Full Length Research Paper

The implementation of document management system (DMS) in managing sub-contracts tenders: A contractor's perspectives

Hafez Salleh[1], Nurshuhada Zainon[1]*, Mustafa Alshawi[2] and Nor Azlinda Mohamed Sabli[3]

[1]Department of Quantity Surveying, Faculty of Built Environment, University of Malaya, 50603 Kuala Lumpur, Malaysia.
[2]Research Institute for the Built and Human Environment (BUHU), University of Salford, United Kingdom.
[3]Faculty of Architecture, Planning and Surveying, University of Technology, Mara, 40450 Shah Alam, Selangor Darul Ehsan, Malaysia.

Company X is a construction organization located in United Kingdom with turnover reaching £370 million and with past and current projects valued up to £15 million, and has completed a number of construction projects both in private and the public sectors. Due to numbers of limitations from previous system in managing sub-contract process, the company management had decided to develop a document management system (DMS) application to replace previous system. The pilot project of DMS implementation in the company was held prior to the implementation wide organization. The case documents the events that led to the selection of the packages with regards to the 'live' system implementation in the company.

Key words: Document management system, sub-contract, construction tenders.

INTRODUCTION

Construction tendering process is a complex, dynamic and long process with involvement players from within and between organizations (Saad et al., 2002). Traditionally, the tendering process is paper based, and it involves much manual work. Thus many problems arise throughout this tedious process (Chan et al., 2007). Since a decade ago, the technology for producing, managing, duplicating, and distributing plan drawings, specifications, bills, etc., has undergone many fundamental changes (Björk, 2001). As the development of network technology has nowadays reached a level where companies can implement Intranet, Extranet or Internet, the construction industry has started to produce documents digitally and transferred digitally. Even so, in term of document management, this hardly offers any improvement over the current situation since finding a document in another person's personal computer may be even more difficult than on his/her shelves. As a solution, a document

management system (DMS) has been introduced to manage these digital documents. The DMS is an automated system used to support the creation, use and maintenance of electronically created documents for the purposes of improving an organization's workflow (National Archives of Australia, 2005). It captures and manages documents within an organization using web access to support occasional users and work from remote sites as well as secure document storage area centrally on a server (Björk, 2002).

LITERATURE REVIEW

Company X was facing many limitations in previous system in managing the practice. A key issue is interfacing between two different IT systems, between two units in the organization, who actually managed and operated the process, namely, the estimator, and the print room. This situation happened because there was no single documentation to define and describe the sub-contracting tender process. Every estimator had a different perception and definition of the sub-contracting

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*Corresponding author. E-mail: zshuhada@gmail.com Tel: +603-7967 7603. Fax: +0603-7967 5713.
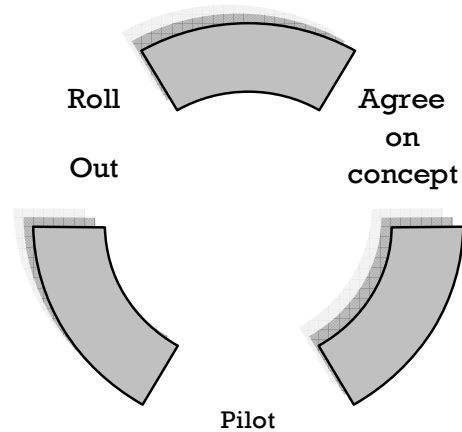
Figure 1. Vendor C's proposed stages of system Z implementation.

tender process and therefore cost, time and quality mainly relied on the estimator capabilities in performing their job. The cost of reproduction of large documentation for producing tender documents, including bills of quantities, specification, preliminaries, and drawings, is high and also time consuming for compiling those documents (Kim, 1998; Yan et al., 2008). Previous system of managing sub-contract process also required large space to allocate filing cabinet to store the volume of large size of document and sometimes, there was a difference in the tender document received by sub-contractors, due to human error during the compiling process (Whittington and Lucas, 1992; Chalmers and Davis, 2001). This has led to the issue of sub-contractors pricing the tender on different basis of information, and disputes during the tender and construction process (Chan et al., 2009). Because of this issue, a lot of problems arose:

(1) Duplication of input
(2) Errors/manual process of cross-referencing
(3) Searching for information
(4) Tracking and controlling revisions
(5) Administering related procedures

To solve the problems, the management decided to switch on to DMS in order to make the sub-contract tendering process more efficient. By using DMS, the tender document can be kept in a centralized electronic database management system (EDMS) and produced in CD format (Johnston and Bowen, 2005).

