

Theme:  
Title: **Process Modelling of E-procurement in the Singapore Construction Industry**  
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Abstract: *The E-commerce, as a new trading and business mode through the Internet, has started to penetrate all industry sectors aggressively in Singapore. As value of construction procurement usually accounts for about 70%-80% of the contract value, more and more portals are being set up by local and overseas companies to target the market, especially in building resources procurement, real estate marketing, etc. This research will focus on the process modelling of the E-procurement in construction, i.e. the reengineering of the E-procurement process in construction, based on the current traditional procurement practice, the survey in local construction industry, and the survey in local construction portal providers. The objectives of the research are to promote IT in Singapore and to reduce the duplication of work in current construction procurement. The ideal model will be proposed after the analysis of the above surveys and the final E-procurement process modelling will be in a format of IDEF0, which is a typical diagramming method for process modelling.*  
Keywords: *E-procurement, traditional procurement, portal providers, process modelling*

### Introduction

Singapore construction industry has been suffering from its low productivity for decades and part of the reason is the low efficiency of current construction procurement operation that is both time-consuming and costly. In order to improve this, portals and websites from both the government and the private sector are put up to provide Internet services on electronic procurement and electronic project management. However, the E-procurement application by the users—the contractors is far from popular partly because: 1) the procurement activities in construction are highly fragmented and complicated; 2) the E-procurement services provided by the portals can not fully meet the requirement of the contractors and 3) a certain number of construction practitioners are not comfortable with the new way of doing business.

It is in this context that this research is carried out. Survey questionnaires are sent out to construction companies in order to gain the understanding, attitude and the major concerns of the contractors towards E-procurement. Interviews are also conducted to the construction companies for current traditional procurement practice, as the prototype of the E-procurement process modelling. Meanwhile, the government initiatives to promote IT in construction and services that the portal providers (IT vendors) will be introduced. Based on these, an E-procurement process model will be proposed particularly for the Singapore market.

In this paper, the term “procurement” covers the activities in both the “tender stage” and “contract stage”, which include the procurement of materials, equipment and services for the construction project.

### Questionnaire Survey

Survey questionnaires were sent to 100 local construction companies, including G6 (10), G7 (20) and G8 (70) and a total number of 28 forms were returned. The professionals that filled in



the questionnaires are either Quantity Surveyors (QS) or Contract Managers, with the average 12 years of work experience in construction management. Therefore, their feedback to a large extent represents the voice from the local construction companies. The survey questions involved the current practice of procurement process, IT implementations and E-business capabilities, as well as attitude and major concerns towards E-procurement application. Part of the results and analysis of the survey are shown below.

