agreement.

2.2.2.1 Information Flow Diagram

Figure 2-7 depicts the different steps involved in the establishment of a framework agreement, as well as, in the procurement of an individual contract within a framework agreement, focusing on the actions performed by all parties involved.

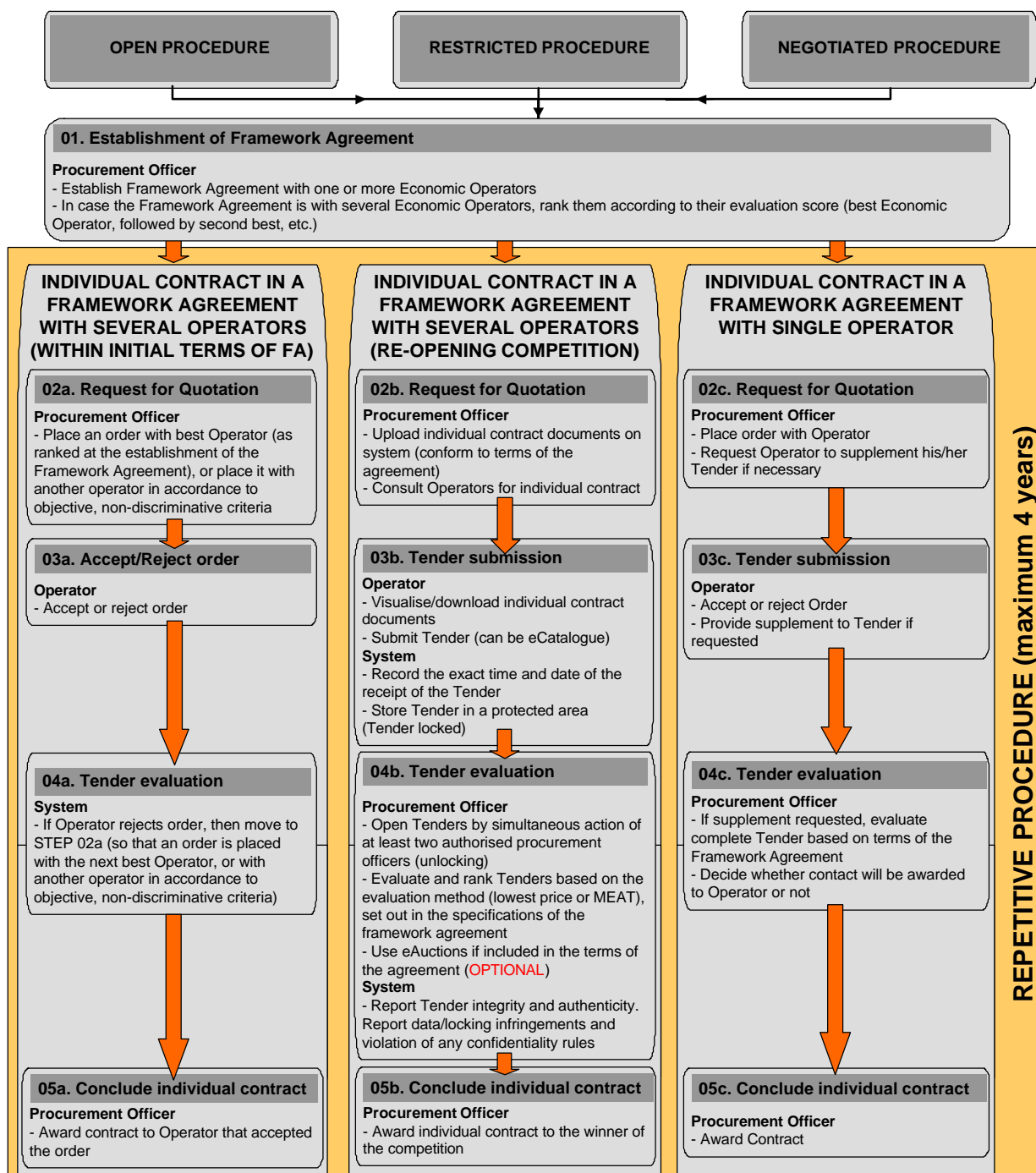
As mentioned above, a framework agreement may be concluded with one or more Economic Operators. In the former case, individual contracts procured within a framework agreement shall be awarded within the limits of the terms laid down in the framework agreement. In the latter case, the Economic Operators must be at least three in number. Individual contracts procured within a framework agreement with three or more economic operators shall be awarded either by application of the terms laid down in the framework agreement, or by re-opening competition.

A re-opening of competition shall be conducted on the basis of the terms laid down in the framework agreement or, where appropriate, more precisely formulated terms. Such terms shall be in accordance with the new EU public procurement legislation.

Figure 2-7 demonstrates the information flow diagrams for the establishment and use of framework agreements for:

- Framework agreement with more than one operator (without a re-opening of competition)
- Framework agreement with more than one operator (with a re-opening competition)
- Framework agreement with one operator

Figure 2-7: Information Flow Diagram of the Framework Agreement



Framework Agreements with a single Economic Operator are not further analysed in the current document, as their operation is similar to Framework Agreements with several Economic Operators (within Terms).

2.2.2.2 Functional requirements for a Framework Agreement system

The current section presents the functional requirements for the realisation of eProcurement systems capable to support framework agreements.

Step 01. Establishment of Framework Agreement

A framework agreement can be established between the contracting authority and one or more operators, following an open, restricted or, where available, negotiated procedure. Therefore, there are no new functional requirements for this step.

*Several Operators, Individual Contract is **WITHIN TERMS** of Framework Agreement*

Step 02a. Request for Quotation

If the contracting authority wishes to award an individual contract without re-opening competition, it may either place an order with the best placed operator within the framework agreement, as ranked at the establishment of the framework agreement ('cascade') or chose the operator best suited for this individual contract. The requirements for this step can be fulfilled by **Functional Req. 22: "Invitation to Tender"**.

Step 03b. Accept/Reject Order

This step involves the operator accepting or rejecting the order. The requirements for this step can be fulfilled by **Functional Req. 17: "Submission of Tenders"**.

Step 04a. Tender Evaluation

If the operator accepts the order, the contracting authority proceeds to the next step and concludes the individual contract. If the operator rejects the order, the contracting authority may select the next best operator (based on the ranking of Tenders at the establishment of the framework agreement), and place the order with him/her. Following this the contracting authority may continue the process in Step 02a, inviting the new operator to accept or reject the order.

Step 05a. Conclude Individual Contract

In this step the contracting authority concludes the individual contract with the operator who accepted the order. After publishing a Contract Award Notice for the initial conclusion of the framework agreement, there is no need to publish Contract Award Notices for individual contracts within the framework agreement. The requirements for this step can be fulfilled by **Functional Req. 16: "Automated Notifications"** for informing the operator of the results of the evaluation, and **Functional Req. 21: "Creation of Mandatory Reports"** for automatically or semi-automatically creating the necessary reports.

Several Operators, Individual Contract awarded by RE-OPENING COMPETITION**Step 02b. Request for Quotation**

This step involves a re-opening of competition for all operators within the framework agreement. The contracting authority creates the Contract Documents for the individual contract to be procured. These shall conform to the terms of the agreement. An Invitation to Tender shall then be sent to all operators within the agreement. The requirements for this step can be fulfilled by **Functional Req. 12: “Publication of Contract Documents”** and **Functional Req. 22: “Invitation to Tender”**.

Step 03b. Tender Submission

The operators to the framework agreement submit a Tender for the re-opened competition. The requirements for this step can be fulfilled by the functional requirements of Step 04 of the open procedure, comprising:

- **Functional Req. 14: Visualise/Download Call for Tenders specifications**
- **Functional Req. 15: Request for Additional Documents**
- **Functional Req. 16: Automated Notifications**
- **Functional Req. 17: Submission of Tenders**

Step 04b. Tender Evaluation

The contracting authority evaluates the Tenders submitted in response to the re-opened competition. The evaluation of Tenders is based on the evaluation mechanism defined at the establishment of the framework agreement. The requirements for this step can be fulfilled by the functional requirements of Step 05 of the open procedure, comprising:

- **Functional Req. 18: Four-eye Principle**
- **Functional Req. 19: Tender Confidentiality**
- **Functional Req. 20: Tender Evaluation**

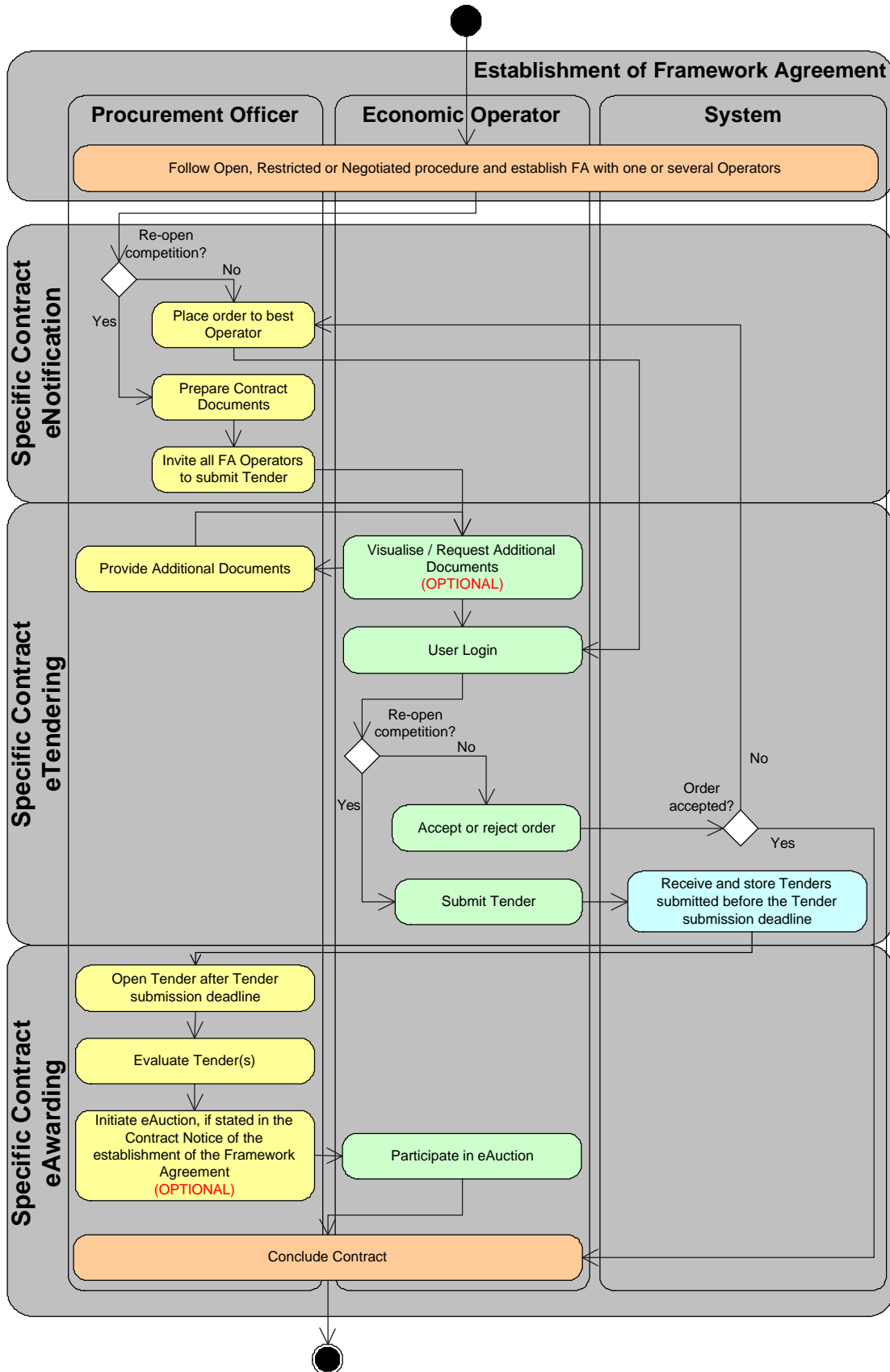
Step 05b. Conclude Individual Contract

The contracting authority concludes the individual contract with the winner of the re-opened competition. After publishing a Contract Award Notice for the initial conclusion of the framework agreement, there is no need to publish Contract Award Notices for the individual contracts awarded within a framework agreement. The requirements for this step can be fulfilled by **Functional Req. 16: “Automated Notifications”** for informing participating operators of the results of the evaluation, and **Functional Req. 21: “Creation of Mandatory Reports”** for automatically or semi-automatically creating the necessary reports.

2.2.2.3 Framework Agreement Activity Diagram

Figure 2-6 presents at granular level the establishment of a framework agreement, as well as, the procurement of an individual contract within the framework agreement. The figure clearly displays all activities that are performed by the main actors (procurement officers, economic operators and an eProcurement system) in the different eProcurement phases: eNotification, eTendering, and eAwarding. The activity diagram groups in phases and serialises all activities that need to be performed in the whole procurement process. Some tasks are subject to legislated time-constraints that need to be respected by Contracting Authorities. Thus, the whole procurement process for the establishment of a Framework Agreement and/or a specific contract within a Framework Agreement may require significant time.

Figure 2-8: Activity diagram for the procurement of an individual contract within a framework agreement



2.3 Extensions

2.3.1 Electronic Auctions

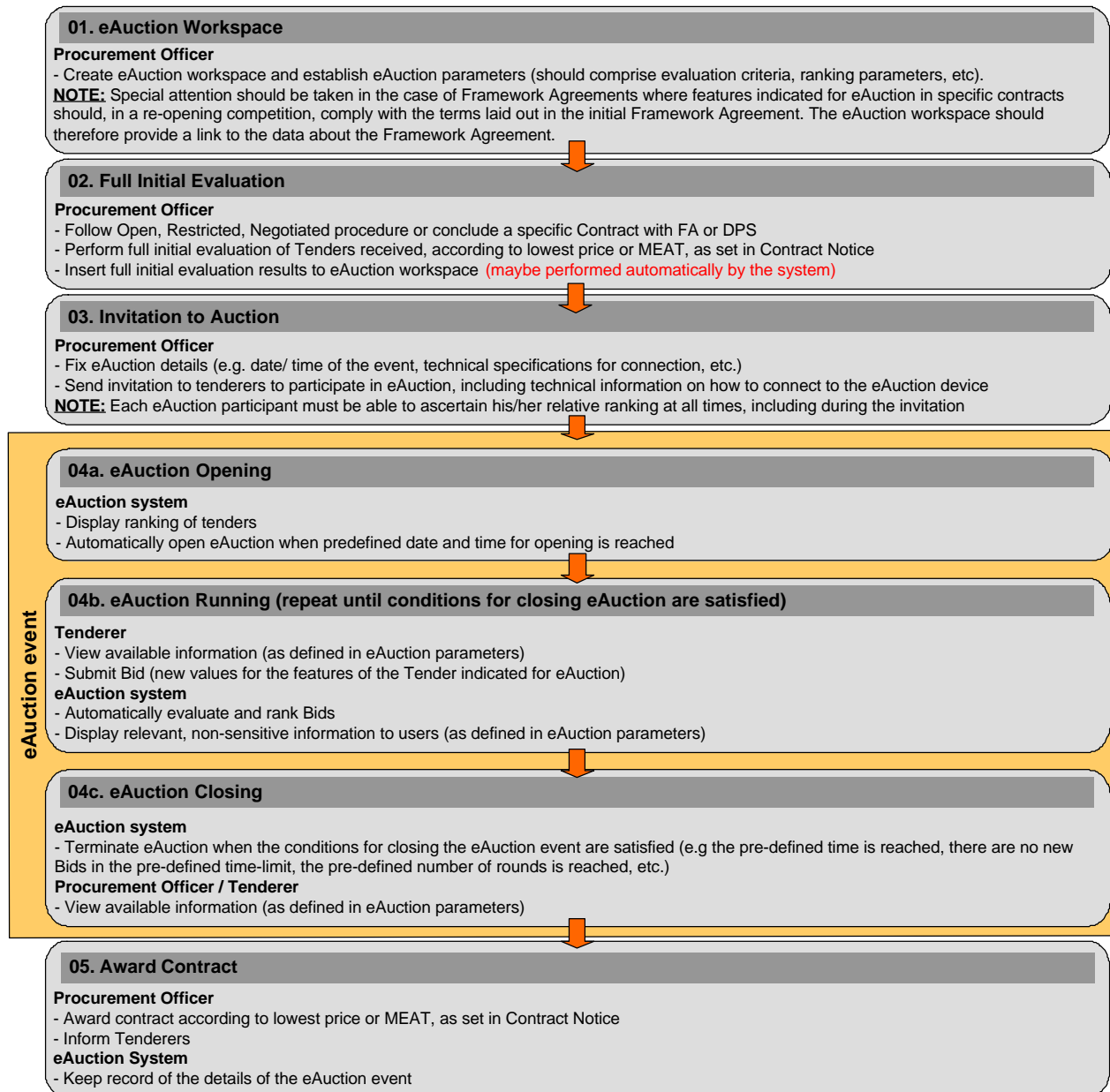
An electronic auction is a repetitive process involving an electronic device for the presentation of new prices, revised downwards, and/or new values concerning certain elements of Tenders. This process occurs after an initial full evaluation of Tenders of a particular Call, enabling them to be ranked using automatic evaluation methods. Electronic auctions are part of the awarding phase of a competition, and do not constitute on their own a full eProcurement procedure for awarding contracts.

Each time the parameters for evaluating a Call for Tenders can be defined with precision, the contracting authority has the possibility to award a public contract through an electronic auction. This fact must be stated in the Contract Notice for the Call for Tenders. eAuctions cannot be used in works or services contracts having intellectual performances for their subject-matter.

2.3.1.1 Information Flow Diagram

Figure 2-9 depicts the different steps of an eAuction procedure, focusing on the actions performed by all parties involved.

Figure 2-9: Information Flow Diagram for Electronic Auctions



2.3.1.2 Functional requirements for Electronic Auctions

This section presents the functional requirements emerging from the legislation for the realisation of eProcurement systems capable to support eAuctions. All functional requirements are associated with one or more steps of **Figure 2-9**.

Step 01. eAuction workspace

In this step, Procurement Officers fix the parameters of running the eAuction, including the definition of the evaluation mechanism as discussed in **Functional Req. 10: “Tender Evaluation Mechanism”**. Specific functional requirements relate to the establishment of an eAuction workspace and preparing and communicating to Tenderers the parameters and, at a later stage, the details of the eAuction.