In 2002, the management practice decided to seek a new IT system that solved or minimized these problems. There was a series of meetings and presentations between the management practice representatives and vendors that were looking for a suitable system to improve the sub-contract tender enquiry process. A

system proposed by vendor Y was selected and called System Z. Vendor Y offers a range of packages for the construction and property related industries. System Z is a DMS, and provides collaboration solution that is ideal to control and manage the creation of drawings and associated documents throughout sub-contract enquiry processes. Vendor Y provides a high commitment to system Z's development;

(1) By providing the package
(2) System requirements definition - functional and non-functional (providing an assistance to in-house expertise)
(3) System analysis – improved sub-contract tendering processes (working with in-house expertise).
(4) System design – developing detailed specifications and hardware/software recommendations.
(5) System development – providing assistance to in-house expertise
(6) System implementation and support – including training (working with in-house expertise)
(7) System maintenance – providing assistance to in-house expertise.

In-house expertise has the capability to develop and maintain IT/IS such as programming, analysis, being able to install and manage off-the-shelf, ready made packages, etc. (Feeny and Wilcocks, 1998). In the early stages, vendor Y assisted the in-house expertise to analyze the existing business processes and recommend the solution. Vendor Y also provides a dedicated on-site Project Manager to coordinate the process. Vendor Y's proposed stages of system Z implementation as shown in Figure 1. A vendor Y and the management practice had agreed on the concept of the proposed system Z as follows:

(1) Business analysis
(2) Functional and non-functional specification

(3) Development
(4) License profile
(5) Training
(6) Support

At that time, there were many training programme conducted within the practice. However, the training was more focused within the business unit. Therefore, for system Z development, the management practice plan was to conduct more centralized training. In most cases, user involvement in IT/IS development was in group and ad-hoc basis, and only involved in high cost of IT/IS project. The trial version of system Z was live for three months for reviews. User representatives came from people who were relevant to the system. For System Z, all the estimators were involved in prioritizing the system's requirements.

Finally, after three months of reviewing the system design and planning, system Z has been implemented throughout the organization. System Z enables the whole sub-contracting tender process to be repeatable for the new sub-contracting documents, which allows organizations to repeat successful practices developed on earlier projects. Policies for managing sub-contracts quotations and procedures to implement those polices are established. The hardware and software requirements for system Z are Windows 2000/2003, run on a UNIX platform, and an Oracle database. Currently, each of Company X's offices has managed their own system according to their project needs.

The practice expected benefits of system Z to:

(1) Reduce duplication, that is, cross referencing
(2) Improve document searching
(3) Reduce reliance on hard copy distribution
(4) Reduce reliance on manual version control
(5) Administer standard practice/procedures
(6) Integrate with existing systems (CDS/Oce)

SUB-CONTRACT TENDERING PROCESS

The four (4) phase of managing sub-contract tendering process in Company X:

1st phase (late 80's) – 100% paper based

(1) Main tender document is received in hardcopy
(2) Estimator determines which pages need to be photocopied
(3) Then taken out from original bills of quantities for photocopy
(4) Print and compile for dispatch sub-contract package (postal)
(5) Received package back from sub-contractors via post and the estimator evaluates manually.

2nd phase (late 90's) – 50% manual and 50% electronic

(1) Main tender document is received in hardcopy
(2) Estimator determines which pages need to be scanned
(3) Then taken out from original bills of quantities for scan (Oce scanning and printing system) and indexed with CDS (Index system)
(4) Print and compile sub-contract package for dispatch (postal)
(5) Receive package back from the sub-contractors via post and the estimator evaluated manually.

At 1st and 2nd phase, most of the tendering process is a standard practice within the company; however, there was no single documentation to define and describe the process available. Therefore, the company experienced wide variations in cost, delivery times and quality targets. This is due to the factors that every estimator has a different perception and definition of the process, and all of these elements (cost, time and quality) rely on the estimator's capabilities in performing their job. The management of the new sub-contract quotation document is based on experience with similar projects. The problems that occurred during the tendering process are solved in an ad-hoc manner and depend on the previous experience of the estimator in handling similar situations. Thus, the success of the work process depends entirely on having an exceptional estimator, and the whole process will be affected if the estimators tend to leave the company. The quality of information was not guaranteed, due to a tendency of duplication of input, or error during taking out the pages from the bills of quantities, scanning, and indexing. The organisation also not assigned responsibility to manage the process. Apart from that, there was a problem on storing, tracking, and controlling the document.