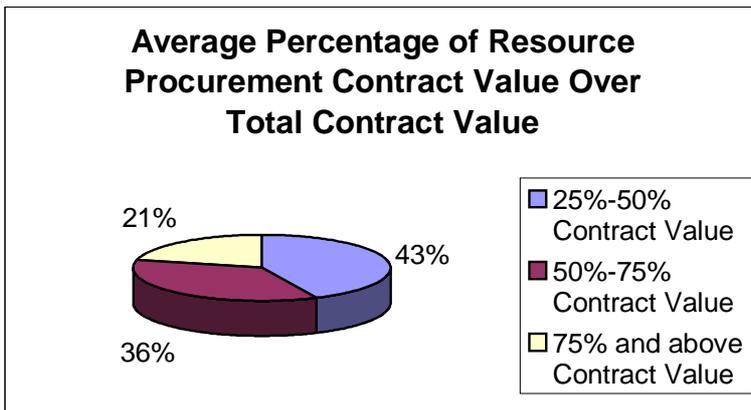


Figure 1

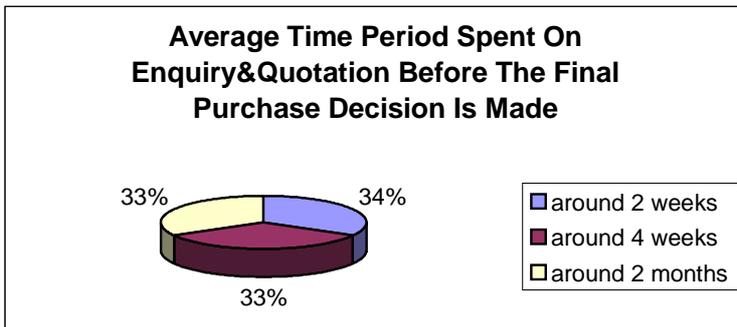


Figure 2

The contract value of construction procurement takes a considerable portion of the total contract value (Figure 1) and therefore, the improvement in this operation, if possible to achieve, will help significantly cut the cost of the whole procurement process. Figure 2 shows that an average of 4-week time is usually required for procurement document transfer process, from the time that initial inquiry starts to the time upon the final agreement is made. As “time” is a critical factor in construction management, especially scheduling, the shortening of this time period will be meaningful to the construction companies—if effective measures can be taken such as accessing the new resource pool—the Internet. Internet has widely penetrated every field and construction industry is no exception. From Figure 3 we see there is a growing popularity for the construction companies to employ the Internet as a communication tool and information channel, to reach out for new resources on the web. 67% of the respondents agree that E-procurement will help improve working efficiency, and 53% think that it will help cut cost. These facts show that generally, the majority of the consumers are aware of the benefits that E-procurement can bring about, in terms of time and cost saving.

When asked whether they would like to conduct the procurement process on line if provided with such a trading platform, 29% of the surveyed construction companies accepted this readily,

50% agree conditionally, with concerns of cost, efficiency, security and the remaining 21% are opposed to E-procurement and prefer direct human contact. Some pointed out that some negotiation should require face-to-face communication. When asked what their major concerns are on the employment of E-commerce in procurement, 38% indicated "security", 23% indicated "reliability of suppliers", 46% mention "insufficient product information on the web" and 15% insisted they prefer personal or phone contact to E-procurement. The major concerns of the customers of E-procurement system focus on network security (transaction privacy), supplier reputation and product information/services provided by the relevant websites, which shows that professional portals/websites on construction procurement that provide both the trading platform and relevant services are in high demand.

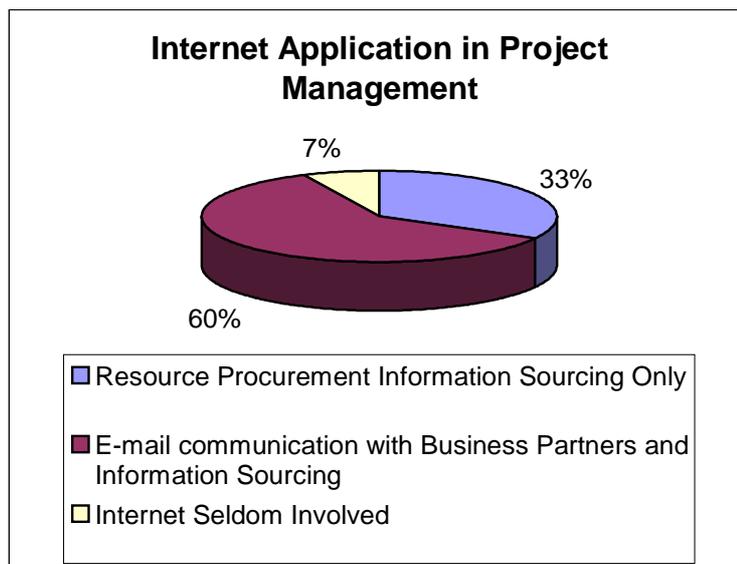


Figure 3

Finally, the construction industry in Singapore is now partially prepared for the coming Internet revolution. It is clear that there is a strong need for the industry to employ Internet in the current procurement process to help both increase efficiency and cut cost, though the market is now not a fully grown one. Once a successful E-procurement environment is set up, it will be easier for the IT companies to further improve the services based on the feedback from the customers, which could possibly initiate a positive cycle for the development of E-commerce in the construction industry.