Functional Req. 26. Creation of eAuction workspace and establishing eAuction parameters

This functional requirement covers the creation of a virtual workspace, where all eAuction related information can be stored. This virtual workspace should only be accessible to authorised users; eAuction parameters should be established and fixed within it. Subsequent eAuction activities, such as tenderers’ placing of Bids and displaying of the ranking of Tenders may be performed within this virtual eAuction workspace or using the services of an external eAuction provider.

eAuction parameters comprise the bidding fields, the eAuction opening and closing conditions, the type of the eAuction, etc. The parameters for the full initial evaluation and the features for auction and their evaluation mechanism should be defined prior to launching the procedure and be published in the eAuction specifications alongside with the Contract Notice.

Step 02. Full Initial Evaluation

The full initial evaluation is performed according to the procurement procedure chosen by the contracting authority. Hence, for an individual contract the contracting authority may perform the full initial evaluation following the open, restricted or, where available, negotiated procedure. For an individual contract within a DPS or framework agreement, the contracting authority shall follow the rules of a DPS or FA, as discussed in previous sections.

The use of an eAuction is allowed only if the technical specifications to be evaluated can be established with precision. The auction itself can only be on some or all of those features established with precision, therefore these must be quantifiable (otherwise the auction cannot be run obviously). The Award criteria must be given a precise weighting. This means that the initial evaluation must attribute a specific value to a feature, not a range of values, to make these suitable for auction.

Also, in this step the eAuction device is provided with information on the tenderers which will compete in the auction event. This task may be performed automatically by the eProcurement system and eAuction device, or manually by Procurement Officers. Under any circumstance, the data must remain fully confidential.

Step 03. Invitation to Auction

Once the definition of the eAuction details (such as time and date of the auction, information about connection to the auction device) is complete, Procurement Officers dispatch invitations to tenderers, in order to invite them to participate in the auction event. This requirement can be fulfilled by **Functional Req. 16: “Automated Notifications”**. The invitation for each participating Tenderer shall be accompanied by the outcome of the full initial evaluation of his/her offer.

Step 04a. eAuction opening

At this step, tenderers connect to the eAuction device. Adding to or displaying the invitation for the auction, the device can provide tenderers with information about their relative ranking, as concluded by the full initial evaluation. This information must be kept fully confidential. Also, tenderers may access details of the auction event, including specifications on how the event will be run, which and how the Bid evaluation mechanism will be used, when the auction will be closed etc.

The aforementioned requirements can be fulfilled by minor modifications of **Functional Req. 12: “Publication of Contract Documents”**.

Step 04b. eAuction running

In this step, tenderers participate in the eAuction event by submitting successive improved Bids. The eAuction device, based on the defined evaluation mechanism, automatically calculates the relative ranking of all tenderers. The requirements related to submission of Bids can be satisfied by **Functional Req. 17: “Submission of Tenders”**. Also, the eAuction device constantly checks whether the conditions for closing the eAuction event are satisfied or not.

If the pre-defined conditions for closing the auction are satisfied, the eAuction device concludes the eAuction event, automatically progressing to the next step. The conditions for closing an eAuction event can be stored in an eAuction workspace, as discussed in **Functional Req. 26: “Creation of eAuction workspace and establishing eAuction ”**.

Step 04c. eAuction closing

Once the eAuction event is concluded, the eAuction device performs a final ranking of all Bids according to the pre-defined evaluation mechanism. The aforementioned functional requirements of eAuctions can also satisfy requirements for this step.

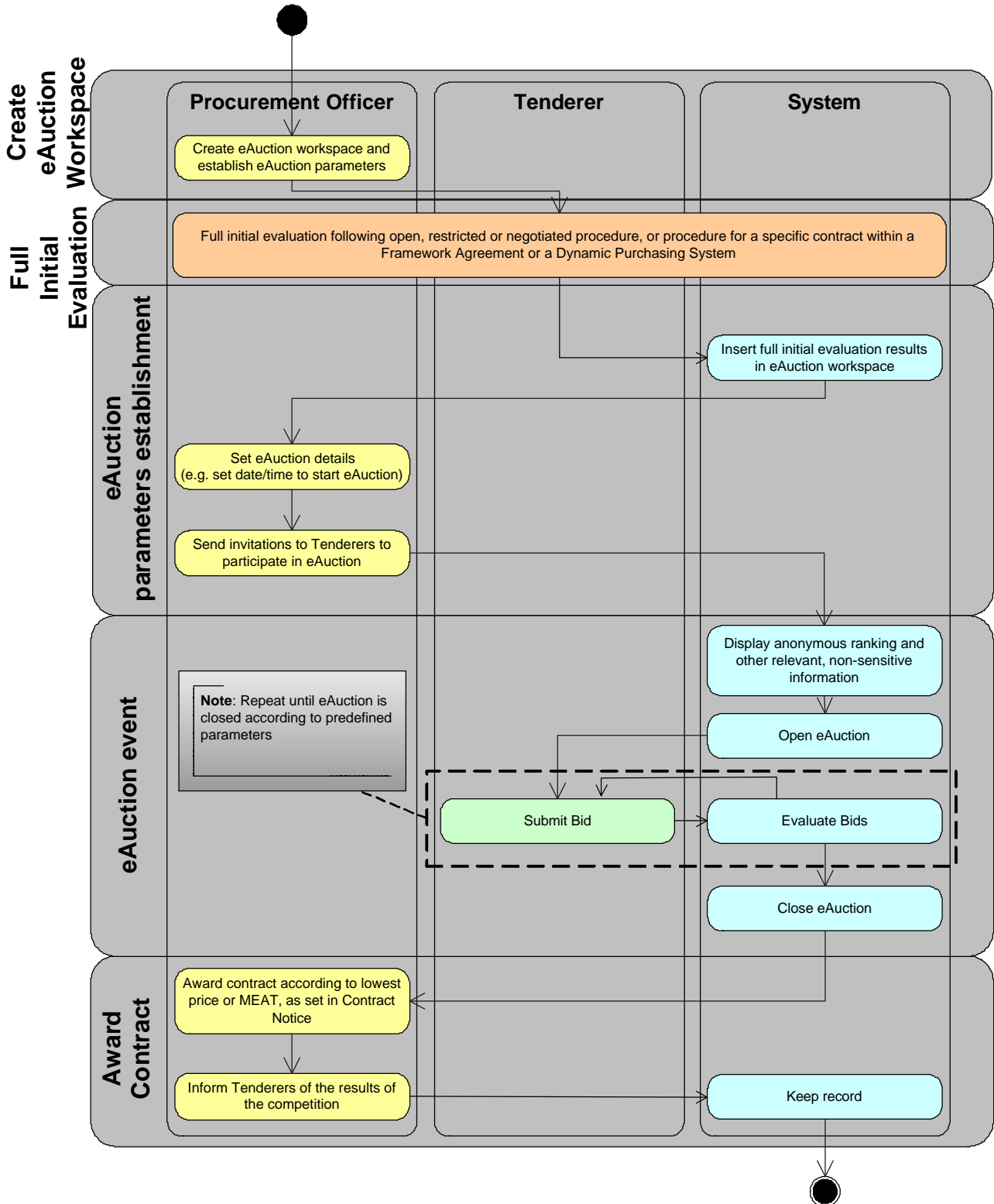
Step 04. Award Contract

Following the conclusion of an eAuction event, contracting authorities identify the winner(s) and award the contract according to the terms of the competition and the full initial evaluation procedure.

2.3.1.3 Electronic Auctions Activity Diagram

Figure 2-10 presents at granular level the various activities of an eAuction. The figure clearly displays all activities that are performed by the main actors (procurement officers, economic operators and an eProcurement system) in the different eAuction phases. The activity diagram groups in phases and serialises all activities that need to be performed in the whole procurement process. Some tasks are subject to legislated time-constraints that need to be respected by Contracting Authorities. Thus, the whole procurement process for a contract and/or a specific contract with eAuction may require some time.

Figure 2-10: Activity Diagram for eAuction



2.4 Summary of Functional Requirements

The following table summarises the Functional Requirements presented in this chapter.

Table 1 – List of Functional Requirements

#	Functional Requirement	Prerequisites
1	User Registration	None
2	User Profiling	#1
3	User Authentication	#1
4	User Authorisation	#2
5	Tender workspace creation	#2
6	Preparation of a Prior Information Notice	#4, #5
7	Use of the Common Procurement Vocabulary (CPV) classification standard	#4, #5, #6
8	Publication of a Prior Information Notice	#4, #5
9	Nomenclature of Territorial Units for Statistics (NUTS) classification standard	#4, #5, #6
10	Tender Evaluation Mechanism	#4, #5
11	Interface with the OJEU	#4, #5, #8
12	Publication of Contract Documents	#4, #5
13	Search Calls mechanism	None
14	Visualise/Download Call for Tenders specifications	#5
15	Request for Additional Documents	#5
16	Automated Notifications	#1
17	Submission of Tenders	#4, #5
18	Four-eye Principle	#4, #5
19	Tender Confidentiality	#4, #5
20	Tender Evaluation	#4, #5, #10
21	Creation of Mandatory Reports regulated by the legislation	#4, #5
22	Invitation to Tender	#4, #5
23	DPS reporting	#4, #5
24	Creation of specific contract workspaces within DPS workspace	#4, #5
25	Indicative Tenders in the form of electronic catalogues (eCatalogues)	#4, #5
26	Creation of eAuction workspace and establishing eAuction details	#4

3 TECHNICAL GUIDELINES FOR IMPLEMENTING EPROCUREMENT PROCEDURES

This chapter provides technical guidelines that can be employed for the implementation of an eProcurement system for supporting the different procedures described by the new directives. All functional requirements identified in the previous chapter are considered for further analysis. For each functional requirement, various technical solutions are elaborated, also providing information on issues related to their implementations.

3.1 Technical Solutions for Functional Req. 1 – User registration and Functional Req. 3 – User authentication

These two functional requirements are related to the process for registering users to the eProcurement system, as well as for identifying users when they access the eProcurement system. The technical implementation followed for these two functional requirements are closely related.

1. *User credentials*: when users access the system, they must authenticate themselves using a combination of email, username, password, and/or other personal information (i.e. Personal Identification Number, etc.).

Additionally, the use of a secret ID number may be requested by the system for validating the identity of a user, every time the user performs a “sensitive” activity (create a Call for Tenders, submit a Tender, etc.). The submission of user credentials is completed using a secure SSL connection via HTTPS.

Users can be logged out when they explicitly request this activity by the system or when they close the application on their personal workstations (e.g. the web-browser). Furthermore, for security purposes, a user can be automatically logged out when there are no user activities on the system for a certain period of time.



The use of User Credentials is the simplest technical implementation for user authentication in terms of effort and cost. It forms the basis for ensuring security, interoperability, and transparency. However, it does not satisfy advanced security requirements, which may be desirable in an eProcurement system. Also, depending on the area an eProcurement system may operate in, national, regional or local legislation may require more advanced security provisions than User Credentials.

2. ***Digital certificate (software)***: an eProcurement system may require the use of digital certificates in order for users to be authenticated. Digital certificates are issued by an official Certification Authority (CA), and may be issued to a person. Effectively, the CA guarantees to third-parties (and as such to an eProcurement system) that the user is indeed who he/she claims to be. The digital certificate, also called “software authentication solution”, refers to a file issued by a CA that is stored locally in a user’s workstation, and can be used for proving his/her identity.

For a user to be authenticated via this method, the eProcurement system must “trust” the CA that issued the digital certificate of that user. In this case, the CA effectively verifies the authenticity of the certificate. Otherwise, the user cannot log in to the system.

This solution offers a higher level of security compared to User Credentials; it involves, however, a compromise regarding the interoperability aspects of the system.



An eProcurement system usually “trusts” a limited number of CAs. The trusted CAs are commonly within the borders of the country the system operates in. Furthermore, the issuing of user digital certificates usually requires the physical presence of the user to the CA offices, and may take some time in order for the CA to perform identification / validity checks. Hence, although the use of digital certificates increases the security level of a system, it can significantly reduce its cross-border interoperability.

3. ***PKI infrastructure (hardware)***: this solution, similar to software digital certificates, also involves digital certificates. However, in this instance user digital certificates are stored in smart cards. A smart card requires a device (reader) for reading the certificate stored on the card. The smart card needs to be issued by a CA, in a similar way to the software digital certificates described above.



The use of smart cards is considered even more secure, in comparison to the software solution, as digital certificates are stored in safer medium (i.e. smart card), and not on a workstation which can be more vulnerable. However, it introduces additional limitations, as a smart card reader becomes an additional hardware requirement for participating in competitions. Furthermore, the cross-border interoperability limitations, as described in the software digital signatures, also apply to this implementation.

3.2 Technical Solutions for Functional Req. 2 – User profiling and Functional Req. 4 – User authorisation

This functional requirement is related to providing the ability to users to store necessary personal information in the system, as well as, potentially storing their preferences when using the system. Also, when a user accesses the system, the system needs to be in a position to identify what data the user may have access to, and also what activities may be performed by that user.

User profiling and authorisation involves the management of user profiles. The former is related to a secure storage area of user personal details, while the latter models the different roles a user can undertake within an eProcurement system. Each role may be constructed by a set of access rights. For each user activity, a specific user right is assigned by the application. In this way, the application can determine the activities that each user can perform within the system.

The technical solutions for implementing these two functional requirements comprise:

1. **Relational Database:** User profiles can be stored in a relational database. All users are associated with records in database tables, which define the access rights the user has been assigned for the various modules and services of an eProcurement system. An efficient and maintainable solution comprises a Users table to be related to User Roles table, which in turn is related to Access Rights table. Furthermore, the Users table needs to be related to an Access Rights table, in order to enable the overwriting of the default user roles and rights. Regarding personal information, the User table may incorporate all necessary database fields for storing such information.



This solution is recommended for an easy to maintain user authentication mechanism, which is relatively simple to model and to implement.

2. **LDAP server:** User profiles may be stored and managed via an LDAP server. The hierarchy of users and users profile rights is contained within the LDAP directory, under a structure similar to the one for relational databases.



This solution is recommended for best performance. Additional licensing and maintenance costs may be related to the installation/operation of an LDAP server.

3.3 Technical Solutions for Functional Req. 5 – Tender workspace creation

This functional requirement is related to the creation of a virtual workspace, where all Call related information (data, users, documents, etc) is stored. The technical solutions for creating a tender workspace comprise:

1. **Collaborative environment:** A collaborative environment can offer significant benefits to users of an eProcurement system. The eNotification phase necessitates the preparation of documents, usually created/updated/approved/published by different users. Through a collaborative environment, an eProcurement system can assist procurement officers in the Call for Tenders preparation process, offering document templates, automated document versioning, multilingual support, document approval workflows, etc. The subsequent eProcurement phases require multi-user coordination, which can be achieved through customisable workflows



This solution can improve efficiency, as tasks are coordinated by the system, exploiting the benefits of online preparation and management of documents. This solution may require a significant investment by contracting authorities, but is considered as the implementation model easiest to maintain.

2. **File system:** Call related documents are prepared offline, and stored in a structured file system. Permissions and access right configurations are set up at the operating system level, in order to ensure security.



Data/document management is performed by authorised users, who are also required to maintain document versioning and control. Security settings need to be set up by computer literate personnel, while the full eProcurement implementation is most probably conditioned by specific operating systems, file systems, etc. This solution can offer a low implementation cost, but high maintenance cost.

3.4 Technical Solutions for Functional Req. 6 – Preparation of a Prior Information Notice

This functional requirement is related to the creation of a Prior Information Notice (PIN). A good technical implementation allows for the creation of any official Notice supported by the Official Journal of the European Union (OJEU). Apart from the technical solutions available below for online preparation of a PIN, contracting authorities can create PINs using offline (PDF) forms, available at the EU Publications Office website. Technical solutions for the creation of Notices comprise:

1. **Internal form filling tool for creating Notices:** Procurement Officers can complete Notices entirely online, using web based forms. The eProcurement system and the internal form filling tool are integrated, so that one may pass information to the other. For instance, when creating a Contract Notice, the form filling tool can obtain already pre-defined information from the Call workspace, including its name of the Call, its description, its estimated value, etc. A tool for supporting the online preparation of Notices may provide functionalities for:
 - a. Creation of notices
 - b. Visualisation and printing options of the Notices, either in Microsoft Word or Adobe Acrobat PDF format
 - c. Visualisation and validation of a Notice prior to its submission to OJEU (all fields can be checked against pre-defined values defined by the legislation)
 - d. Use of CPV codes
 - e. Use of UTF-8 character encoding to support multilingualism
 - f. Temporary storage of Notices for further editing
 - g. Electronic submission of a Notice to OJEU
 - h. Electronic confirmation of dispatch and of publication from OJEU



This solution offers a user friendly mechanism for Procurement Officers to create Notices. It is integrated to the eProcurement system, so that information can be passed back and forth between the two applications. Automated validity checks, together with advanced utilities for guiding users on preparing Notices can be provided to increase efficiency.

This implementation requires some investment by contracting authorities.

2. ***External form filling tool for creating Notices:*** Establish an interface with compliant external services that provide the complete functionality for the online creation of notices. A mechanism may be implemented in order to pass information between the eProcurement system and the external form filling tool.



A good implementation of this solution may benefit from the realisation/maintenance of an internal form filling tool. Appropriate messages (probably in the form of XML), complying with the API of the external tool, can achieve such communication.

Such implementation may initially avoid large implementation costs by a contracting authority. However, subscription fees for utilising such external service may be required.

3. ***Offline form filling tool for creating Notices:*** Procurement officers use an offline application installed in their local environment. The offline tool supports all the aforementioned functionalities and creates the necessary file(s) for officially publishing Notices. The offline tool can be implemented in such way that information can automatically or semi-automatically be obtained by the eProcurement system.



This solution offers flexibility, as this offline tool can operate as an autonomous application or be integrated with the eProcurement system. The downside is that Procurement Officers may need to obtain and install such tool in their workstation, while specific software may be required for the application to become operational. Tool versioning and upgrades may be difficult to maintain.

3.5 Technical Solutions for Functional Req. 7 – Use of the Common Procurement Vocabulary (CPV) classification standard and Functional Req. 9 – Nomenclature of Territorial Units for Statistics (NUTS) classification standard

This functional requirement is related to the use of the CPV and NUTS codes in Notices. Both CPV codes and NUTS codes are updated and made available by the Publications Office.

In the creation of Tender workspace phase, an eProcurement system may prompt Procurement Officers to specify the CPV codes of the goods/services/works to be procured, as well as, the location of the contract in the form of NUTS codes. Two plain text boxes can prompt Procurement Officer to fill the required CPV and NUTS codes. A more advanced solution can be provided in the form of a look-up table, where users can perform a textual search through the CPV or NUTS codes, and select the ones applicable for the contract. When Notices are created, the mechanism used for the creation of Notices can automatically utilise the CPV and NUTS information provided by Procurement Officers during the Tender workspace creation.