3rd phase (currently) – 80% electronic

(1) Main tender document is received in hardcopy
(2) Estimator determines which pages needs to be scanned
(3) Then taken out from the original bills of quantities for scanning (Oce scanning and printing system) and indexed with CDS (Index system)
(4) These scanned and indexed bill pages imported into system Z
(5) The sub-contract system package is dispatched to sub-contractors in three ways; e-mail, hardcopy and in CD format
(6) Receive package back from the sub-contractors via post and the estimator evaluates manually.

At 3rd phase, the whole tender process in producing the

sub-contract document is repeatable for the new sub-contract documents which allow organizations to repeat successful practices developed on earlier projects. The overall process can be described as disciplined because the planning and tracking of the tender process is stable, and earlier successes can be repeated. For example, the information in the earlier projects can be used for future sub-contract documents, and improved information sharing, that is, templates, sub-contractors selection, and evaluation, etc. Policies for managing sub-contracts quotations and procedures to implement those polices are established. However, none of the written document is evident. The procedure for managing sub-contract documents is improved as the work progresses.

4th phase (future-prediction) – 100% electronic

(1) Main tender document is received electronically
(2) Estimator selects which pages needs to be indexed with the CDS Index system and then imported into EDMS
(3) Then the sub-contract package is downloadable via the website
(4) Receive package back from sub-contractor electronically in the original format, and the estimator evaluates electronically.

At 4th phase, e-tendering solutions will provide a single point of information across an organization (Chan et al., 2009; Du et al., 2005). This advantage also extends beyond the organization while all sub-contractors obtain the same documents from a single source of information, and disputes may be avoided due to inconsistency of documents in the traditional tendering processes. This will increase the degree of satisfaction of all parties involved, and maintain the level of harmony across the supply chain. The system might have an e-mail trigger process control to alert that someone has made changes to the original document. Thus, the company gains the capabilities to monitor and maintain the quality of the original document up to certain standards. All tender projects use the same well defined process, and therefore the quality, time, and cost can be measured, compared and standardized across tender projects. When the quality, time and cost are exceeded against standards, action can be taken to correct the situation. Apart from that, e-tendering solutions also will facilitate the audit trail of tendering processes throughout the cycle, which improves the transparency and fairness (Chan et al., 2009; Du et al., 2005). The automatic tender reporting functionality ensures the tenders are evaluated on the same platform.

Figures 2, 3, 4 and 5 illustrate the maturity of the process of sub-contract tendering.

CONCLUSION

The development of system Z was initiated in a top-bottom way where the management practice decided to seek a new system that solved or minimized the problems with the old sub-contract tendering system, such as duplication of input, errors/manual process of cross-referencing, searching for information, tracking and controlling revisions, and administering related procedures. There was a series of meetings and presentations between the practice representatives and vendors who were looking for a suitable system to improve the sub-contract tender enquiry process. The selection was made by the IT department that comprised the ICT director, software development manager, ICT support manager and the head of the estimating department. This is due to the fact that the practice does not have any plan to give the authority to the business unit to make decisions on the purchasing/development of IT/IS.

At the early stages, the vendor Y assists the in-house IT experts to analyze the existing business processes and recommend the solution. It was identified that the in-house IT experts had the capability to develop and maintain IT/IS, such as programming, analysis, being able to install and manage off-the-shelf, readymade packages, etc.

Whereas, the regular users of IT/IS has the capability to operate a technical standalone packages such as AutoCAD, CAD estimating, Agresso, etc. Vendor Y also provides a dedicated on-site Project Manager to coordinate the process and proposed stage of system Z implementation. Vendor Y also played a vital role in providing advice and transferring knowledge to the in-house expertise system requirements definition. These were: functional and non-functional (providing an assistance to in-house expertise), system analysis – improved sub-contract tendering processes (working with in-house expertise), system design – developing detailed specifications and hardware/software recommendation, system development – providing an assistance to in-house expertise, system implementation and support – including training (working with in-house expertise) and system maintenance – providing an assistance to in-house expertise. It was also noticed that the practice managed well their sub-contract tendering process maturity improvement, which follows the expected maturity sequence; manually, half manually and fully electronic.