### Traditional Procurement Practice

The traditional procurement process, especially the application in the Singapore construction industry is discussed by a case study. A case company is chosen in order to map out the current procurement process. Interviews were carried out for acquiring the procurement operations in the company, and the characteristics and problems in the current procurement operation will be discussed below.

The case company, "China Construction (South Pacific) Development Corporation Pte Ltd" (CCDC), is a BCA registered company for General Building (G8) and Civil Engineering (G6). (Singapore contractors are registered as G1-G8 companies, with the highest G8 qualified for projects over S\$50 million and G6 for S\$10-30 million) It ranks itself top 5 among the construction companies in Singapore in terms of contract value, which is as high as S\$270 million. The reasons why CCDC is selected as a case company in this research lie in:

- a) Like the majority of other local companies, CCDC conducts standard document format in project management, (such as contract format, purchase order format, etc) which is from SIA (Singapore Institute of Architects) and therefore its procurement operation can be regarded as representative of the current procurement operations in Singapore;
- b) After playing different roles, such as main contractor and sub-contractor in many different large-sized projects, the company is extremely experienced in project management, especially procurement and this helps to enrich the picture of procurement process when being mapped;
- c) CCDC's IT department and procurement department are attempting to promote IT within the company, which includes setting up a database within their intranet. This shows that CCDC is among the construction companies that value and would employ IT or E-procurement in their work in the near future.

After a few interviews with the procurement manager and one of the project managers, the current procurement process in CCDC is summarised in Figure 6 and Figure 7, respectively, in the format of IDEF0 methodology. Detailed explanation of the processes is given below:

In the tender stage (shown in Figure 6), the company will decide to tender when there is an tender opportunity based on the company's resource, capacity as well as existing commitments. After the tender documents are studied and the clarification regarding the tender is made with the Client / Consultant, the company will start to source for sub-contractors and suppliers as potential candidates. Usually priority will be given to those in the Company Approved List (CAL). After the candidates are identified, the Request For Quotation (RFQ) will be immediately sent out for quotations. Subsequently, all enquiries regarding the Specifications and Drawings in the tender will be clarified for better understanding on the tender requirements. Eventually, the tender price will be produced from the estimates and the tender is then ready for submission.

Since there are many projects going on at the same time in CCDC, (usually over 10 projects) the company engages central procurement in order to better manage the procurement in each project. The general idea of central procurement is: (shown in Figure 7) The project sites send their request of material to the Procurement Department in Head Quarter (HQ), and the Procurement Department will then check the CAL and call for quotations of the material requested by the site from the suppliers and make a comparison. During this process, the project site will negotiate with HQ for an agreement on the suppliers. Upon their decision of the grant to certain suppliers, the Procurement Department will issue the Purchase Order or sign contract with the above mentioned suppliers and, meanwhile, notify the project site. Upon the delivery of the goods to the site, payment will be made by the Finance Department of HQ. Usually the suppliers are chosen from the CCDC's Company Approved List (CAL).

After some detailed conversations with the procurement manager in CCDC, some basic characteristics and problems of the current procurement practice can be identified. They are:

1. There are certain repetitive processes such as "Request for Quotation" in both the tender stage and contract stage due to the fluctuation of the prices offered by the suppliers after the company wins the bid.
2. The Company Approved List, which is a record of previous partners with the company, plays an important role in the decision on the sub-contractor / supplier candidates
3. The project site plays an essential role in selecting the appropriate sub-contractor / supplier candidates by its negotiation with the HQ.
4. A large amount of time is wasted for endless phone calls, fax for paper-based document transfer in current procurement, and managing and tracking piles of procurement documents to prevent misplacement and misuse of these documents are difficult.
5. There is a high cost in photocopying and faxing the procurement documents for document transfer purpose.

6. Certain opportunities are lost for more new partners with better qualification and / or better price (including overseas entrants) due to the limited procurement resources in the Company Approved List (CAL).