The inclusion of CPV and NUTS codes in the details of a Call are simple to implement and can significantly assist Economic Operators in locating interesting Calls for Tender.

3.6 Technical Solutions for Functional Req. 8 – Publication of a Prior Information Notice

This functional requirement is related to the publication of a PIN, and other types of Notices. The technical solutions for this requirement are discussed in section 3.8.

3.7 Technical Solutions for Functional Req. 10 – Tender Evaluation Mechanism

This functional requirement is related to the establishment of an evaluation mechanism for Tenders of a Call. Contracting authorities shall establish the evaluation mechanism they will use for evaluating Tenders prior to the publication of the Contract Notice, and detail this mechanism either in the Contract Notice or Contract Documents. The information on the evaluation mechanism shall include conditions for participation, as well as the criteria to be used (either in weighted form or in descending order of importance if the Tender evaluation is based on MEAT).

The list of conditions for participation and awarding criteria can be made available for display in a commonly acceptable format (e.g. TXT, RTF, PDF, WORD, EXCEL, XML, JPEG, etc.) to all interested parties. The tool used for generating the list of awarding criteria can provide an expert utility, which supports any of the above formats. The technical solutions for defining the conditions for participation and awarding criteria comprise:

1. *Application based:* The use of forms enables the definition and visualisation of the awarding criteria in a hierarchical structure (i.e. levels and sub-levels of criteria). The awarding criteria can be stored in the file system as XML files, or in a relational database. If weighted criteria are used, an evaluation mechanism can be used for automatically or semi-automatically calculating the final score for each Tender. If criteria are stated in descending order of importance, contracting authorities shall define the exact algorithm to follow for concluding the winner of the competition.



This solution offers flexibility and allows for the automated or semi-automated evaluation of Tenders, both with regard to the conditions for participation, and for the awarding criteria. In a system that supports the restricted and/or negotiated procedures, the definition of objective selection criteria may also be supported.

2. ***Back office system:*** Procurement Officers can use the functionalities provided by a back-office system (e.g. ERP), in order to create a form that contains all contract awarding criteria (including the necessary hierarchical structure). When Tenders are evaluated, Procurement Officers can manually complete the defined forms for each tenderer, in order to enable the automated or semi-automated evaluation of Tenders.



This solution can be very effective for organisations that already operate a back-office system, and use such functionality. Also, the creation of contracts between the contracting authority and the winner(s) of a competition can be simplified by automatically or semi-automatically passing on information to the back-office system.

3.8 Technical Solutions for Functional Req. 11 – Interface with the OJEU

This functional requirement is related to the establishment of an interface with the OJEU for the automated publication of Notices. An interface can be established between the eProcurement system or form filling tool (section 3.4) and the OJEU, for submitting notices, as well as, for receiving confirmation of publication. The technical solutions for interfacing with the OJEU comprise:

1. ***OJEU communication protocol:*** The communication with OJEU (send notice/receive confirmations) can be established via XML documents, using the specifications described under DTD version 1.4 of the Publications Office. An asynchronous API must be established between the eProcurement system or form filling tool and OJEU, in order to exchange XML messages



This solution requires the development of a communication interface between an eProcurement system or form filling system and the OJEU. All Notices can be established in the required XML format.

The communication can accommodate three types of messages:

- *Message from eProcurement system or form filling tool to OJEU, containing the details of the Notice to be published*
- *Confirmation message from OJEU to eProcurement system or form filling tool, confirming the dispatch date of a Notice, as well as, whether it is accepted by the OJEU or whether it is incomplete*
- *Confirmation message from OJEU to eProcurement system or form filling tool, confirming the publication date of a Notice*

3.9 Technical Solutions for Functional Req. 12 – Publication of Contract Documents

This functional requirement is related to the creation and publication of Contract Documents. A Contract Document to be created and published probably needs to go through an approval workflow, which depends on the internal procedures of a contracting authority. This process can be modelled by a collaborative environment, as discussed in section 3.3. The technical solutions for creating and publishing a Contract Document, and any other official document of a Call, comprise:

1. **Offline preparation:** Contract Documents should be available in a commonly acceptable format (e.g. TXT, RTF, PDF, WORD, EXCEL, XML, etc). Procurement Officers can prepare Contract Documents offline, using tools they are familiar with. When the Contract Documents are completed, Procurement Officers can upload them onto the eProcurement system. In case a document is uploaded in XML format, it must be associated with an appropriate XSL/XSLT template, for correct visualisation.



This solution offers flexibility, as users are not bound by specific applications for generating documents. However, this solution may introduce interoperability limitations to users, as interested parties are required to have the necessary software for accessing/reading a specific document.

2. **Online forms:** Procurement Officers complete several web forms online, which contain all necessary information about the Contract Documents. The system may allow users to upload several types of files (e.g. image, chart, diagram, etc.). The eProcurement system can be flexible in order to allow Procurement Officers to define the Contract Documents, as they would normally do in an offline approach. Web forms need to be highly customisable, as Contract Documents may vary for different Calls for Tenders, depending on the goods/services/works procured and other parameters of the competition



This solution offers high interoperability, as customisable forms may provide the best medium for all users to access/read Contract Documents and other types of official documents. This implementation can integrate with a collaborative environment, automatically catering for document versioning, approval workflows, multilingual support, etc.

It can also allow for the automated or semi-automated creation of Contract Documents, obtaining information from the eProcurement system. Also, data verification, correct formatting of images, paragraphs, sections, titles, etc. can be accommodated.

The creation of appropriate online forms can however be difficult to achieve, and potentially involves high costs of implementation and maintenance.

3.10 Technical Solutions for Functional Req. 13 – Search Calls mechanism

This functional requirement is related to the provision of an end-user service facilitating the searching of Calls for Tenders. An eProcurement system can host large number of Calls and there can be a mechanism allowing users to search through those Calls in a timely, accurate and simple manner. The technical solutions for performing Call searches comprise:

1. **Internal search engine:** An internal search mechanism can allow users to search for interesting Calls for Tenders through searching meta-data, as well as its content. This search functionality may comprise the following options:
 - a. Simple search forms: Users can use these forms for conducting a simple text-based search for specific Calls of interest to them. This kind of search is likely to produce a bulky result list
 - b. Advanced search forms: Users can use these forms for conducting more advanced searches for Calls of interest to them by providing additional information

regarding the Call(s) they are interested in, narrowing down the results returned by the system to the most relevant ones

- c. Query By Example (QBE): Users can construct custom terms, based on a predefined list of supported attributes (list needs to be supplied) where logical or arithmetic operations apply, and link them together with AND, NOT and OR



This solution is simple to adopt and can provide adequate functionality to users to locate interesting Calls. The search mechanism can be adopted accordingly to be used for other data searches, like users, authorities, etc.

It requires relatively low implementation cost.

2. External search mechanism: Alternatively, the system may utilise an external search engine so as to take advantage of the features offered by a specialised search engine, such as support for UTF-8 character encoding, content-based search, support for searching content stored within several types of documents (doc, xls, pdf, plain text, etc.), etc.



This solution most probably comes at additional cost because of the effort required to integrate the external search engine with the eProcurement application. Additionally, licensing fees may be required.

3.11 Technical Solutions for Functional Req. 14 – Visualise/Download Call for Tenders specifications

This functional requirement is related to the provision provided to users of an eProcurement system for viewing and downloading the specifications of the Call for Tenders. The specifications may comprise many documents of various types. The technical solution for allowing the viewing and downloading of Call for Tender specifications comprise:

1. Web-pages: The eProcurement system may allow users to access and download documents comprising the specifications of a Call via an Internet web-site. The HTTP (HyperText Transfer Protocol) protocol may enable users to transfer files across the Internet. Where security provisions are necessary, the HTTPS protocol (HTTP Secure) may instead be utilised.



This solution is simple to implement and can satisfy this functional requirement in an efficient manner. It requires an HTTP client program for users (an Internet web-browser), and an HTTP server for the eProcurement system (a web server). Users may easily and at no cost obtain an HTTP client program, while some licensing/maintenance costs may be required on behalf of a contracting authority for operating an HTTP server.

2. e-mail/secure e-mail: e-mail, using simple SMTP (Simple Mail Protocol) or secure e-mail, using protocols such as Microsoft's SMIME (Secure Multipurpose Internet Mail Extensions) as a more secure method, can be used in order to accommodate this requirement.



This solution can be easily employed, however it should not introduce unequal treatment for Economic Operators. Economic Operators should be provided with an easy and accessible mechanism (preferable electronic) for requesting such e-mails to be sent to them, in a prompt and reliable manner.

3. *Internet download site (FTP/SFTP)*: Apart from HTTP/HTTPS discussed above, FTP (File Transmission Protocol), the commonly used Internet protocol for exchanging files on top of TCP/IP, or SFTP (Secure FTP), can be used in order to allow users to download documents comprising the specifications of a Call for Tenders.



Similarly to the first technical solution, this solution is simple to implement and can efficiently provide the necessary functionality to users to download Call specifications. It requires an FTP client program for users, and an FTP server for the eProcurement system. Users may easily and at no cost obtain an FTP client program, while some licensing/maintenance costs may be required on behalf of a contracting authority for operating an FTP server.

3.12 Technical Solutions for Functional Req. 15 – Request for Additional Documents

This functional requirement is related to the functionality offered by an eProcurement system to users for submitting requests for additional documents. Once the Contract Notice for a Call is published, Economic Operators are usually provided with the opportunity to request additional documents (i.e. ask questions) about the Call. Contracting authorities shall provide such additional documents (i.e. provide answers) to all interested parties, preserving the “equal treatment” principle of the legislation. This phase is commonly referred to as the “Question & Answers session” The technical solutions for requesting additional documents comprise:

1. *Online form*: An appropriate online form may be offered by the system to users for submitting online their requests for additional documents. The technical implementation of online forms is discussed in Section 3.9
2. *e-mail*: Users may send their requests for additional documents via e-mail. This technical solution is discussed in section 3.13
3. *SMS*: Short Messaging Service (SMS) can be supported by the system, allowing users to submit their requests to the system via their mobile phones. Section 3.13 provide information regarding this technical implementation



*The technical solution provided for this functional requirement is primarily dependant on technical solutions employed for **Functional Req. 12: “Publication of Contract Documents”** and **Functional Req. 16: “Automated Notifications”***

3.13 Technical Solutions for Functional Req. 16 – Automated Notifications

This functional requirement is related to the provision of user notifications in an automated or semi-automated manner. After significant user interactions with the system, an automated response may inform users of the current status of their activities (e.g. user registration, uploaded documents, etc). Furthermore, notifications may be triggered by time events (e.g. tender submission period expired). The technical solutions for automated notifications comprise:

1. e-mail: Users receive automated notification via email. These messages can inform users both for activity-driven events (e.g. publications of an Additional Document), as well as, time-driven events (e.g. notification that the opening of Tenders following the four-eye principle will commence on a specific date and time).



This solution may be used both for activity-driven and time-driven notifications. Nevertheless, e-mail is an insecure method of communication with users; therefore e-mails may not include confidential information. The delivery of e-mails is not guaranteed, so an eProcurement system may facilitate other means of notifications, provided the principle of equal treatment of all Economic Operators is maintained.

2. Secure e-mail: Another option is the implementation of secure e-mail. An automated notification mechanism employing protocols like Microsoft SMIME may be implemented, in order to provide for more secure user notification environment in contrast to SMTP (i.e. simple e-mail protocol). However this technical solution will introduce software prerequisites for receiving automated notifications, thus reducing the interoperability of the system.



Just like the previous technical solution, this solution may be used both for activity-driven and time-driven notifications. Through this solution, the security of e-mails is increased; however the interoperability of the system is reduced, as users will require prerequisite software in order to receive notifications.

3. SMS messages: Short Messaging Service (SMS) is a mobile phone service widely offered by service/network mobile providers. An eProcurement system may take advantage of this service to notify users of activities taking place in the system. The technical implementation for utilising this service is relatively simple, as numerous SMS providers offer tools for automated notifications.



Similar to e-mail, SMS can be used for notifying users of activity-driven or time-driven events taking place in the system. Additional costs may be related to the use of such service. SMS is not secure and the delivery of such notifications is not guaranteed, however users can be notified for events even when not using their workstations (where they would normally access either the eProcurement system or their email)

4. Application confirmation pages: When a user completes a significant activity (e.g. uploading a document, submitting a Tender, creating a Call for Tenders workspace), the eProcurement system may inform the user of the results of his/her actions. Through this mechanism users can be notified whether their activities have been performed, or whether there were any errors/problems which might have caused their activities to be aborted. Application confirmation pages may also be used for activities which take significant time to complete, for instance when a user uploads a large document in the system.



Application confirmation pages can be used for informing users of the results of their activities. Such pages can be easily created in any application, without significant implementation effort.

3.14 Technical Solutions for Functional Req. 17 – Submission of Tenders

This functional requirement is related to the activities of Economic Operators for the preparation and submission of Tenders for a Call. The technical solutions for the preparation and updating of tender responses by tenderers comprise:

1. ***Offline preparation:*** An offline preparation tool can be used for creating and submitting Tenders. This tool can be technically implemented as described in section 3.9
2. ***Online preparation:*** An online preparation tool can be used for creating and submitting Tenders. This tool can be technically implemented as described in section 3.9
3. ***Tender preparation tool:*** Economic Operators can be provided with a specific tool for the preparation and submission of Tenders. The Tender preparation tool presents a number of offline electronic forms, which are completed by Economic Operators. Tenders can be validated by the Tender preparation tool before being submitted to the eProcurement system, guaranteeing that a Tender is compliant with the Tender specifications. Such validation checks may validate the correctness of specific fields, number of documents attached to the Tender, etc. Once the validation check of a Tender is performed successfully, an Economic Operator may submit his/her Tender to the eProcurement system. Therefore, Economic Operators can only upload Tenders that conform to the Call for Tenders specifications. The tool can also foresee printer friendly utilities, so that the tenderer can view and validate a Tender prior to its submission.



A tender preparation tool allows Economic Operators to prepare their Tenders offline, through the completion of forms specific to the Call for Tenders. Such a tool can support advanced validation facilities, allowing for the validation of Tenders before their submission, also guaranteeing that all Tenders submitted are compliant with the Call specifications. Also, guidance can be provided to Economic Operators on how to prepare their Tender.

Such mechanism can increase the control a contracting authority is given in terms of specifying how a Tender should be constructed. However, there can be significant implementation costs with such a tool to make it customisable, depending on the details of each Call for Tenders.

4. ***Tender XML schema:*** Economic Operators are provided with the opportunity to download a Tender XML schema, functioning as an XML template on how Tenders should be constructed. Such a schema may contain the exact structure of a Tender, allowing for the easy insertion of Tenders to a back-office system (e.g. ERP). Contracting authorities are provided with tools to re-define the Tender XML schema depending on the details of a particular Call for Tenders.



This solution offers flexibility, as the Tender XML schema can be easily created by Procurement Officers to reflect the Call for Tenders specifications, before being distributed to Economic Operators.

This solution requires however significant design and implementation costs, as a tool for creating the XML template must be realised, assisting Procurement Officers in defining Tender XML schemas. Also, such a tool may need to be distributed to Economic Operators, assisting them in preparing their Tenders.

3.15 Technical Solutions for Functional Req. 18 – Four-eye Principle

This functional requirement is related to the secure storage of Tenders until their pre-defined opening time, as well as, to the implementation of the four-eye principle, requiring at least two Procurement Officers to perform simultaneous action for unlocking Tenders.

The storage of tender responses must be secure-proof, for all system users (Procurement Officers, Economic Operators, etc.), as well as, administrators of the eProcurement system.

The technical solutions for the secure storage of uploaded Tenders comprise:

1. *Data encryption and fragmentation of encryption keys:* encryption of Tenders can be performed by the tenderer, based on cryptographic keys communicated by the contracting authority prior to the Tender submission, or by the system upon Tender submission. The same keys may be used by Procurement Officers for the decryption of Tenders. Keys can be automatically fragmented and distributed to various Procurement Officers. Only at the designated opening time, Procurement Officers may combine their respective keys in order to re-construct the initial key for the decryption of a Tender.

This solution can fully satisfy the four-eye principle, as only the simultaneous action of at least two Procurement Officers can unlock Tenders.



Contracting authorities may consider additional “procedural” requirements for further enforcing the four-eye principle, for instance the procedure followed if Tenders are not unlocked at the designated opening time, if Procurement Officers provide wrong decryption keys, etc.

2. *Tender file fragmentation:* Tenders are constructed by Tender files. On submission, such files can be automatically fragmented and different parts be distributed to different designated Procurement Officers. To enhance security, the parts of the fragmented files can also be encrypted, as described above. Only at the designated opening time, Procurement Offices can decrypt their relative parts and re-combine them in the eProcurement system, for reconstructing the original Tender files.

This solution, similarly to the previous technical solution, can satisfy the four-eye principle.



This mechanism requires more significant design and implementation effort in relation to the fragmentation of encryption keys. However, it offers an even more advanced implementation of the four-eye principle, as Tenders apart from being fragmented, their various parts are further encrypted by the encryption keys of different Procurement Officers.

3.16 Technical Solutions for Functional Req. 19 – Tender Confidentiality

This functional requirement is related to preserving the confidentiality of Tenders after their opening. Tenders should be securely opened following the four-eye principle. After their opening, Tenders remain confidential data, and should be accessible only to authorised users. This functional requirement can be satisfied by user authorisation issues, discussed in section 3.2.

3.17 Technical Solutions for Functional Req. 20 – Tender Evaluation

This functional requirement is related to the automated or semi-automated evaluation of Tenders. Contracting authorities should evaluate Tenders according to the Tender evaluation mechanism, discussed in section 3.7. This process is internal to the Contracting Authority.

The technical solutions for evaluating Tenders comprise:

1. **Online Evaluation:** Tenders are evaluated according to the evaluation criteria (as pre-stated in the Contract Notice), and ranked according to their score. For Calls for Tenders where the evaluation mechanism is “lowest price”, ranking is based on the price values of the Tenders. On the other hand, for Calls for Tenders that the evaluation mechanism is based on MEAT, ranking is performed according to the scores of each Tender, based on the pre-stated MEAT criteria and evaluation function. The online evaluation may allow the automated or semi-automated evaluation of Tenders. It primarily depends on how the Tenders are constructed and submitted by tenderers (discussed in section 3.14). For instance, if a Tender preparation tool is used, certain aspects of the Tender are completed in specific fields and can be used for a fully-automated evaluation.