The current status of the project is that the interaction between departments is more frequent, particularly in the sub-contract tendering process, the practice also developed the skills matrix for the training of IT skills to develop IT core capabilities in the future IT/IS. The IT departments was expanded where the IT department was split into two main division; software development and ICT support and the IT Manager was also promoted to the senior management status to facilitate the contribution of the IT department towards IT/IS strategy and business strategy.
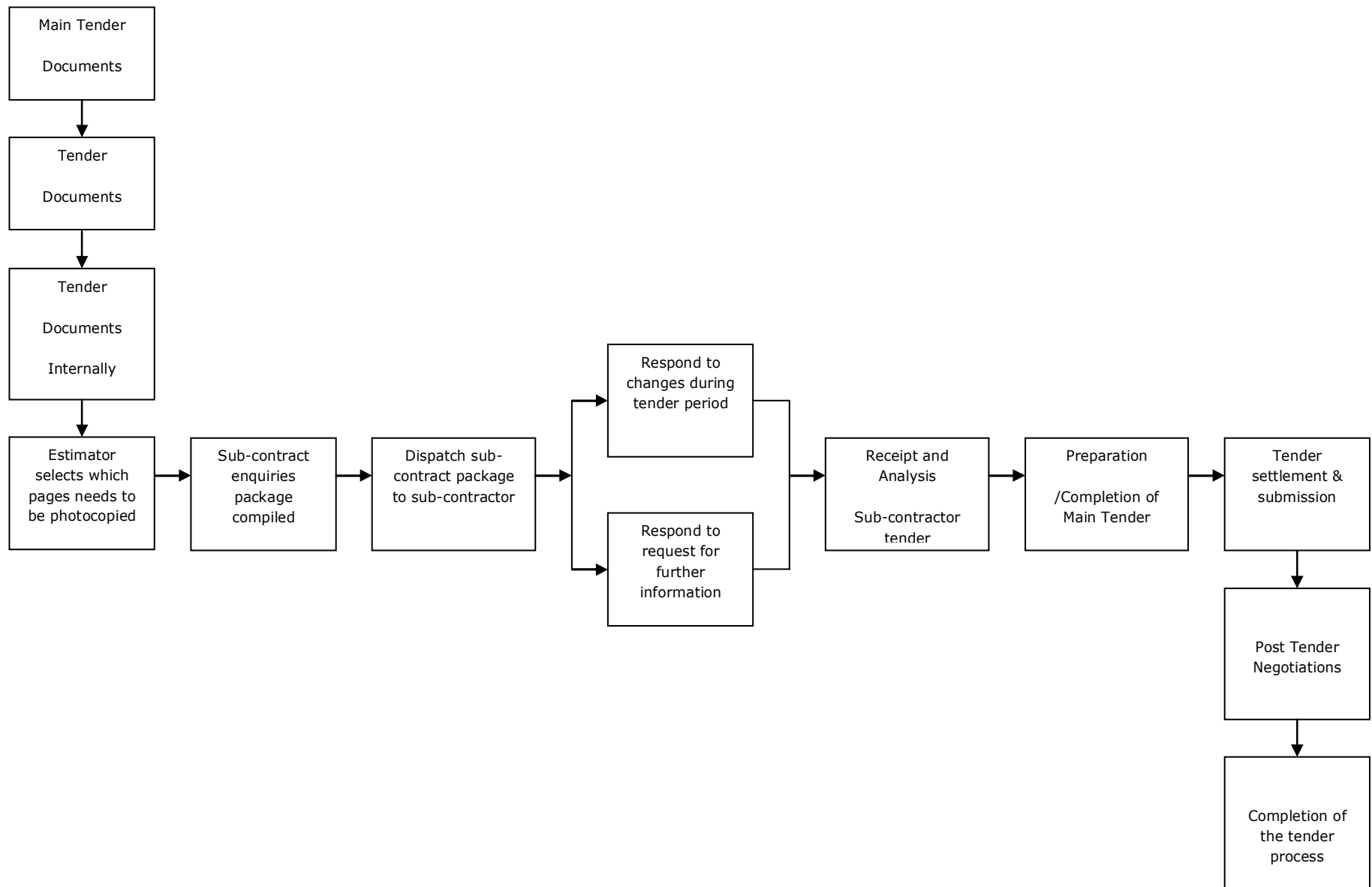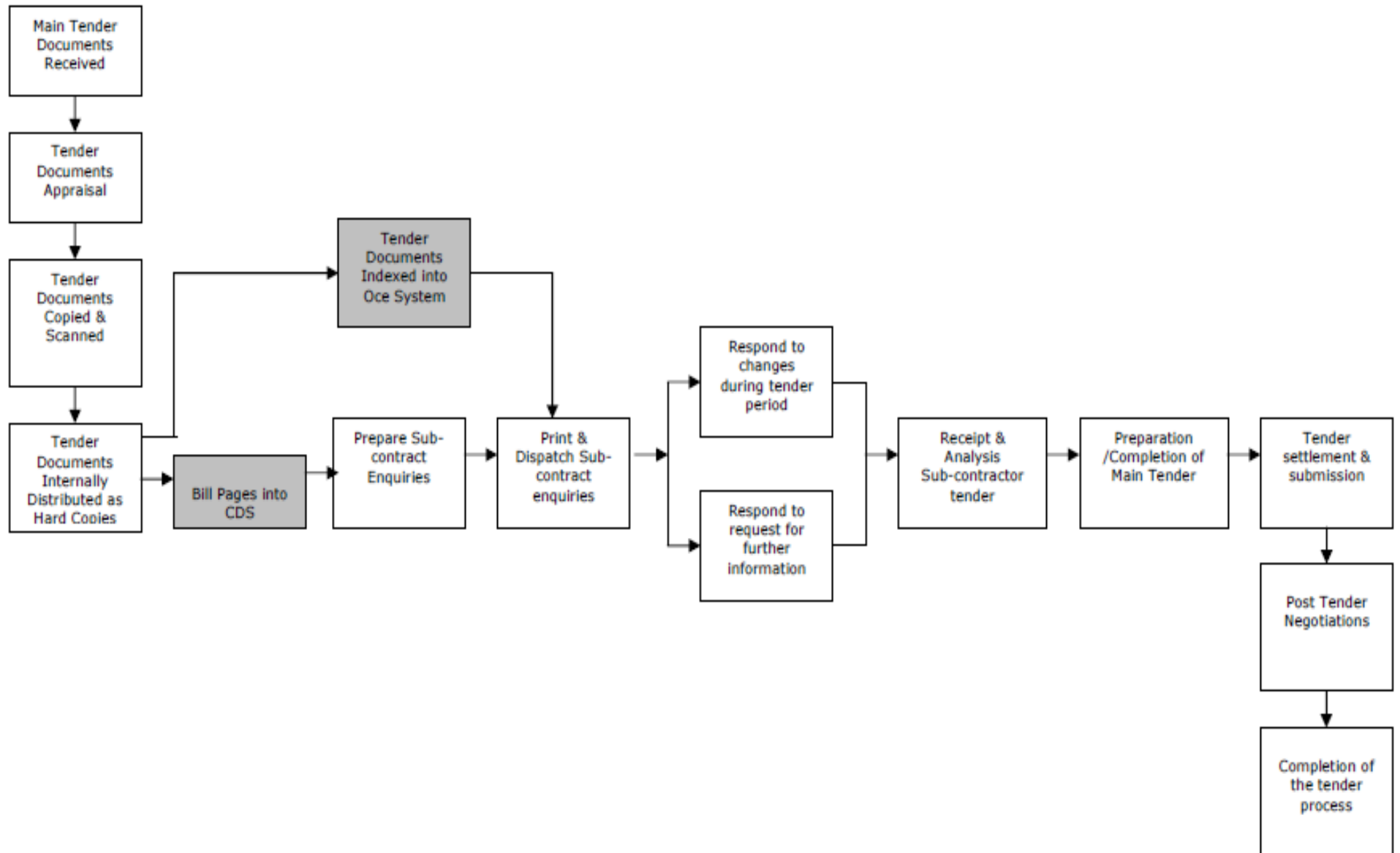
Figure 2. Status prior to project (Process A).
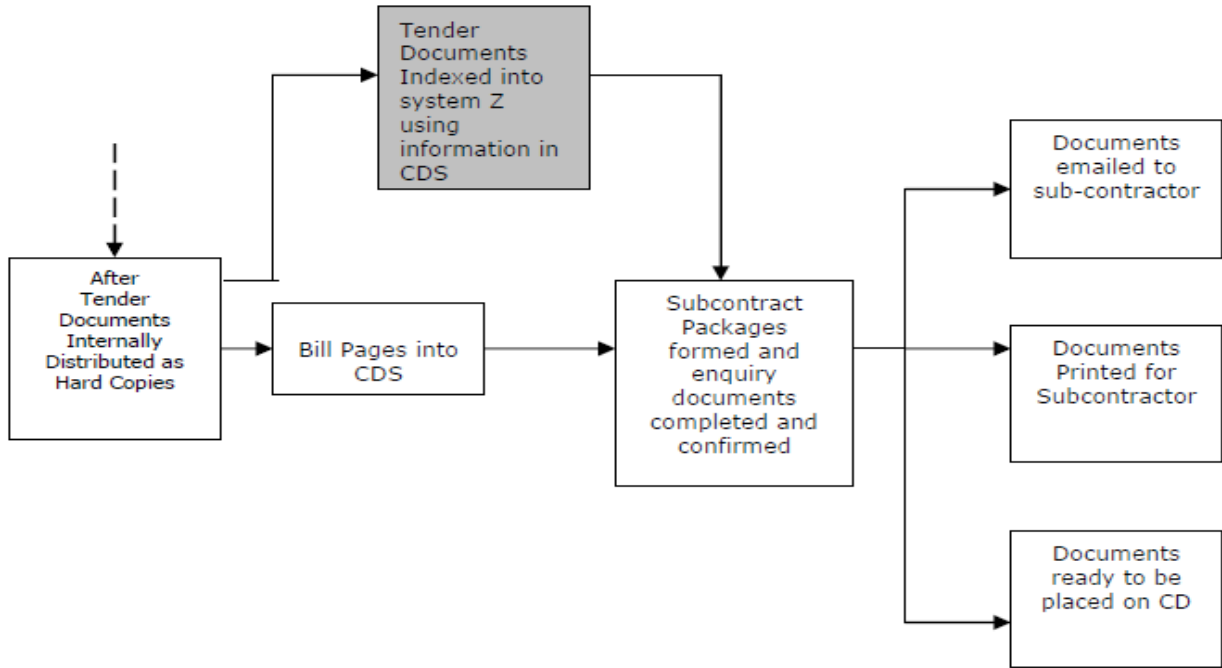
Figure 3. Status prior to project (Process B).