This mechanism can offer a very efficient and transparent mechanism for automatically or semi-automatically evaluating Tenders. However, the exact technical details can be established only after a contracting authority has decided the mechanism for the submission of Tenders. Depending on that mechanism, Tenders may be evaluated automatically or semi-automatically.



In the first case, all significant aspects of the Tender are completed in a form that the eProcurement system can automatically receive and process (e.g. the model, quantity and product price for a Tender are given within specific fields of an electronic form).

In the second case, Procurement Officers may be provided with electronic evaluation forms. Through these forms, Procurement Officers are given the functionality to store information about the Tenders linked to a specific Call for Tenders. Based on that information, the eProcurement system can calculate the final ranking.

2. **Offline Evaluation:** The evaluation of Tenders is performed manually outside the context of the eProcurement system. The eProcurement system offers functionality for Procurement Officers to input the final ranking of the Tenders, as concluded by the offline evaluation. This functionality can be offered so that the system registers the final results and uses these for subsequent steps (e.g. the creation of the Contract Award Notice), as well as, audit trailing purposes.



Offline evaluation is obviously less transparent in comparison to the online evaluation. However, as contracting authorities may need to invest significant effort for implementing an efficient and flexible online evaluation mechanism, the offline evaluation may be appropriate as an initial step towards building a system which can support all procedures and phases of eProcurement.

3.18 Technical Solutions for Functional Req. 21 – Creation of Mandatory Reports

This functional requirement is related to the various types of reports an eProcurement system should be in position to generate. The EU public procurement legislation requires for contracting authorities to be able to provide reports, detailing the different aspects of an eProcurement competition. As such, an eProcurement system may assist contracting authorities by providing a flexible reporting mechanism, allowing the automated or semi-automated generation of various reports.

Additionally, the system may also provide the capability to procurement officers to create customised reports, not only for regulated reporting, but also for statistical analysis and other internal activities of the contracting authority.

To accommodate this requirement, a system needs to be capable to obtain and store the necessary data for the production of reports. The technical solutions for the creation of reports comprise:

1. *Internal statistical/reporting tool*: A statistical tool of the eProcurement system can automatically produce reports satisfying the requirements of the legislation. For this reason the statistical module can store and retrieve data, and dynamically perform computations to generate the reports.



This solution is flexible, as adding/modifying a statistical capability to the statistical tool, in order to satisfy new reporting requirements, simply consists of relatively minor modifications to the existing tool. The adoption of this technical solution may introduce some maintenance costs.

2. *Integration with back-office statistical tool*: Functionality offered by a back-office statistical tool (e.g. SPSS, SAS) can be utilised by the eProcurement system for the purpose of creating reports.



This solution can be very effective for organisations that already operate a back-office statistical tool, and can utilise such functionality. The integration of the eProcurement system with the back-office system, for the exchange of information between the two, will require some implementation effort, however a contracting authority can then benefit from the use of only one system for reporting purposes, avoiding additional training for its personnel.

3. *External reporting tool*: An external reporting tool such as Seagate's Crystal Reports and Sybase® InfoMaker® may also be used. The reporting tool should be capable of directly accessing the data of the eProcurement system. This will probably be the fastest and most convenient method for creating various types of reports. However, unless there is a third party reporting tool capable of directly accessing the data stored in the eProcurement system, it will be required to export the data from the system into files and then import it on the external reporting tool. This process can be automated or semi-automated, depending on the exact requirements of a contracting authority.



This solution can take advantage of the sophisticated reports an external reporting tool can generate, without necessitating implementation costs. Customised reports can be easily created by end-user, while the generation of reports can also be scheduled and initiated automatically.

Some licensing costs may be required, while the transfer of data from the eProcurement system to the external reporting tool may prove difficult to establish, depending on the technical infrastructure of the contracting authority.

3.19 Technical Solutions for Functional Req. 22 – Invitation to Tender

This functional requirement is related to sending invitations to Tender following the selection of tenderers in the restricted or negotiated procedure. However, such functionality may be used for other similar activities, like placing an order within a framework agreement, inviting all tenderers admitted to a DPS to submit a Tender for a specific contract, etc. The technical solution for this step can be implemented similarly to solutions for automated notifications, discussed in section 3.13. Obviously, the technical solution “Confirmation Application pages” described in the aforementioned section is not applicable in this instance, as only asynchronous notification mechanisms (user not required to be logged in the system) are necessary for this functional requirement.

3.20 Technical Solutions for Functional Req. 23 – DPS reporting

This functional requirement is similar to **Functional Req. 21: “Creation of Mandatory Reports”** as discussed in section 3.18. However, an eProcurement system may cater for advanced reports concerning a Dynamic Purchasing System (DPS). The reporting functionality of the system may also allow for reports concerning specific contracts within a DPS. Hence, reports may concern information of Tenderers admitted to a DPS, number of specific contract procured, total cost of specific contracts procured within a DPS, etc.

The technical solutions discussed for **Functional Req. 21: “Creation of Mandatory Reports”** are also applicable for this requirement.

3.21 Technical Solutions for Functional Req. 24 – Creation of specific contract workspaces within DPS workspace

This functional requirement refers to the creation of workspaces for specific contracts within a Dynamic Purchasing System (DPS). Each specific contract workspace must be associated with a DPS workspace, so that one workspace functions as the “parent” workspace (DPS workspace) and the others as “child” workspaces (specific contract workspaces within a DPS). The technical solutions for the creation of a specific contract workspace within DPS can be achieved by the technical solutions discussed for **Functional Req. 5: “Tender workspace creation”**. The only difference is that one workspace may have a logical or physical link to another workspace, permitting the “parent-child” relationship of workspaces to be achieved.

3.22 Technical Solutions for Functional Req. 25 – Indicative Tenders in the form of electronic catalogues (eCatalogues)

Where the submission of Tenders takes the form of electronic catalogues, the contracting authority may define eCatalogue specifications (i.e. XML schema, commodity attributes, acceptable formats, etc.) and templates to be used by Economic Operators for creating and submitting eCatalogues. These should be stated at the latest in the Contract Notice and possibly be made available to Economic Operators to ensure non-discrimination and wide participation. The templates should be capable to validate the data provided by Economic Operators, and need to be in a generally available and commonly acceptable format. The technical solutions for accepting a Tender in the form of eCatalogues comprise:

1. *Spreadsheets*: Economic Operators complete their Tenders based on spreadsheet eCatalogues. The Contracting Authority may specify the Tender attributes to be completed by Economic Operators (i.e. fields of the spreadsheet) in the eCatalogue. Economic Operators can use widely available applications (e.g. MS Excel, Lotus Quattro Pro) for completing their Tenders and save them in files, which can be submitted to the eProcurement system. Pre-defined spreadsheet templates can be made available to Economic Operators, which may include all required fields, guidelines for completion, and validation rules.



A simple solution for creating Tenders in an eCatalogue format is by utilising spreadsheets. Contracting authorities may define templates for the eCatalogues to be completed. Also, if contracting authorities specify an application to be used by Economic Operators in order to design their eCatalogues, it needs to be generally available.

More sophisticated tools of the contracting authority may involve tools for verifying whether an eCatalogue submitted complies with the required format, and/or support for the uploading of an eCatalogue to the eProcurement system, permitting Procurement Officers to visualise it.

2. *Portable databases*: Economic Operators may be asked to complete their eCatalogues in portable database format, using generally available portable database applications (e.g. MS Access, Paradox, etc). Such database applications can create files containing both the database structure and data, which can subsequently be easily uploaded by Economic Operators onto the eProcurement system. Similar to the previous solution, contracting authorities can make available pre-defined database templates, which can guide Economic Operators into creating their eCatalogues utilising validation rules. This solution can offer more flexibility in comparison to the previous one, as database applications provide advanced functionality and data control. Furthermore, this solution can allow the use of images and other multimedia features, further enhancing the usability and efficiency of eCatalogues.



A relatively advanced solution for creating Tenders in an eCatalogue format is by utilising portable database files. Such files contain not only the structure of a database, but also its data. Contracting authorities may define the desired structure of an eCatalogue for a particular Tender. Subsequently, Economic Operators may fill the database with their product details and upload onto the eProcurement system.

This approach is slightly more advanced in comparison to spreadsheets. Advanced tools can also be provided for validating an eCatalogue. Also, better visualisation and functionality for comparing eCatalogues can be provided.

3. **Text-based eCatalogues:** eCatalogues can be created in flat text files, separating each commodity attribute (i.e. product field) by a pre-defined special character (i.e. comma character, tab, etc.), or fixed length. This is the more simplistic method for constructing eCatalogues, which offer high interoperability, as almost any system can read/write text files. The creation of text-based eCatalogues can however be cumbersome, unless a supplier uses appropriate tools, which can automatically export data to the pre-defined structure. Text-based eCatalogues cannot support advanced features, as the previous two solutions do.



Text-based eCatalogues are very interoperable, as they do not depend on the operating system, application and/or version of the application the Economic Operators is using. Tools may be made available to Procurement Officers to upload a text-based eCatalogue in an application, where advanced searching and user-friendly visualisation can be achieved.

4. **XML-based eCatalogues:** The structure of an electronic catalogue can be represented by an XML schema that is used by Economic Operators, in order to exchange data about products and services. XML files can be based on:
- Existing commercial XML vocabularies (e.g. Electronic Business XML - ebXML, Commerce XML - cXML), which describe the structure and semantics for exchanging data about commodities. Such vocabularies are not yet fully standardised, thus posing a limit to the interoperability capabilities that an XML schema should normally offer
 - Customised XML schemas defined by contracting authorities to model their specific needs



XML-based eCatalogues may be used for the automated communication between Economic Operators systems and an eProcurement system. This implementation requires minimum effort by both Economic Operators and Procurement Officers in order for an eCatalogue to be imported into the eProcurement system. However, contracting authorities shall ensure non-discrimination of smaller Economic Operators by making this the only way to provide eCatalogues.

For an Economic Operator to produce an eCatalogue of this sort, it usually prerequisites some IT expertise, as well as, the existence of a back-office system. This can limit the participation of a large number of Economic Operators, and particularly of SMEs

3.23 Technical Solutions for Functional Req. 26 – Creation of eAuction workspace and establishing eAuction

This functional requirement is related to the creation of a virtual workspace where all eAuction related data can be stored. An eAuction workspace should support all requirements of a Tender workspace, as discussed in section 3.3.

4 NON-FUNCTIONAL REQUIREMENTS

The new EU public procurement directives, in addition to describing the functional requirements (as conceptualised in section 2 and analysed in section 3), impose also a set of non-functional requirements. These requirements are primarily concerned with usability and security aspects, for ensuring accessibility, transparency, equal treatment, security, and other principles of the EU legislation. Furthermore, a number of non-functional requirements that are not required by the legislation are presented in this chapter. While these are of a more implicit nature, they can significantly assist contracting authorities in establishing effective Public eProcurement systems.

The analysis and presentation of non-functional requirements for eProcurement systems is based on the IBM Rational Unified Process. RUP is a process platform for software development that supports a wide range of project types, ranging from custom business applications to commercial-off-the-shelf (COTS) program implementations.

RUP captures functional requirements as “use cases” and ties non-functional requirements to use cases wherever possible. RUP considers requirements which cannot be tied to use cases or domain concepts as general requirements and lists them as supplementary requirements. Non-functional requirements originate from system properties, such as environmental or implementation constraints (e.g. remote access should be provided, software must run on various operating systems) and qualities of the system, such as the ones analysed in this section:

- Usability
- Reliability
- Interoperability
- Scalability
- Security

In the current chapter, a limited number of specific products/technologies are mentioned as examples for better describing concepts of non-functional requirements. As described in page 2 of the current report, any reference to specific products, technologies, processes and/or services does not constitute or imply its endorsement, recommendation or favouring by the European Commission.

4.1 Usability

4.1.1 User Support Requirements

One of the primary objectives of the new EU public procurement legislation is to support suppliers to successfully participate in public procurement competitions. Advanced eProcurement systems, built according to the highest GUI standards, significantly assist users, and in particular suppliers, to understand the eProcurement process, thus reducing the need for user support. However, Contracting Authorities may also envisage user support operations providing adequate support to users if and when required. Table 2 demonstrates a number of methods to achieve the desired user support.

Table 2 - Methods for supporting users

Type	Details
Help Desk	Provide support to users through the use of a Help Desk, facilitating: <ul style="list-style-type: none"> • Application support and problem reporting: allows users to report all system errors and application defects to the Contracting Authority. This operation involves the investigation and resolution of incidents and problems. The Help Desk must be in a position to assess the criticality of a system error, and either provide information to users as to how to resolve the error by themselves, or transmit the issue to the corresponding IT department for resolution • System Monitoring: monitors the operation of the eProcurement system, identifying potential problems caused by increased user activity and assist in the necessary monitoring for the identification of potentially illegal activities • User Assistance: allows users to communicate directly with an employee of the Contracting Authority and obtain answers to questions regarding system functionality. Problems of a general nature should be communicated to all users • Feedback/comments collection centre: allows users to provide feedback and comments to the Contracting Authority about the system, regarding current functionality, or functionality which should be made available through the system. This allows the Contracting Authority not only to identify areas of the system that need potential modifications, but also define the scope of future development phases for the system
User education and training	Offer user training sessions to help procurement officers and suppliers to fulfil their roles when using functions and services of the system. eLearning demonstrators and testing environments (simulating the operation of the real system) can assist users to better understand the complete functionality of the eProcurement system
Documentation & technical authoring	Provide documentation to assist users to understand the details of eProcurement, as well as the exact functionality of the system. eProcurement guides, user manuals, walkthrough/training manuals, system online help, in-context help, are types of means which can effectively offer the desired user support

4.1.2 Application Graphical User Interface (GUI)

eProcurement systems are not in principle used on an “everyday” basis. Procurement Officers of a Contracting Authority utilise such systems only when creating a Call for Tenders, or when managing their existing Calls. Depending on the size/type of a Contracting Authority, and the frequency of its purchases, the utilisation of the system can be as rare as a few times every year, while Economic Operators use such systems only when participating in a particular Call for Tenders, which may also occur very rarely.

A public eProcurement system should therefore be widely accessible and based on generally available means. The user interface of such a system needs to be operational in all geographic regions, while technical prerequisites for their accessibility shall not impose significant limitations to suppliers. Additionally, functionality made available to users, is recommended to be implemented in a self-explanatory manner and assistance should be offered at all times, helping to understand the steps they need to follow, taking advantage at the same time of all functionality offered by the system.

The current section elaborates on the GUI requirements of a Public eProcurement system.

4.1.2.1 Graphical User Interface (GUI) Interoperability

The technology used for GUI implementation of an eProcurement system needs to be chosen primarily based on a single criterion; the level of accessibility. In the last few years, several state-of-the-art GUI implementation techniques have emerged, allowing system developers to implement GUIs in a simpler and/or more efficient way. Nevertheless, not all new technologies have set standards, or may not be supported in exactly the same way by Web-browsers, Operating systems, etc. This obviously is an undesired effect, which substantially reduces the level of accessibility.

It is therefore recommended that the GUI of eProcurement systems is based on widely accepted technologies. For instance, all commonly used Web-browsers support the HTML 4.01 standard. Therefore, a GUI of an eProcurement system constructed in HTML 4.01, reduces accessibility considerations to other, non-functional issues (“Security” in section 4.5 and “Availability” in section 4.4.1).

In particular for Web-based solutions, the EC is utilising “10 golden rules” for any Web-based applications implemented in the Europa Web-site (<http://europa.eu.int/>). These guidelines can also be utilised for the implementation of the GUI of an eProcurement system (<http://europa.eu.int/comm/ipg/>).

4.1.2.2 Search functions

Advanced search facilities should be provided to all users of a public eProcurement system. They should allow all users (including anonymous, non-logged-in users) to use the search functionality for all available Calls for Tenders, and to identify the potentially interesting ones.

A predefined set of the most important data in a Call for Tenders, (including its name, CPV codes, NUTS codes, etc.) can be made available as search criteria, as well as the option for end users to combine these criteria. Advanced Boolean logic operations (AND, OR, and their precedence) may also be provided, allowing users to execute refined searches.

The system can allow users to define the fields used for displaying the results of a search and the sorting parameters used. Furthermore, users can be given the possibility to select a particular Call from the search results, and view its details. Depending on the details and status of a particular call, Economic Operators can be presented with the appropriate activities to perform. Table 3 presents the set of activities per procurement type, as they result from the Use Case analysis presented in section 5.2.

Table 3 - Economic Operator activities on a particular Call for Tenders

Type	Status	Activities
All	eNotification (prior to Tender submission)	<ul style="list-style-type: none"> • View Call Details • View Contract Notice (if published) • View Contract Documents (if published)
Open	eTendering (submission of Tenders)	<ul style="list-style-type: none"> • View Call Details • View Contract Notice • View Contract Documents • View/Request Additional Documents • Submit a Tender
Restricted	eTendering (submission of Tenders)	<ul style="list-style-type: none"> • View Call Details • View Contract Notice • View Contract Documents • View Additional Documents • View/Request Additional Documents • Submit Expression of Interest • Submit a Tender (if invited)
All	eAwarding (evaluation of Tenders)	<ul style="list-style-type: none"> • View Call Details • View Contract Notice • View Additional Documents
All	Archived	<ul style="list-style-type: none"> • View Call Details • View Contract Notice • View Additional Documents • View Contract Award Notice

Apart from presenting search results on screen, advanced features comprise the following functionality in relation to results:

- printing results
- storing results as HTML, Excel, PDF, etc. files
- displaying and/or storing results as structured files (e.g. XML, CSV, etc.)

4.1.2.3 Online help

eProcurement systems are not used on an everyday basis, and therefore their GUIs need to be as simple and self-explanatory as possible. Advanced online help can be offered, providing assistance at any time to users performing activities in the system. “In-context” sensitive help, user manuals, wizards, walkthroughs, and online demonstrators can significantly assist users to understand the functionalities of the services offered by the system. Online help documentation, glossary, and FAQ (Frequently Asked Questions) can provide fast and easy access to clear definitions for all the fields used (what they represent, what they measure, etc.). User guides can explain in detail the GUI of the eProcurement, for example using screen-shots and detailed textual descriptions. The FAQ can provide answers to questions that are expected to be most commonly asked by the users of the system.