Figure 4. Current status of the project (Process).
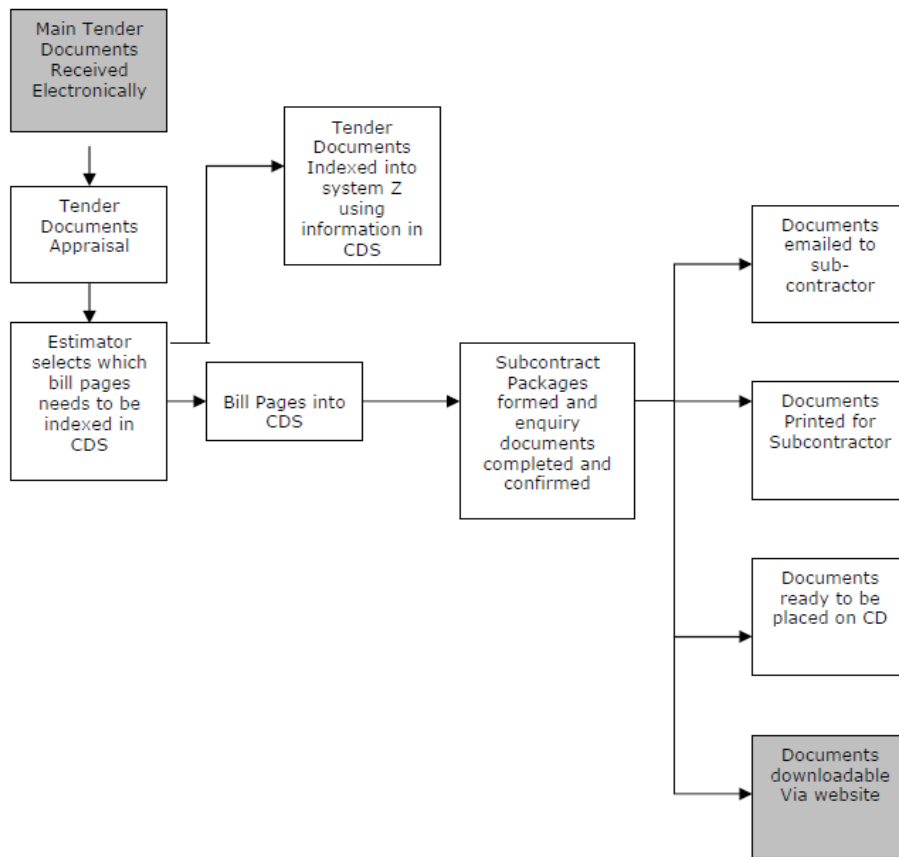
Figure 5. Target status (desire to be in the future) (Process).

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