A successful eProcurement process depends heavily on the correctness of the data submitted by users of the system. The validity of all data submitted by users through completed Web forms can therefore be checked. This can be done at both the server and the client sides:

- **Server side:** when the validity of data provided by a user is verified on the server side and the values are invalid in any way, users can be prompted to access the same entry form again, with descriptive warning messages next to the field(s) improperly completed.
- **Client side:** when the validity of data provided by the user is verified on the client side, the browser uses business logic in order to locate and explain the errors to the user. This check does not add more load on the server. With this check, error messages need to be shown to the users. In Web-based technologies, this implementation may however create interoperability issues, as JavaScript or other client-based scripting languages will need to be enabled.

eProcurement systems may also inform users performing “significant” activities (i.e. create a Call, submit a Tender, etc.) using informative/confirmation pages and automated notification mechanisms.

All online help facilities can be made available in all languages supported by the system, as discussed in section 4.3.1.1.

4.2 Reliability

The degree of reliability of a system can be assessed in relation to the reliability of its components, allowing reliability requirements to be expressed at the component/unit level, rather than entire system level. Reliability requirements are related to the quality of a system, and are usually defined quantitatively. Typical requirements comprise values for:

- Mean time between failures (MTBF): measure of the average time between failures. As an example, if there are 8,760 hours per year (365 days x 24 hours per day) then the MTBF of the system can be divided by 8,760 to identify how long the system will run in years. A system with a rating of 30,000 MTBF, would on average run 3.42 years without a failure.
- Mean time to repair (MTTR): measure of the average time required to perform corrective maintenance on a system in the event of a system failure. As the value for MTTR approaches zero, the availability of the system increases to 100%.
- Probability of failure on demand (POFOD): measure of the likelihood that the system will fail when a service request is made. As an example, if POFOD equals 0.01, this means that 1 out of every 100 service requests results in a failure. This is relevant for eProcurement systems operating non-stop.
- Rate of fault occurrence (ROCOF): refers to the frequency of occurrence of unexpected behaviour. As an example, a ROCOF value of 0.02 means that 2 failures are possible every 100 operational time units.

Because some functionalities of an eProcurement system are more critical than others, reliability requirements may be restricted to the most important ones. For example, the reliability of Tender submission and Tender locking modules should typically be higher than the module used for creating a Contract Award Notice.

When defining the metrics for the reliability requirements, the Contracting Authority needs to specify the exact system conditions. For instance, the reliability of any IT system usually depends on the user request load, and may decrease when the number of simultaneous transactions/requests increases. Therefore, reliability and scalability (section 4.4) are closely related.

The new EU public procurement directives do not specify the exact reliability requirements of an eProcurement system. Nevertheless, an eProcurement system needs to be easily accessible, guaranteeing minimum disruptions to eProcurement competitions, not compromise confidentiality of data and security at any time and ensure transparency and non-discrimination at all times. These requirements can only be fulfilled by a highly reliable eProcurement system.

Contracting Authorities need to specify the exact reliability requirements according to their national, regional and/or local laws and estimated usage of the system. During the development phases, a wide range of testing techniques (including unit testing, integration testing, factory testing, stress testing, etc.), may be employed to ensure the good quality of the programming code. Moreover, apart from realising as highly-reliable systems as possible, Contracting Authorities are recommended to establish mechanisms for handling potential system disruptions, in the form of Business Continuity Plans and Disaster Recovery Plans.

4.3 Interoperability

Interoperability is one of the main principles imposed by the new EU public procurement legislation. The European Interoperability Framework distinguishes between organisational, semantic and technical aspects of interoperability. In the following, non-functional interoperability requirements are analysed according to these three levels.

The European Interoperability Framework document, can be obtained on the IDA web-pages <http://europa.eu.int/ida/servlets/Doc?id=18063>.

4.3.1 Organisational Interoperability

At the organisational level, interoperability issues refer to defining business goals and modelling business processes. The goal is to allow the collaboration between administrations that wish to exchange information but do not have a homogeneous internal organisation and structure. The requirements for pan-European eGovernment services should be determined by all participating administrations and then prioritised according to citizen demand. If pan-European eGovernment services are set up to cover life-event (situations involving human beings that trigger public services) and business episodes (situations involving companies and self-employed citizens that trigger public services or interactions with public authorities), public administrations responsible for implementing them should consider the business process and actors involved and agree on the necessary Business Interoperability Interfaces (BII). Through the BII, their business process can operate at a European level. If the provision of such services requires contributions from several public administrations across Europe, then a Service Level Agreement (SLA) should be formed and should at least consider the BII concerned, as well as agree on a common security policy.

4.3.1.1 Linguistic/Multi-lingual Requirements

An eProcurement system of a Member State should ideally be available in the official language(s) of the Member State, as well as, an additional European language, similarly to pan-European services “Your Europe” Portal (<http://europa.eu.int/youreurope>). Users may then be provided with the functionality to select their preferred language for the Graphical User Interface (GUI), from the supported languages, as well as, to easily switch from one language to another.

With regards to the User Interface and the language used, all descriptions should best be placed in an easily customisable and parameterised format (e.g. property file or database table), so that they can be translated if there is future need to export the User Interface to another language. Additionally, the fonts used in the application should use all the glyphs for all the official EU languages (20).

Apart from the GUI language however, data stored in the system may be in any of the EU official languages. A Contracting Authority may create the Contract Notice and Contract Documents of a Call for Tenders in any EU language, or possibly create the aforementioned documents in more than one language. Users can therefore be provided with the functionality to access the available documents in their preferred language. Through the provision of functionality for multi-lingual support a system conforms to aspects of the equal treatment principle.

In principle, two parts of the eProcurement system localisation should be considered:

- **Language:** the User Interface needs to be capable to display data in any of the EU languages supported by the system (if more than one language is provided) allowing users to set their preferred language from a user profile screen.
- **System character encoding:** system character encoding is the method for encoding text entered in any input fields. UTF-8 (Unicode) character encoding can be supported for non-Latin characters. The database might also need configuration for UTF-8 to work. For instance, previous versions of MySQL™ did not support Unicode, it was however possible to configure a JDBC driver to use Unicode when handling texts.

4.3.1.2 Collaboration Requirements

Throughout the stages of an electronic public procurement procedure, Contracting Authorities internally exchange documents, reports and messages. These processes are considered as an integral part of the whole electronic procurement functionality on the administration side. Automating these processes can considerably reduce administrative costs and use of resources. The bottlenecks introduced by common manual processes can be eliminated and the continuous automation flow can result in a more efficient procurement process.

To provide automation of processes within the administration, a collaboration tool can be adjusted and used. Integration of such a tool may be defined in several cases, such as the drafting/publication of documents, the circulation of participation requests within the administration, the opening and evaluation of documents, the exchange of internal reports, the application of hierarchical structure and multiple authorisations, etc.

A collaborative environment provides services like document management, knowledge management, advanced communication/collaboration tools and workflow services, which apart from capturing the internal processes of Contracting Authorities, can also provide for their improvement. Existing collaborative platforms which may be considered for enhancing eProcurement are CIRCA, Lotus Notes™, Microsoft Exchange®, Microsoft Sharepoint Server™, Livelink™, as well as, open source community tools such as the MERMIG tool (www.mermig.com). Web-based collaborative environment platforms provide on-line services for workgroups and committees, facilitating the effective and secure sharing of resources and documents, and modelling the processes internal to the administration into system workflows, enhancing internal collaboration and communication.

Typical services of a collaborative platform are:

- **Document Manager:** provides a multi-function repository, storing documents organised in a folder tree structure, supporting multi-lingual and multi-versioned documents (*can be used for the uploading of contract documents and Tenders by suppliers*)
- **Group Manager:** incorporates tools for the management of user accounts, and maintenance of personal information of members (*can be used for the definition of users and user roles*)
- **Calendar:** manages the meetings and events schedule of a workgroup through the preparation, announcement and administration of meetings and events. Synchronous communication mechanisms allow online meetings to take place (*can be used for time-relevant activities, like the opening of Tenders*)
- **Forum:** supplies the virtual area for discussions among members on various subjects of interest. Users can read and/or participate in discussions, while support for moderated forums usually requires all information that is displayed to be “approved” by an appointed member before it is made public (*can be used for an FAQ and Q&A section*)
- **Email & SMS:** offers access to email and the ability to send SMS messages (*can be used for automated notification*)

- **Workflow:** boosts team-working and cooperation between members of a workgroup, by supporting the execution of workflows, thus automating complicated procedures performed by team members, ensuring better communication and control of the team. Advanced features may encompass delivery of tasks in user email, and use of task deadlines (*can be used for following the Contracting Authority procedures for the preparation of documents, evaluation of Tenders, etc.*)
- **Workflow designer:** supports design of business processes and their dissemination
- **Search:** allows for searching through the workgroup data
- **On-line help:** presents detailed information for the activities supported by each service

4.3.2 Semantic Interoperability

Semantic interoperability is concerned with the integration of resources which were developed using different vocabularies and possibly different data perspectives. Systems are semantically interoperable when they are capable of exchanging data in a way which makes the precise meaning of the data readily accessible. This means any eProcurement system should be able to translate the data into a form it understands. All data elements exchanged through Contracting Authorities and Economic Operators operating on a pan-European level should be interoperable. Subsequently, some requirements need to be satisfied by the administrations responsible:

- publish information about the data elements involved in the exchange
- draft proposals for and agreement on the data and related data dictionaries required on a pan-European level
- draft proposals for and agreement on tables with multilateral mappings between national and pan-European data elements

For semantic interoperability to be meaningful, the linguistic equivalence in approved directives and regulations needs to be taken into account when these are used in the delivery of e-Government services. XML vocabularies may be developed taking into account agreed e-Government data elements. Semantic interoperability is an area which affects eProcurement and is currently addressed by IDA through the XML Study project and other initiatives.

4.3.3 Technical Interoperability

On the technical level, interoperability refers to the technical issues involved in linking computer systems and services (open interfaces, interconnection services, data integration and middleware, security services, etc.). Technical interoperability of pan-European networks, applications and services requires that Member States administrations, EU institutions and/or agencies develop and use common guidelines. These guidelines should follow the IDA guidelines and be updated regularly, also taking into account results and guidelines from technological research and development programs as well as Community programs such as IST, eTen and eContent. They should be based on open standards.

Multilingualism adds technical interoperability requirements if citizens shall be provided with mechanisms allowing them to submit requests and to obtain information in more than one language. This requires the use of machine translation software that will enable users to understand requests in other languages and respond accordingly.

4.3.3.1 Application Interfaces

In light of the importance of technical interoperability aspects in an eProcurement environment, it is recommended that an eProcurement system should have appropriate open application interfaces to support the interaction between various operational systems, as well as systems and applications under development. An eProcurement system can be realised in a way which enables interoperability with existing legacy systems, allowing the re-use of existing systems and minimising the costs for public administrations.

The European Interoperability Framework emphasises that the interoperability of eGovernment services on a pan-European level is very beneficial. eProcurement systems can enable their integration with existing Enterprise Information Systems (EIS). To address the interoperability requirements, eProcurement systems may employ several strategies:

- **Service Oriented Architecture (SOA):** SOA is concerned with the independent construction of services which can be combined into meaningful, higher level business processes within the context of an organisation. SOA describes several aspects of services existing within an organisation:
 - The detail ('granularity') and types of services (granularity refers to the size or extent of a functionality in a given interaction).
 - How services are constructed
 - How services are combined together
 - How services communicate on a technical level
 - How services interoperate on a semantic level.

By applying the SOA paradigm to the design of the core components, system implementers can ensure a significant improvement in system flexibility, while at the same time business components are re-used. This consideration needs to be taken into account during the system design phase.

- **XML based communication protocols (SOAP and XML-RPC):** XML-based communication protocols can be utilised when cross-platform interaction is required. Furthermore, SOAP and XML-RPC are standard components of almost all environments, constituting two protocols to enable remote cross-platform communication in a standardised and convenient way
- **Integration capabilities depending on the specific development framework used:** depending on the development framework used, Contracting Authorities may design their applications so that future interoperability capabilities are enhanced through the adoption of the appropriate standards. The J2EE Connector Architecture (JCA) for the J2EE framework for instance, can assist in establishing an environment for secure system interoperability. JCA defines and enables a standard way for connecting J2EE based applications to heterogeneous EIS. EIS systems comprise Enterprise Resource Planning (ERP) systems, database systems and various legacy applications. Furthermore, JCA offers a set of scalable, secure, and transactional mechanisms to enable connectivity to EIS and there is a huge marketplace of JCA adapters to simplify integration of enterprise applications.

Widely used architectural methods for solving interoperability issues comprise:

- **Java/J2EE based applications:** depending on the deployment architecture of the existing application, two means of accessing services, objects, and servers in a platform-independent manner are available; Simple Object Access Protocol (SOAP), and the Remote Method Invocation (RMI). SOAP protocol uses an HTTP connection, and can thus be used to access applications behind a firewall, or having other security provisions preventing usage of other protocols. RMI provides a slightly more advanced solution (in terms of performance), and can be used for accessing existing applications in a pure J2EE manner (getting objects references via JNDI). However, this solution cannot be easily used for accessing applications that are behind firewalls (to get across firewalls, RMI makes use of HTTP tunnelling by encapsulating RMI class, within an HTTP POST request).
- **Microsoft-based applications (C++, ASP, .NET, etc):** applications based on Microsoft technologies can be accessed through SOAP. The .NET framework, as well as, other Microsoft technologies have strong SOAP support and are capable of exchanging SOAP messages with various systems. .NET SOAP capabilities allow components on other platforms to exchange data messages with .NET components. However, .NET is proprietary and while some of its elements, such as SOAP and its discovery and lookup protocols are provided as public specifications, the core components of the framework (IL runtime environment, ASP+ internals, Win Forms, etc.) are not disclosed by Microsoft. Hence, Microsoft is the only provider of complete .NET development and runtime environments.
- **Mail servers:** mail servers (Microsoft Exchange, sendmail, etc.) provide access through standardised POP3 and SMTP protocols
- **Python:** Python-based applications provide a large set of functionalities and can usually be easily connected with other applications. Some of the existing functionalities supply SOAP access, while for others it is feasible through extensions developed in Python or another programming language (e.g. Java)
- **Perl:** there are Perl-based applications and extensions providing SOAP interface which can easily be plugged into existing applications
- **Mainframes with APIs:** existing mainframes may provide a connection API. Such APIs usually provide a SOAP-enabled interface that can be used for data exchange
- **Mainframes without APIs:** if the mainframe application vendor does not provide connection APIs, it might still be possible to access some part or parts of the system (most likely permanent storage – database system) through ODBC/JDBC drivers. However, if this possibility is not available, the connection can most probably not be established
- **Relational database systems:** most of the existing Relational Database Management Systems come with vendor supplied connection drivers, which can be used by an application to directly access data stored in the RDBMS. An ODBC/JDBC connection is not the only way to access such systems. If it is architecturally possible and justified, the system can also be accessed through the EJB (Enterprise Java Bean) layer or via DLLs. If the server is located behind a firewall, SOAP access (with vendor supplied or in-house developed components enabling SOAP) can be used

4.3.3.2 Time-stamping

A secure and reliable time-proofing mechanism can be used for dealing with issues such as whether a Tender was submitted before the Tender submission deadline, etc. An eProcurement system needs to be in a position to record the exact time for all activities taking place and also to obtain that time from an official source.

Time can be obtained using the Time-Stamp Protocol (TSP) and a Time-Stamping Authority (TSA) issuing time-stamps associating a unique date and time with any action in the eProcurement system. The digital time-stamp can be used to prove that an electronic document was transmitted properly to the procurement server at the time stated on its time-stamp. eProcurement servers of a system can continuously synchronise with a TSA, through the reception of broadcasted time signals. Through this mechanism the audit trailing module of an eProcurement system can use an accurate time-stamp to record all activities performed.

All documents can be time-stamped on the server side immediately after the completion of their transmission from the client site. Electronically signed documents can be associated with a strong cryptographic time-stamp, if sent to the TSA, which stamps documents with a (legally) valid date and time.

All eProcurement servers, apart from time synchronisation capabilities, can also be equipped with an internal clock and a sequence of security functions capable of providing high accuracy, even in cases when the time signal fails or is tampered with.

4.3.3.3 Synchronous Communication

Synchronous communication methods allow two-way communication to take place in various forms in 'real-time'. This type of communication removes geographical barriers and allows Contracting Authorities to inform Economic Operators about important events, activities, etc. and to provide clarifications regarding Calls for Tenders in a more efficient manner. An eProcurement system can incorporate functionalities allowing synchronous communication between the Contracting Authorities and Economic Operators to take place, making the eProcurement process more efficient.

For instance, synchronous communications utilising "real-time chat", through commonly used Internet chatting facilities, can allow the real-time exchange of messages facilitating the Questions and Answers sessions of a Call for Tenders. Through this facility, a contracting authority can publish connection details for a "live" Questions and Answers session, to which Economic Operators can openly connect to and participate in. The contracting authority must however ensure that all tenderers are being informed equally and at the same time.

4.3.3.4 Asynchronous Communication

Asynchronous communication does not take place in real-time, meaning that parties can communicate outside a specific time window. This is important when eProcurement takes place on a European scale where Public Administrations and Economic Operators from different time-zones and locations need to interact. E-mail and electronic bulletin boards are examples of asynchronous communication. Asynchronous communication methods remove temporal barriers and can be employed for notifying users that are not logged-in to the system of events, activities, information, etc. The following asynchronous communication functionality can be considered when implementing an eProcurement system:

- **Threaded discussion forums:** refers to the functionality for capturing the exchange of messages over time, sometimes over a period of days, weeks, or even months. Threaded discussion forums are organised into categories so that messages and responses exchanged are grouped together and are easy to find. This functionality is well suited to support Questions and Answers sessions.
- **Internal e-mail:** refers to the functionality for supporting electronic mail that can be read or sent from within the system. This functionality enables messages to be sent or read exclusively within the system; alternatively, the tools provided enable links to external email addresses of those using the system so that contacting users is facilitated. Internal email may include an address book and some address books are searchable. This functionality makes the eProcurement system more secure as messages will be sent and read exclusively within the system. Also, it can also be used for online notifications.

4.4 Scalability

Software systems should be designed to meet significantly larger transactional load than what is estimated prior to their development. The efficiency in which this can be done, in terms of cost, time, quality, etc., can determine the scalability of a system. Good scalability for a system can be achieved through effective software architecture and/or adequate hardware components. In this section, two aspects of scalability are considered: system availability and system performance.

4.4.1 Availability Requirements

During the eProcurement lifecycle, there are a number of critical events, which are strictly regulated by the new EU public procurement legislation. It is therefore essential for Contracting Authorities to establish systems which remain constantly available, in order to guarantee the support for these and all other types of events.

Probably the most critical event is during the closing stages of Tender submission for a Call for Tenders (the eTendering phase). Before the end of eTendering, Economic Operators are required to access the system to submit their Tenders. However, it is common practice for Economic Operators to submit their Tenders towards the end of the Tender submission deadline. Additionally, depending on a specific Call, a Tender may be composed of several files. This in turn can result in megabytes of data that need to be transferred from the IT environment of the Economic Operator to the eProcurement system, and stored in the appropriate secure servers. The combination of these parameters signifies that the eTendering closing period for each Call can potentially cause failures due to volume capacity problems.

Furthermore, an eProcurement system may be harmed by disruptive events, including internet connection failures, malicious attacks, power failures, system software/hardware failures, etc. System implementers must ensure that their systems can handle all failures they can possibly envisage, while plans must be in place for handling critical failures, in the form of Business Continuity and Disaster Recovery Plans.

For establishing the exact availability requirements for an eProcurement system, future users of the system could be interviewed, in order to determine their real needs and expectations. This interview can form the basis of a Service Level Agreement (SLA) between the technology provider of the service and contracting authorities.

The availability of an eProcurement system can be improved through identification of the system components. If one component is prone to failure, the entire system will be prone to failure too. An eProcurement system is usually composed of three elements:

- One or more servers, where most of the data is processed and stored.
- A client, making requests to the server
- The network, which allows for the communication between the client and the server

All three elements can be broken down into components, such as hardware, software, processes, procedures, etc. All these components need to be checked for their reliability, in order to guarantee the availability of the system.

More specifically, the hardware making up the system includes, among others, the following components that need to be checked:

- Central Processing Unit
- Storage devices
- Input devices (keyboards, serial ports, mice, etc.)
- Output devices (monitors, printers, etc.)
- Cables

The software running in the system generally includes the following components, all of which need to be reliable:

- Firmware embedded in the hardware (BIOS) to allow it to communicate with the operating system
- Operating systems, such as Windows™, Linux, etc.
- Programs used by administrators or maintenance staff for performing control functions and data housekeeping
- Applications performing specific tasks or operations depending on the user
- Middleware programs supporting communication or data exchange

The processes needed to run the system will typically include:

- Power-up and system initialisation
- Network management and operation
- System monitoring
- Backup/restore and archiving
- User managements, including security
- System shutdown

When all relevant system components are identified, the following approaches can reduce the risks associated with critical components, i.e. those that are a single-point of failure for the system:

- Reduce frequency the system is not operational by looking for ways to prevent outage from happening to critical components
- Minimise the duration the system is not operational by trying to prevent outage from happening to critical components and reducing the number of critical components that may be affected by an outage
- Reduce the parts of the system that are potentially affected by an outage

System developers can quantitatively measure availability, by following certain approaches and at regular intervals calculating values for the degree of availability achieved, in order to set targets for improving the availability values.

An indicative calculation for quantitatively measuring availability is provided below:

- **Hours the system should be available in a month:** 24 hours per day x 7 days x 4.33 weeks per month (on average) \approx 720 hours / month
- **Hours the system was down in a month:** Consider 5 hours due to corrective maintenance (e.g. correction of software defect), 3 hours due to perfective maintenance (e.g. hardware upgrade), 1 hour due to hard disk failure, totalling 9 hours of unavailability
- **Net availability:** $((720 - 9) / 720) * 100\% = 98.75\%$
- **High availability:** 3 out of the 9 hours were due to perfective maintenance activities and only 6 hours (5 + 1) were due to failures. Therefore, high availability is $((720 - 6) / 720) * 100\% = 99.16\%$

4.4.2 Performance Requirements

A system that can handle and respond promptly to any user request, can not only accelerate the eProcurement activities, but also assist users to better understand the different functionalities offered by the system.

Naturally, there may be activities which inevitably require significant time (e.g. uploading of documents). In such cases, system implementers need to ensure that users are informed of the progress of their requests, avoiding events such as users cancelling their activities or being unsure of the status of their actions.

Obviously the performance requirements of an eProcurement system are dependant on the envisaged number of users and Calls. System implementers need to plan for software/hardware scalability and establish systems which can achieve the predefined performance goals.

The following definitions are commonly used for measuring performance:

- **Simple Query:** a query accessing a single database table or a join of two tables
- **Complex Query:** a join of three or more database tables
- **Report:** a report ready to be printed, produced by PDF generation on the server, reporting tool plug-in or any other technology applicable
- **Document Management:** uploading, downloading and opening of a document to/from the document library of the system to the client workstation
- **Active User:** a user of the application performing constantly typical operations
- **Response Time:** the period of time from the moment the user initiates an action (e.g. by clicking on a button or a link) until the moment a Web-page with the requested information or update confirmation message is completely downloaded and displayed on the screen of the user. Response times can be effected by Internet latency, therefore response time is commonly tested in a Local Area Network (LAN) environment.

Example performance goals can be:

- 50 concurrent active users with maximum response time
- Up to 200 concurrent active users with 10% increase in maximum response time
- Maximum response times that return up to 200 result rows is X. For every additional 100 results, the maximum response time may increase for up to X seconds.

Maximum response times (in a LAN environment) can be:

- (1) 90% of simple queries to have a maximum response time of 2 seconds.
- (2) 99% of simple queries to have a maximum response time of 5 seconds.
- (3) 95% of complex queries to have a maximum response time of 5 seconds
- (4) 99% of complex queries to have a maximum response time of 10 seconds
- (5) 95% of reports to be generated in less than 6 seconds.
- (6) 99% of reports to be generated in less than 15 seconds.
- (7) 95% of document management activities to have a maximum response time of 5 seconds
- (8) 99% of document management activities to have a maximum response time of 8 seconds.

The response times for testing the performance of an eProcurement system must be measured in a database that has pre-loaded a considerable amount of data, simulating the performance of the system in real conditions. In addition, actual use of the system will have to be simulated including concurrent data uploads and downloads.

4.5 Security

Security mechanisms provide a secure communication interface, mainly for the exchange of documents between procurement authorities and Economic Operators. Standards constituting adequate and acceptable security need to be provided for the implementation of services during each stage of the procurement process. The required specifications need to be provided for ensuring adequate authentication, digital signature, non-repudiation, data integrity and encryption. Distribution and management of digital certificates, either directly from the different Contracting Authorities, or indirectly through outsourcing to accredited Certification Authorities need to be analysed and presented. The resulting analysis will provide the different Member States with the required certification standards, as well as, identify the PKI technology standards that all the public procurement components must comply with. This should ensure that public procurement components are PKI “enabled”, promoting interoperability.

The main objectives considered for the creation of a secure environment are the following:

- **Authentication:** guarantees that the service is only accessible to users with a verified identity.
- **Authorisation:** guarantees that authenticated users can only access services or data matching their role and access rights.
- **Confidentiality:** guarantees that the data exchanged between the person requesting it and the provider cannot be intercepted or accessed by a third non-authorised party.
- **Integrity:** guarantees that data exchanged between the person requesting it and the provider has not been modified or tampered with by a third non-authorised party.
- **Non-repudiation:** guarantees that the sender of the message cannot deny, at a later point in time, that s/he sent it.

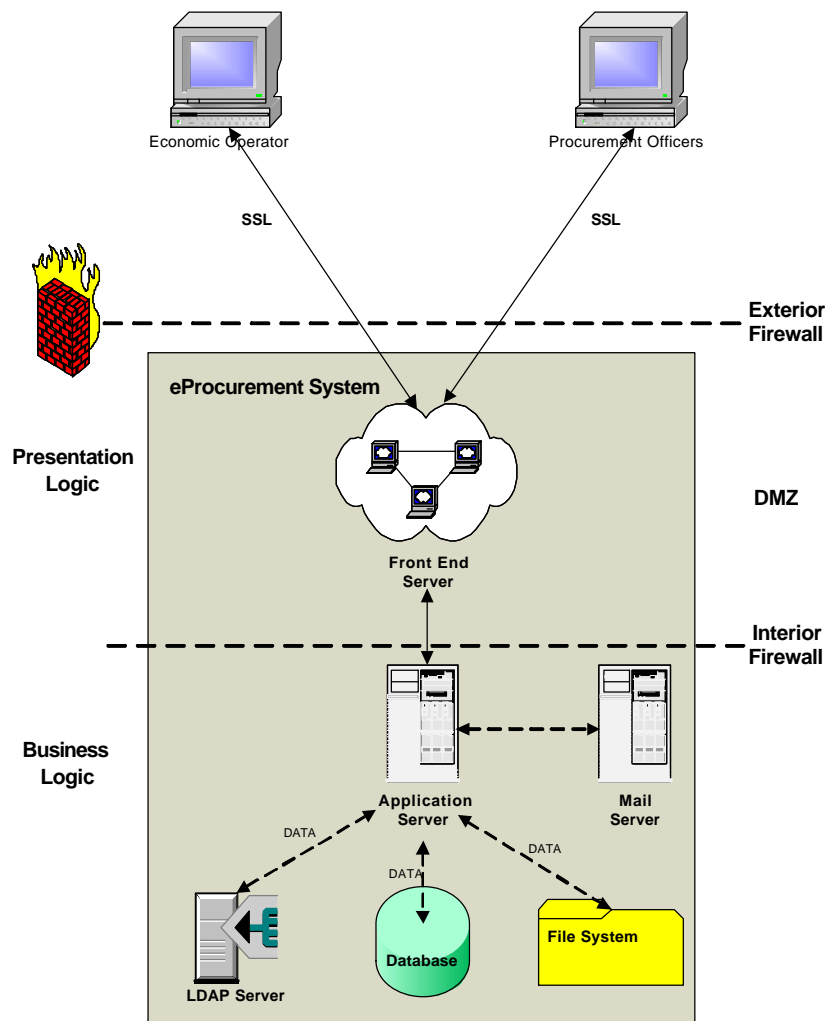
These objectives can be achieved through:

- **Audit trailing facility:** allows system managers to monitor activities on the network of the eProcurement system. These include all activities performed by users, either successful or unsuccessful (such as attempted but failed logons). Audit trails need to be archived indefinitely in case security incidents or disputes need to be investigated (thus providing for non-repudiation).
- **Firewalls:** used as a hardware line of defence when connecting trusted networks to non-trusted networks, such as the LAN/Intranet of an organisation to the Internet. Firewalls are highly configurable. They can be set to allow or deny access to certain machines, IP addresses, network services, servers, protocols and port numbers in either direction.
- **Secure communication (data transfer) with the client (user or third party system/application):** as a Web-based application, one of the most vulnerable parts is the communication with its users or clients. The eProcurement system can provide a high level of security, such as HTTPS, avoiding any unauthorised access to sensitive information.
- **Encoding stored data:** since the eProcurement system deals with sensitive information, it is recommended to encrypt stored data in its various modules (database, LDAP or file system) via proven encryption algorithms (TripleDES, AES, BLOW FISH, etc.). Such a feature increases system security and protects data even in case that an unauthorised person has physical access to the hosting server(s). By applying this solution, it is not possible to read data that is stored on the eProcurement system without applying the appropriate decoding algorithms.
- **Digitally signed documents:** for the management of documents, the eProcurement system can consider all material that is transferred through the system. In this respect, e-mail messages, SMS messages, and Chat transcripts can be considered as documents. By incorporating a Certification Authority functionality, allowing the CA to operate as part of a Public Key Infrastructure (PKI), it is ensured that the user identity is certified, thus guaranteeing at the same time the non-repudiation of the documents.

4.5.1 Communication

A security framework based on the general principles (confidentiality, non-discrimination, non-repudiation, etc) supported by the PKI infrastructure can be implemented to support the needs of an eProcurement system. This security framework enables the management of Public Key certificates for identifying the user and for securing the communication between the users of the application and the servers that host the application environment (Web Server) and the corresponding business logic (Application Server) as shown in **Figure 4-1**.

Figure 4-1: A security communication framework for an eProcurement system



In **Figure 4-1**, Economic Operators and Procurement Officers communicate with the Web-server of the eProcurement system through the firewall. More specifically, "server certificates" can be used for supporting secure communication over an encrypted SSL session, between internet users (Economic Operators and Procurement Officers) and the Web Server of the eProcurement system. This certificate can either be obtained from a commercial certification service provider, or issued by an internal Certification Server of the PKI. The security provided can be based on server authentication and encryption of the documents exchanged over an SSL session. In addition, authenticated e-mails can be transmitted by the e-mail server to Procurement Officers and Economic Operators of the eProcurement system.

The Demilitarised Zone (DMZ) in **Figure 4-1** refers to the part of the network situated between two networks (the internal network and the Internet). It is neither part of the internal network nor directly part of the Internet.

In principal, the security framework implemented for supporting eProcurement can incorporate authentication mechanisms, user authorisation to restricted application services and resources (user roles and distinct access rights) and the security of the system on the storage level may be based on the local implementation of time-stamping operations, in order to implement a type of non-repudiation service.

4.5.2 Storage

During the analysis of the modules and services required for the provision of an adequate level of security, the following fundamental requirement was established:

For to ensure secure storage of documents and bids uploaded to the system, the documents shall not be accessible in a usable form until the start of the eAwarding phase.

Cryptographic keys (not including public keys) generated by the security module should not be stored in clear-text on the same host as the bid documents, in order to prevent unauthorised decryption by individuals with local access.

4.5.3 The "4-eyes Principle"

The new EU public procurement directives prescribe the application of the 4-eyes principle during the opening of Tenders, in order to ensure that the opening of Tenders is the result of the simultaneous actions of multiple users. The legislation does not impose a specific Tender opening procedure. Therefore, Contracting Authorities may model the four-eyes principles as it is deemed most appropriate according to their local legal requirements and internal administrative procedures.

When creating a new Call for Tenders, a number of procurement officers may be associated with the Call, and be responsible for opening the Tenders when the pre-specified time is reached. It should be possible to authorise the opening of Tenders only after the Tender opening time is reached (as specified at the creation of the Call), and only after the simultaneous action of two or more procurement officers.

4.5.4 Reporting, Logging and Monitoring

Monitoring of the entire electronic procurement procedure needs to be performed by the administrative personnel. This can be accomplished by analysing the system logs and statistics that the platform provides on a regular basis. All stages that are not currently traced and logged by the system, such as tender key administration and final awarding can be logged manually, in order to provide an integrated trace-log for the complete procedure. Moreover, reports and statistics can be generated based on these logs to be used for internal or external auditing.

Log files need to be generated throughout the user interaction with the eProcurement services and all log files should be viewed and examined only by authorised administrators. It should be possible to retrieve the log files by applying several search criteria, such as date ranges, number of log entries, etc.

It should be possible to use all criteria to automatically query the system log file entries (stored on the server) and to extract information on all actions performed by users. The auditing service needs to be enhanced during the eTendering implementation in order to comply with the legal requirements of the current EU legislation. Extensive auditing can be provided for every electronic procurement activity performed through the system (e.g. track tender uploading/downloading, versioning, approvals). Inspection of auditing logs can provide information to effectively detect attempts of intrusion, for example tampering with the tender documents by an authorised user after the submission deadline.

4.5.5 User profiling

An eProcurement system allows users to execute several different actions and to obtain access to various data. Due to the highly confidential nature of the data stored in such systems, all users need to have a unique user account, associated with a specific user role. User roles can form the required medium, mapping user accounts to access rights, defining which users can access what data, and what actions they can perform on that data. Through this method, system administrators are not required to define specific access rights for each user account. Instead, they can define the user roles of the system (i.e. Call for Tender administrators, Tender Opening Staff, Tender Evaluating Staff, etc.), with pre-defined access rights, and associate users to these roles.

The exact user roles defined in an eProcurement system depend on the complexity of the system, the size of the Contracting Authority, the number of system users, etc.

5 OVERVIEW OF TECHNICAL SPECIFICATIONS

The current section provides an overview of proposed technical specifications for the design of an eProcurement system capable of supporting the core functionalities required by the new legislation. It comprises a conceptual model and an associated schema and description, as well as, high-level Use Cases.

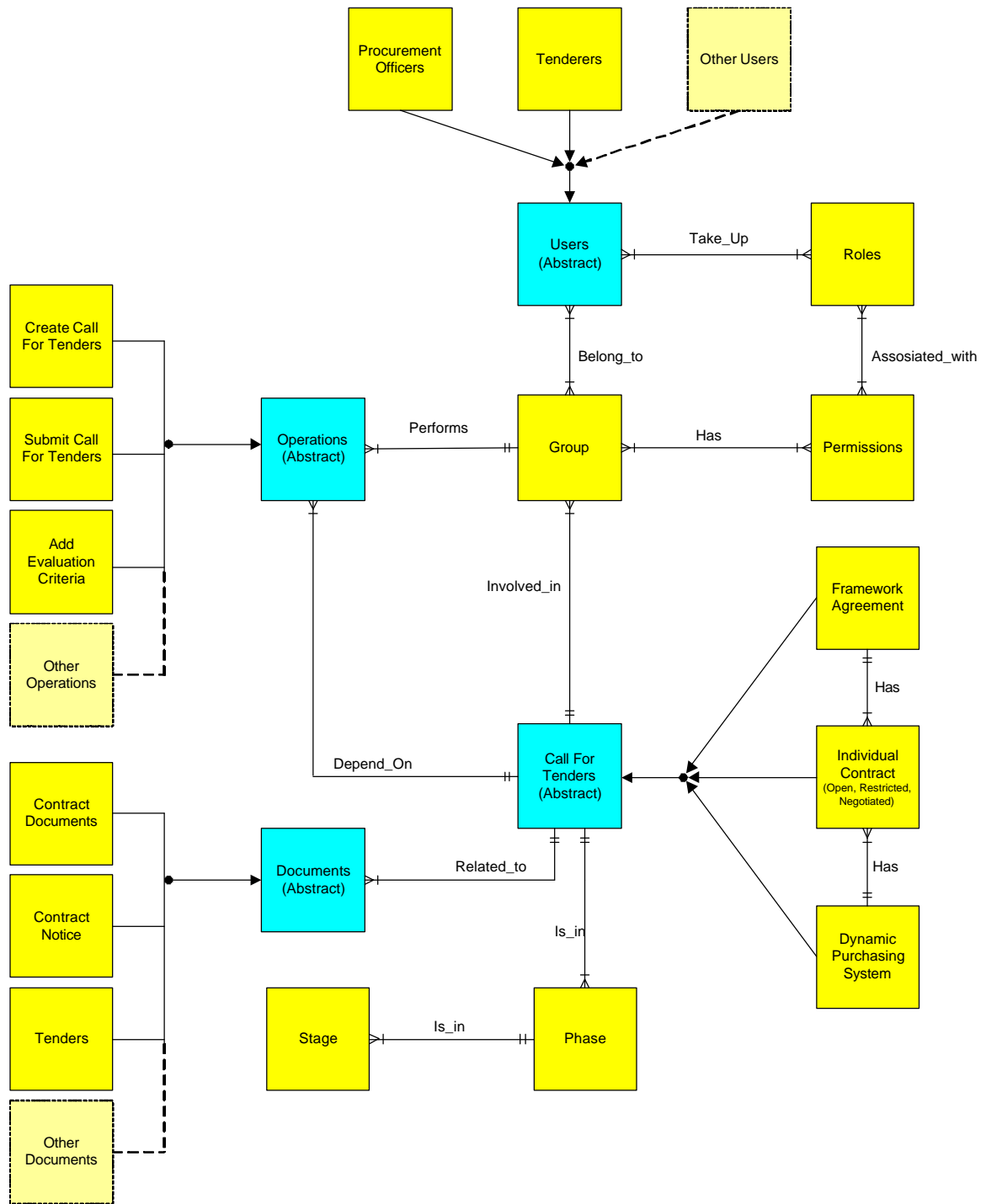
The conceptual model constitutes a set of abstract objects (i.e. concepts) and their relationships according to a technology-independent method, which can be used for modelling a system. The conceptual description, apart from offering further details for all conceptualised objects, also demonstrates the hierarchy of objects in an Object-Oriented implementation approach.

The high-level Use Case analysis presents the main actors of an eProcurement system, while the main functionalities for each actor are identified. In-depth analysis of the Use Cases presented is provided in the second volume of the report (FReq Volume II).

5.1 Conceptual Model

The conceptual model presented in **Figure 5-1** focuses on a possible implementation of the core business context of an eProcurement system. This model should not be considered as complete from a technical point of view, as new entities can be added to satisfy all specific functional requirements of an eProcurement system. It attempts to propose to interested parties software components/objects that can be defined, as well as, their static relationships, for implementing a fully integrated eProcurement system, capable to support all procedures/instruments discussed in chapter 2 of the current document.

Figure 5-1: Conceptual Model



The conceptual schema of **Figure 5-1** is described below in terms of the entities it comprises and the existing associations between these entities.

Table 4 - Description of Conceptual Schema Entities

Entity	Description
Economic Operator /Tenderer	A specialisation of a User
Procurement Officer	A specialisation of a User
Users	A generalisation of a Procurement Officer or Economic Operator/ Tenderer (or other types of users). A User can take up certain Roles and belongs to a Group of Users with a common interest (e.g. Tenderers associated with a particular Call For Tenders)
Role	A Role is associated with one or more Permissions to perform Operations in the system (e.g. evaluating staff for received Tenders)
Permissions	A Permission is a collection of rights given to a particular Group , which allows each group member to perform certain activities
Group	A certain number of Users with a common interest (e.g. Economic Operators/ Tenderers interested in a particular Call for Tenders) that have the same Permissions allowing them to perform certain Operations in the system (e.g. Evaluating Staff of a particular Call for Tenders can access/download Tenders received)
Call For Tenders	A virtual workspace for Call for Tenders
Individual Contract	A specialisation of a Call for Tenders
Framework Agreement	A specialisation of a Call for Tenders that also groups individual contracts and serves as a specification and container for those.
Dynamic Purchasing System	A specialisation of a Call for Tenders that also groups specific contracts and serves as a specification and container for those.
Phase	The different procedural phases associated with a Call for Tenders (e.g. eNotification)
Stage	The different stages of an eProcurement Phase (e.g. technical evaluation of Tenders within eAwarding Phase)
Documents	Any Document(s) related to a Call For Tenders
Operations	Any Operation(s) that can be performed by a Group of Users , involved in a particular Call for Tenders (e.g. unlock Tenders can be performed by Opening Staff of a particular Call for Tenders)

Main Associations:

- A **User** can take up one or more **Roles**
- **Roles** are associated with certain **Permissions**
- **Users** belong to a **Group** of Users with a common interest (e.g. Procurement Officers, Economic Operators/Tenderers)
- A **Group** has certain **Permissions**
- A **Group** of Users with common interest (e.g. Procurement Officers, Economic Operators/Tenderers) performs certain **Operations** (e.g. Create a Call for Tenders, Submit a Call for Tenders)
- An **Operation** depends on the particular **Call for Tenders** (Phase and Stage of the Call for Tenders)
- A **Call for Tenders** is in/goes through a **Phase** of the procurement cycle (e.g. eNotification, eAwarding, etc.)
- An **Individual Contract** is considered a **Call for Tenders**
- A **Framework Agreement** is considered a **Call for Tenders**
- A **Dynamic Purchasing System** is considered a **Call for Tenders**
- A **Framework Agreement** includes **Individual Contracts**
- A **Dynamic Purchasing System** includes **Individual Contracts** (i.e. specific contracts)
- A **Document** (e.g. Contract Notice, Contract Documents) is related to a **Call for Tenders**

5.2 High level Use Case model

This section provides a so-called “high-level Use Case Model” analysis, summarising the in-depth Use Case analysis presented in the Functional Requirements - Volume II. The purpose of this section is to present the main actors of the system, and the main functionality made available for each actor.

Use cases are a technique for capturing the functional requirements of a system, and describe the typical interaction between users and the system, or between system components, providing a narrative of how a system is used. The main actors of a Public eProcurement system are:

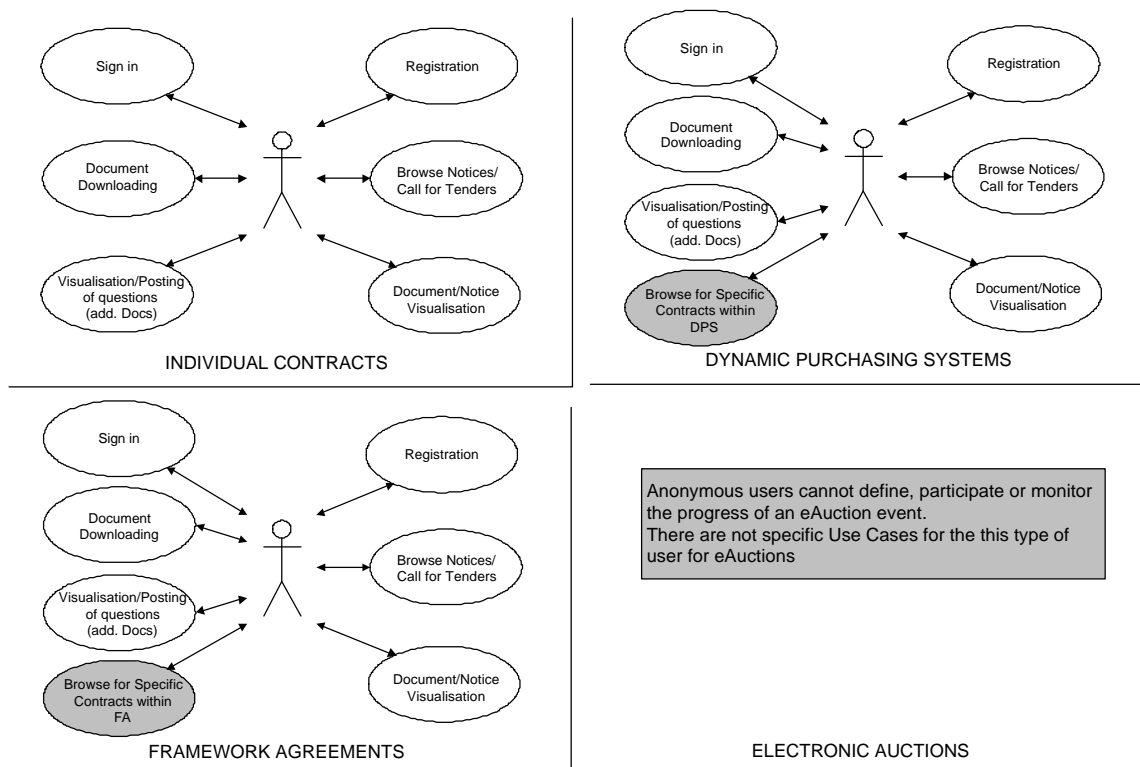
Table 5 - Main actors of a Public eProcurement system

Actor Type	Actor	Notes
Guest	Anonymous	The three types of anonymous users can perform the same actions in a Public eProcurement system. The functions of the “Economic Operator (not logged in)” and the “Procurement Officer (not logged in)” are identical to the Anonymous role
	Procurement Officers (not logged in)	
	Economic Operators (not logged in)	
Procurement Officers	Administrative staff	The main responsibilities of “Administrative staff” are: <ul style="list-style-type: none"> ▪ creation/management of Calls for Tenders ▪ establishment of DPS and FA ▪ creation/management of specific contracts within DPS and FA ▪ definition of eAuction parameters
	Opening staff	The Procurement Officers who perform the role of “Opening staff” are responsible for the opening (or unlocking) of Tenders for a Call or of a specific contract within a DPS or FA
	Evaluating staff	The main responsibilities of “Evaluating staff” are: <ul style="list-style-type: none"> ▪ evaluation of Tenders for a Call ▪ evaluation of Indicative Tender for a DPS ▪ evaluation of Tenders for specific contracts in a DPS or FA ▪ admitting Tenderers to a DPS ▪ inviting tenderers to participate in eAuction ▪ concluding Calls or specific contracts
Economic Operators/Tenderers	Economic Operators (logged in)	The main responsibilities of “Tenderers” are: <ul style="list-style-type: none"> ▪ creating and submitting Tenders ▪ creating and submitting Indicative Tenders ▪ participating in eAuctions
System	System	The eProcurement system occasionally needs to automatically perform certain actions, triggered either by user activities, or by the system on a certain date/time

5.2.1 Guest

The *Guest* role is taken up by any non-authenticated user of the system. If a user does not have a user account with the system, or is not signed into the system, s/he is only given access to publicly available information. Furthermore, s/he is provided with limited functionalities which allow for searching running or past Calls for Tenders, as well as, the functionality to sign in or create a user account. The main functionality available to the *Guest* user of an eProcurement system should be:

- **Registration:** allows users to provide their personal information to the system and create a new user account
- **Sign in:** allows users that have user accounts with the system to provide their username and password and authenticate themselves, in order to use additional specific functionalities of the system depending on the user rights
- **Browse Notices/Call for Tenders:** allows users to provide search criteria, and view Notices/Calls for Tenders that match these criteria
- **Document/Notice Visualisation:** allows users to view the details of a document or Notice
- **Visualisation and posting of request for Additional Documents:** allows users to view the Additional Documents (questions and answers) for a particular Call for Tenders, or post requests for new Additional Documents (post a question)
- **Document Downloading:** allows users to download one or more documents
- **Browse for Specific Contracts within DPS/Simplified Contract Notices:** allows user to search through the specific contract within a DPS
- **Browse for Specific Contracts within FA:** allows users to search through the specific contract within a Framework Agreement

Figure 5-2: Use Cases for the *Guest User*

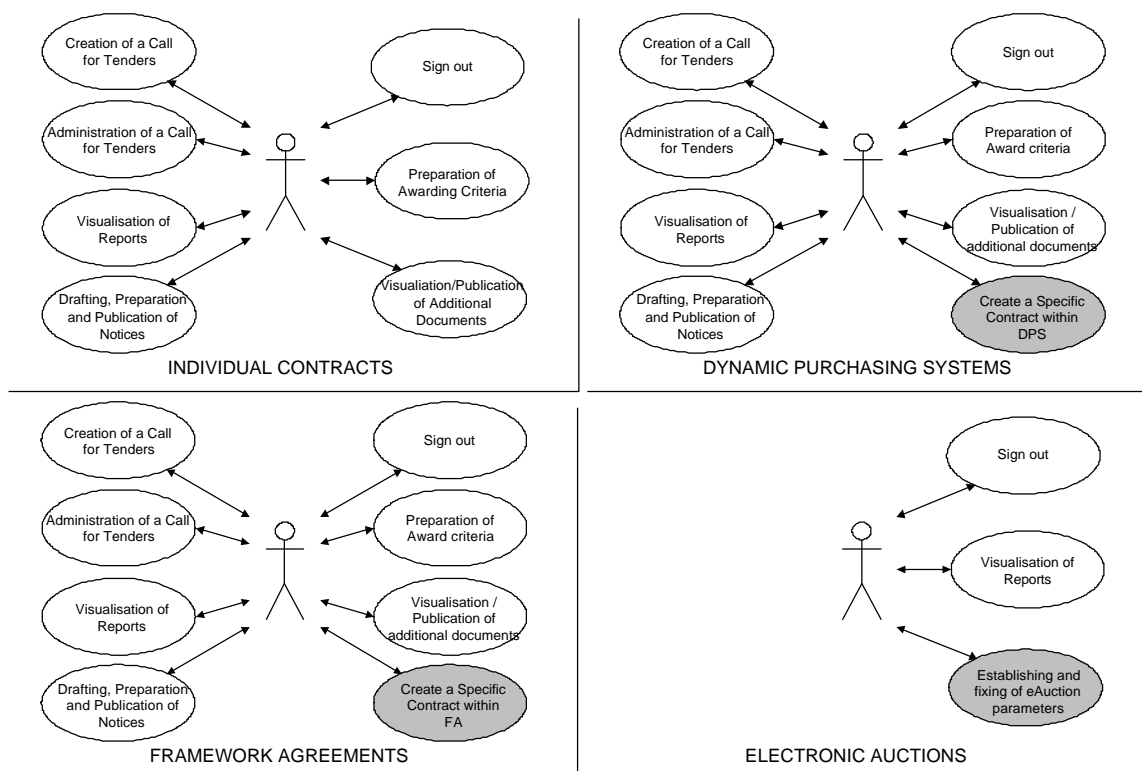
5.2.2 Procurement Officer - Administrative Staff

Users performing the role of *Procurement Officer Administrative staff* are responsible for the creation and management of Calls for Tenders. All their actions should be traceable in the system. The main functionalities available to the *Procurement Officer Administrative staff* user of an eProcurement system should be:

- **Sign out:** allows users authenticated by the system (i.e. signed in), to sign out of the system. This operation is usually invoked by users after completion of their actions (e.g. create a Call for Tenders, or change the details of a Call) and prompts users to inform the system that they no longer need to act as authenticated users (i.e. return to the access rights of a Guest User). This operation can also be automatically performed when the user closes his/her browser or when the user session is timed-out
- **Creation of a new Call for Tenders:** allows the user to create a new Call for Tenders
- **Administration of an existing Call for Tenders:** allows users to view the details of an existing Call for Tenders and to modify its details. It should not be possible to modify certain details of a Call, depending on the exact phase of the Call for Tenders and user access rights. For instance, when a Call is in the Tender Evaluation phase, the system does not allow users to modify the details of the Contract Documents
- **Preparation of the Awarding Criteria:** allows users to define the awarding criteria for the Call for Tenders. These criteria are used in the Tender Evaluation phase, when all received Tenders are evaluated

- **Drafting/Preparation/Publication of Notices:** allows users to create and publish a Prior Information Notice, Contract Notice or Contract Award Notice
- **Visualisation and Publication of Additional Documents:** allows users to view all published Additional Documents for a Call (i.e. questions and answers), as well as, to view new requests for Additional Documents. In addition, this functionality allows users to provide Additional Documents (i.e. give answers to posted questions)
- **Visualisation of Reports:** allows users to view reports related to a Call
- **Create a Specific Contract within a DPS:** allows users to create specific contracts within a DPS
- **Create a Specific Contract within a FA:** allows users to create specific contracts within a Framework Agreement
- **Establishing and fixing eAuction parameters:** allows users to parameterise and specify the exact operation of the eAuction device for an eAuction event

Figure 5-3: Use Cases for the *Procurement Officer Administrative User*

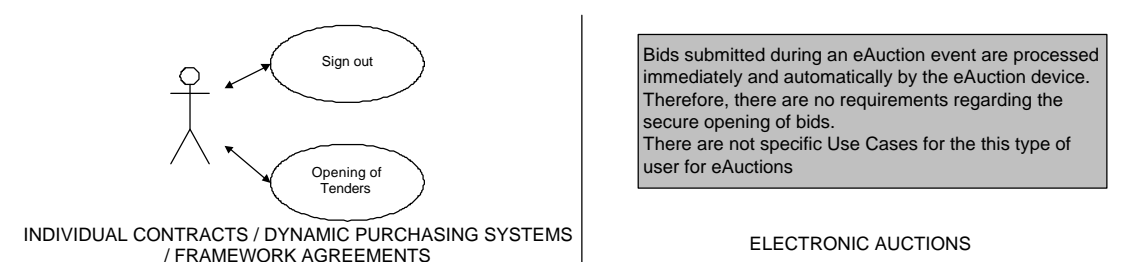


5.2.3 Procurement Officer - Opening Staff

Users performing the role of *Procurement Officer Opening staff* are responsible for the opening (or unlocking) of Tenders for a Call. The main functionalities available to the *Procurement Officer Opening staff* user could be:

- **Sign out:** allows users authenticated by the system (i.e. signed in), to sign out of the system. This operation is usually performed by users after completion of their actions (e.g. accessing confidential details of a Call, or authorising the opening of Tenders) and prompts users to inform the system that they no longer need to act as authenticated users (i.e. return to the access rights of a Guest User). This operation can also be performed automatically when the user closes his/her browser or when the user session is timed-out
- **Opening of Tenders:** allows users to authorise the opening of Tenders for a particular Call for Tenders, and to proceed to the opening of the tenders themselves. These activities can only be performed once the pre-defined Tender opening time has been reached

Figure 5-4: Use Cases for the Procurement Officer Opening Staff User



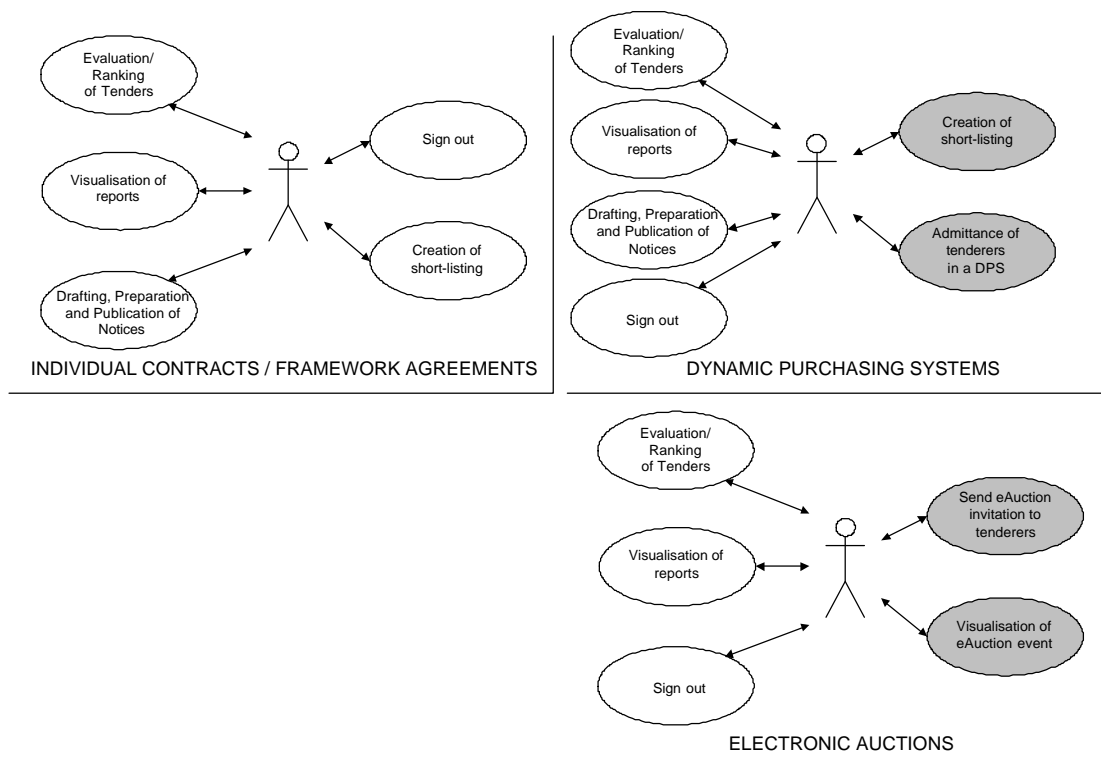
5.2.4 Procurement Officer - Evaluating Staff

Users performing the role of *Procurement Officer Evaluating staff* are responsible for the evaluation of Tenders for a Call, as well as, the conclusion of a competition by selection of the winner(s) and publication of the Contract Award Notice. The main functionalities available to the *Procurement Officer Evaluating staff* user of an eProcurement system should be:

- **Sign out:** allows users authenticated by the system (i.e. signed in), to sign out of the system. This operation is usually performed by users after completion of their actions (e.g. accessing confidential details of a Call, or evaluating a particular Tender for a Call) and necessitates users to inform the system that they no longer require to act as authenticated users (i.e. return to the access rights of a Guest User). This operation can also be performed automatically when the user closes his/her browser or when the user session is timed-out
- **Creation of short-listing:** allows users to select and invite Tenderers to participate in a particular Call for Tenders. This functionality is available only in the restricted procedure. Once the Expression of Interest submission period is complete, Procurement Officers access the supporting documentation of all Tenderers (i.e. proof documents), and evaluate their compliance with the Conditions for Participation. Following the evaluation, Procurement Officers create Tenderers short-listing, and conclude on the tenderers invited to submit a Tender. For the restricted procedure at least 5 Economic Operators must be selected

- **Evaluation and ranking of Tenders:** allows users to evaluate the Tenders received for a particular Call for Tenders, and to create Tender rankings. This functionality can only be performed once all Tenders are accessible to authorised officers. Users are required to provide scores for all evaluation criteria, before ranking the Tenders according to the pre-defined evaluation function
- **Drafting/Preparation/Publication of Notices:** allows users to create and publish a Prior Information Notice, Contract Notice or Contract Award Notice
- **Visualisation of Reports:** allows users to view reports related to a Call for Tenders
- **Admittance of Tenderers in a DPS:** allows users to admit into the DPS Tenderers that have submitted qualifying Indicative Tenders
- **Send eAuction invitation to tenderers:** allows users to specify the exact date/time for an eAuction event to start, to select the tenderers to invite to the event and to create an appropriate notification for the invitation to auction
- **Visualisation of eAuction event:** allows users to visualise the eAuction event, ensuring they can monitor the good operation of the eAuction device

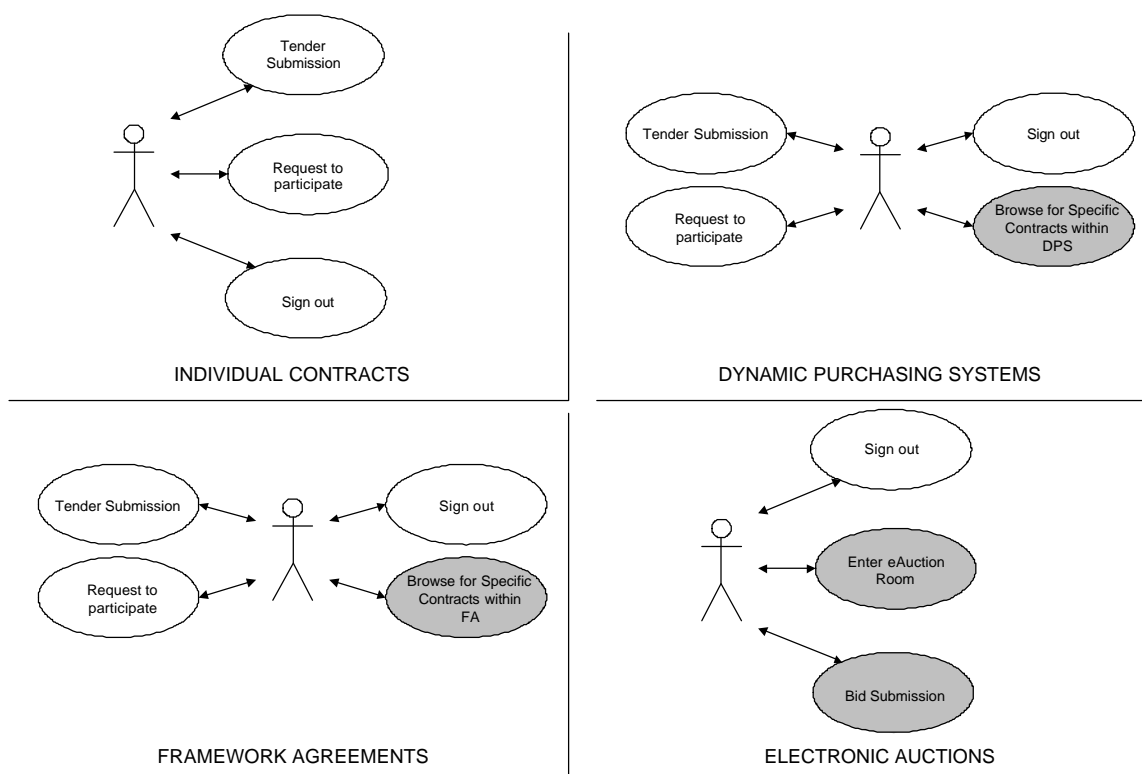
Figure 5-5: Use Cases for the *Procurement Officer Evaluating Staff User*



5.2.5 Tenderer

The main functionalities available to the *Economic Operator or Tenderer* of an eProcurement system should be:

- **Sign out:** allows users authenticated by the system (i.e. signed in), to sign out of the system. This operation is usually invoked by users after completion of their actions (e.g. submit a Tender for a Call, or view the details of an existing Tender) and necessitates users to signify to the system that they no longer require to act as authenticated users (i.e. return to the access rights of a Guest User). This operation can also be automatically invoked when the user closes his/her browser or when the user session is timed-out
- **Request to Participate:** allows users to express their interest to participate in a Call for Tenders. This functionality is only available for Calls running under the restricted or negotiated procedure
- **Tender submission:** allows users to create and submit a Tender for a particular Call for Tenders. For Calls running under the open procedure, this functionality is available as soon as the Contract Notice is published, and until the Tender submission deadline (also referred to as Tender closing time). For Calls running under the restricted procedure, Tenders can be submitted by Economic Operators which have been invited by the Contracting Authority to submit a Tender (i.e. Economic Operators first need to submit an expression of interested, and only if they are invited by the Contracting Authority, they can submit a Tender)
- **Browse for Specific Contracts within DPS:** allows users to search specific contracts within a DPS
- **Browse for Specific Contracts within FA:** allows users to search specific contracts within a FA
- **Enter eAuction room:** allows user to access the relevant virtual eAuction room in order to visualise and participate to the eAuction event
- **Bid submission:** allows users to create and submit a bid during an eAuction event

Figure 5-6: Use Cases for the *Tenderer*

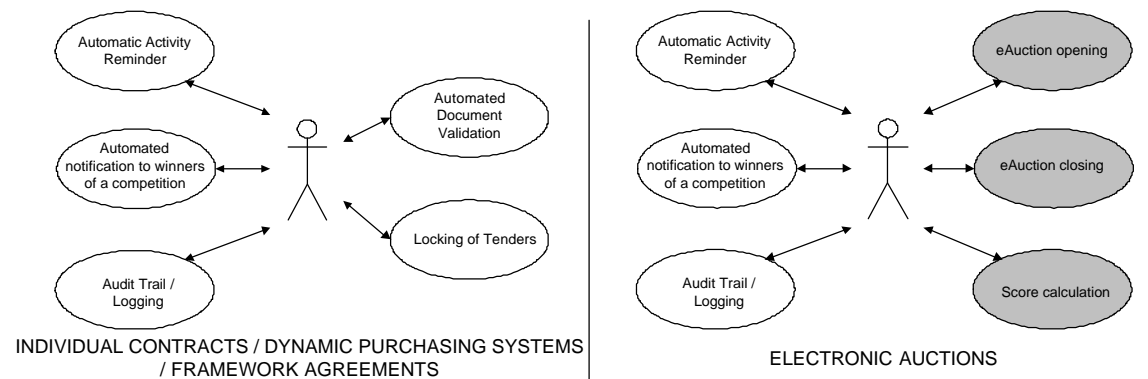
5.2.6 System

The eProcurement system occasionally needs to automatically perform certain actions, either triggered by user activities, or by the system on a certain date/time. The main functionalities performed by the *System* should be:

- **Audit Trailing/Logging:** all user activities and system events must be logged (i.e. recorded) to designated secure areas, which can assist in the regulatory reporting requirements of the legislation, as well as, the identification of infringements
- **Automatic Document Validation:** when Tenders submit a document, the system must perform certain validation checks, in order to ensure the documents compliance with the system specifications. For instance, if a system requires documents to be signed electronically before submitted, the document validation mechanism must ensure that all documents are signed, as well as, that the electronic signature of a document is valid
- **Locking of Tenders:** when Tenders are received for a given Call, the system must ensure that they remain locked and inaccessible until authorised personnel (opening staff) proceed to their opening, which can only be performed after the pre-defined Tender opening time
- **Automatic Activity Reminder (i.e. notification based on time events):** when time events take place (i.e. the time for unlocking Tenders for a Call is reached), the system must automatically inform the associated users
- **Automatic Notification of winners of a competition (i.e. notification based on user events):** when user events take place (i.e. conclusion of a Call for Tenders), the system must automatically or semi-automatically inform the associated users

- **eAuction opening:** when the pre-defined date/time is reached, the system must automatically open the eAuction event, inform the related users, and allow tenderers to submit bids
- **eAuction closing:** when the pre-defined conditions are met, the system must automatically close the eAuction event, inform the related users, and not allow tenderers to submit new bids
- **Score calculation:** when a new valid bid is submitted, the system must automatically apply the pre-defined score calculation formula, in order to calculate the score of the submitted bid, and subsequently rank all received bids accordingly

Figure 5-7: Use Cases for the System



6 OPEN ISSUES RELATED TO PUBLIC EPROCUREMENT

In discussions that took place in several fora amongst Commission services, Member State IDA experts, public administrations, private companies and the contractor, several questions were identified regarding the EU public procurement legislation and the technical solutions possible for being used. Some of the questions raised constitute “open issues” that need to be further discussed, analysed, and/or researched, in order to provide state-of-the-art solutions to real problems encountered in implementing public eProcurement systems. The solution to some of these issues will depend on the implementation method chosen by national authorities.

This chapter summarises such “open issues” related to public eProcurement to stimulate discussion. They are classified under the following categories:

- Legislative aspects
- Technical aspects
- Business development aspects

6.1 Legislative aspects

“Open issues” related to legislative aspects of Public eProcurement comprise:

- Individual Contracts
 - How can appeal procedures be incorporated in the workflow? What are the legal requirements for appeals?
- Repetitive Purchases
 - What products/services/works can a contracting authority buy through a DPS? Can a CA establish a DPS covering a broad range of products/services/works or shall DPS be restricted to specific products/services/works?
 - How can a contracting authority better define the terms of a specific contract within a DPS or FA? Shall a Contracting Authority foresee all terms which will govern specific contracts when establishing the DPS or FA? DPS or FAs can last up to 4 years. What happens if during the creation of a specific contract inside a DPS or FA, the CA needs to update the initial terms, for instance due to technological developments.
 - How can a Contracting Authority establish evaluation criteria for a DPS or FA, which are also used for specific contracts within the DPS and FA?
- Electronic Auctions
 - What should happen in an eAuction event, when a tenderer submits a wrong bid (e.g. negative prices, abnormally low prices, etc.)? Can Contracting Authorities restrict the possible admitted values for a bid or it is the Tenderer’s responsibility to submit correct bids?
 - What should happen in an eAuction event conducted in rounds, in case a bidder does not place a bid in one round?
 - Who is the winner of a competition if at the end of an eAuction event two or more bidders have placed the same bid?

6.2 Technical aspects

This section describes “Open issues” that are related to technical aspects for realising eProcurement systems compliant with the EU public procurement legislation. These comprise:

- Global issues related to all eProcurement procedures
 - What security architecture should Member States adopt, in order to ensure high security without violating the principle of interoperability? Are there minimum requirements guaranteeing the secure operation of an eProcurement system fully compliant with the EU legislation?
 - What systems can an eProcurement system be integrated with, and what benefits such integration can offer? Are there any workflows or is there a standard procedure to follow in order to perform eInvoicing?
 - How can an accreditation methodology/system be established, allowing existing eProcurement systems to be evaluated against the EU eProcurement legislation?
 - What XML standards should be adopted in order to ensure interoperability?
 - What exception procedures need to be followed by an eProcurement system and/or a Contracting Authority in case of system failures, document viruses, document illegible formats, unknown certification authorities, etc?
- Repetitive Purchases
 - How should eCatalogues be constructed and used? What is the definition of an eCatalogue? What standard for eCatalogues should be followed?
 - How can integration with supplier systems be achieved, preserving the equal treatment principle? SMEs may be disadvantaged if such an integration will be decided by a Contracting Authority. What is the acceptable investment an SME should be required to make for performing such integration?
- Electronic Auctions
 - What should happen if, during an eAuction event, a bidder loses his/her connection to the eAuction device? What are the recovery procedures that must be put in place and how the eAuction event is affected?
 - Should eAuction bids be signed before accepted by the eAuction device?
 - How can MEAT evaluation for eAuctions be performed? What are the rules for placing bids containing more than one field?

6.3 Business development aspects

“Open issues” related to the business development of eProcurement comprise:

- Economic Operators
 - How can suppliers be sensitised to and trained in the new Public eProcurement rules?
 - How can supplier adoption be achieved, preserving the equal treatment principle?
- Contracting Authorities
 - How can national-level systems be created/maintained at low cost, allowing a great number of different Contracting Authorities in a Member State to utilise them?

7 CONCLUSIONS

Adopted on 30 April 2004, the new EU public procurement directives should be transposed into national law by Member States by 31 of January 2006 at the latest. In this context, the present report identifies the different steps required to implement a fully integrated electronic Public Procurement system that would be compliant with the legal framework. It provides an analysis of the eProcurement procedures at different levels:

- transcription of the new directives into a comprehensive conceptual view
- detailed description of the main eProcurement procedures and phases in the form of information and activity flow diagrams
- deduction of functional requirements
- identification of potential technical implementations for the deduced functional requirements
- deduction of non-functional requirements
- description of a technical conceptual model, capable to support core eProcurement functionalities
- identification of main actors
- conclusion of Use Case analysis
- documentation of “open issues” related to Public eProcurement, as discussed in several public expert fora

The eProcurement analysis carried out in the present report is based exclusively on the regulatory framework established by the EU public procurement directives. Depending on national, regional and/or local legislation, a contracting authority may be required to consider additional functional and non-functional requirements for an eProcurement system.

The above analysis provides the ground for identifying alternative technical solutions available for the various eProcurement procedures, phases and steps. Description of these technical solutions is carried out at a functional level, while the advantages and disadvantages of each technical solution are also presented where appropriate.

The non-functional requirements discussed in the current report comprise requirements for usability, reliability, interoperability, scalability and security. The new EU procurement directives do not impose specific non-functional requirements, hence the non-functional requirements presented in this document should only be considered as guidelines.

The work carried out has revealed a number of critical decision points and alternative technical implementation scenarios, which contracting authorities should decide upon before implementing an eProcurement system. Such decisions may have an impact on several functional and non-functional aspects of a new eProcurement system. Some of these decision points, especially with regard to security and interoperability, are already being analysed at European level.

To further assist contracting authorities, standardisation bodies, and any other interested party to fully understand the new EU public eProcurement legislation, this report is further complemented by static and dynamic demonstrators, developed in the context of the same project, in order to simulate a fully functional eProcurement system, compliant with the EU legislation. Volume II of the report contains details for interested parties to access and experiment with these demonstrators. More information about the demonstrators can be found at the Internet address <http://europa.eu.int/idabc/eprocurement>. The demonstrators are also accessible at <http://delos.eurodyn.com/idaeproc/>.

These demonstrators cover the required functionality for individual contracts, framework agreements, DPS, and eAuctions. They aim to:

- provide a medium for experimentation and review of the required eProcurement workflows
- trigger discussion on the directions and technical approaches to follow for the implementation of eProcurement systems, in line with underlying eProcurement legislative aspects
- train procurement officers and economic operators on the functionalities required by the current directives

The analysis presented in the current report can provide the basis for administrations or vendors developing eProcurement systems, in full compliance with the new directives. It is envisaged that this analysis should result in a more focused development of software and, possibly, savings for administrations, since they will be in position to describe more accurately to contractors the desired functionality, rather than being forced to accept and customise generic solutions offered by existing commercial eProcurement systems.

On the technical implementation level, the analysis has shown that technology is not a restrictive factor, as a wide selection of alternative technical solutions is available for the implementation of different functional requirements. Therefore, the key aspect for administrations is to model appropriately the eProcurement procedures they need to automate and make decisions on the technical solutions to implement, by applying their specific requirements. This will allow administrations to select solutions more appropriate to their existing infrastructure, available budget, specifications, and the scope of their eProcurement project.

Most eProcurement procedures can be viewed as extensions or minor alterations to the open procedure as many steps of different eProcurement procedures can be implemented through the same mechanisms (e.g. implementation of official publication, submission of tenders, opening of tenders, etc.). This can result in considerable cost savings via re-utilisation of software modules.