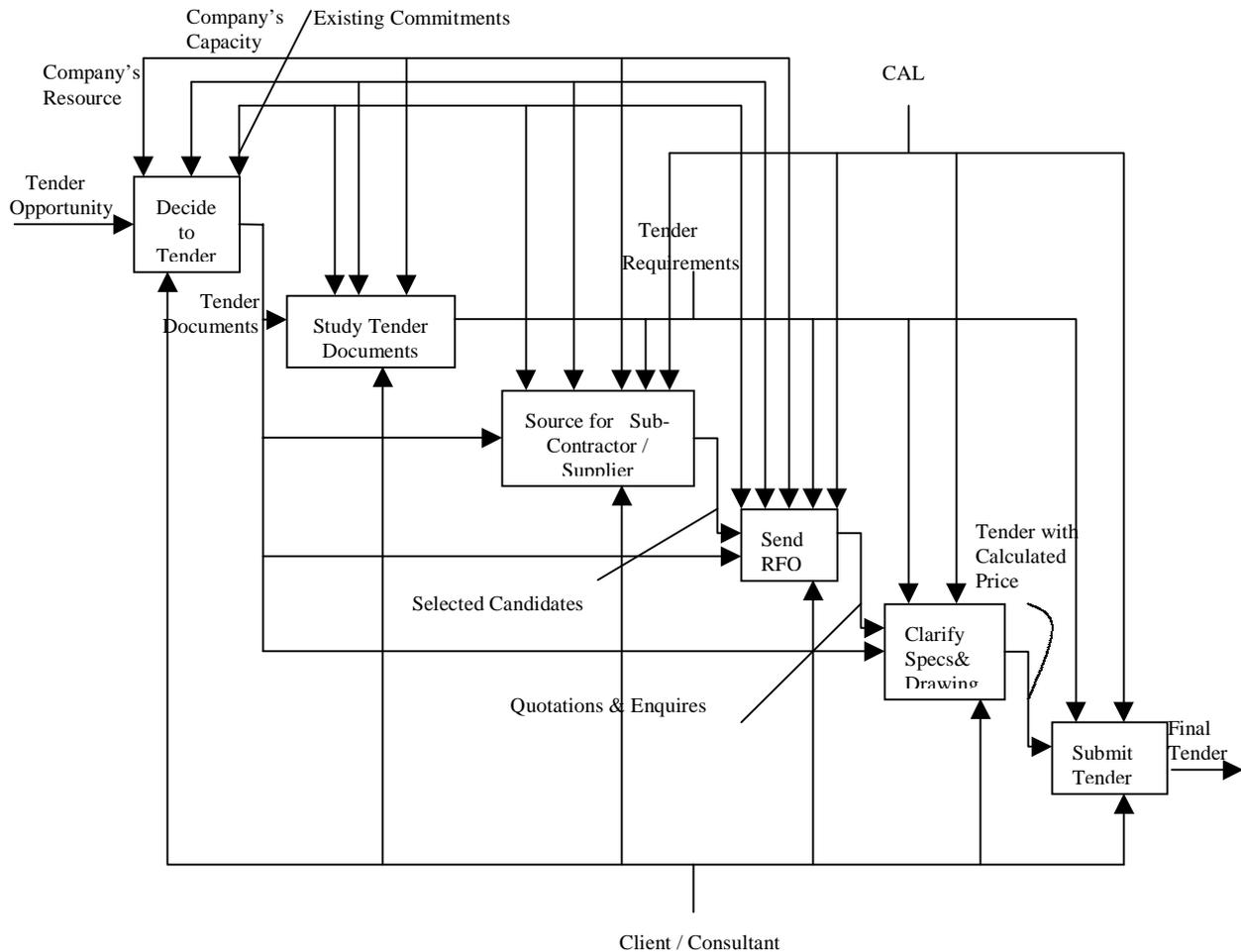


Figure 4 Traditional process of tendering for sub-contractors / suppliers

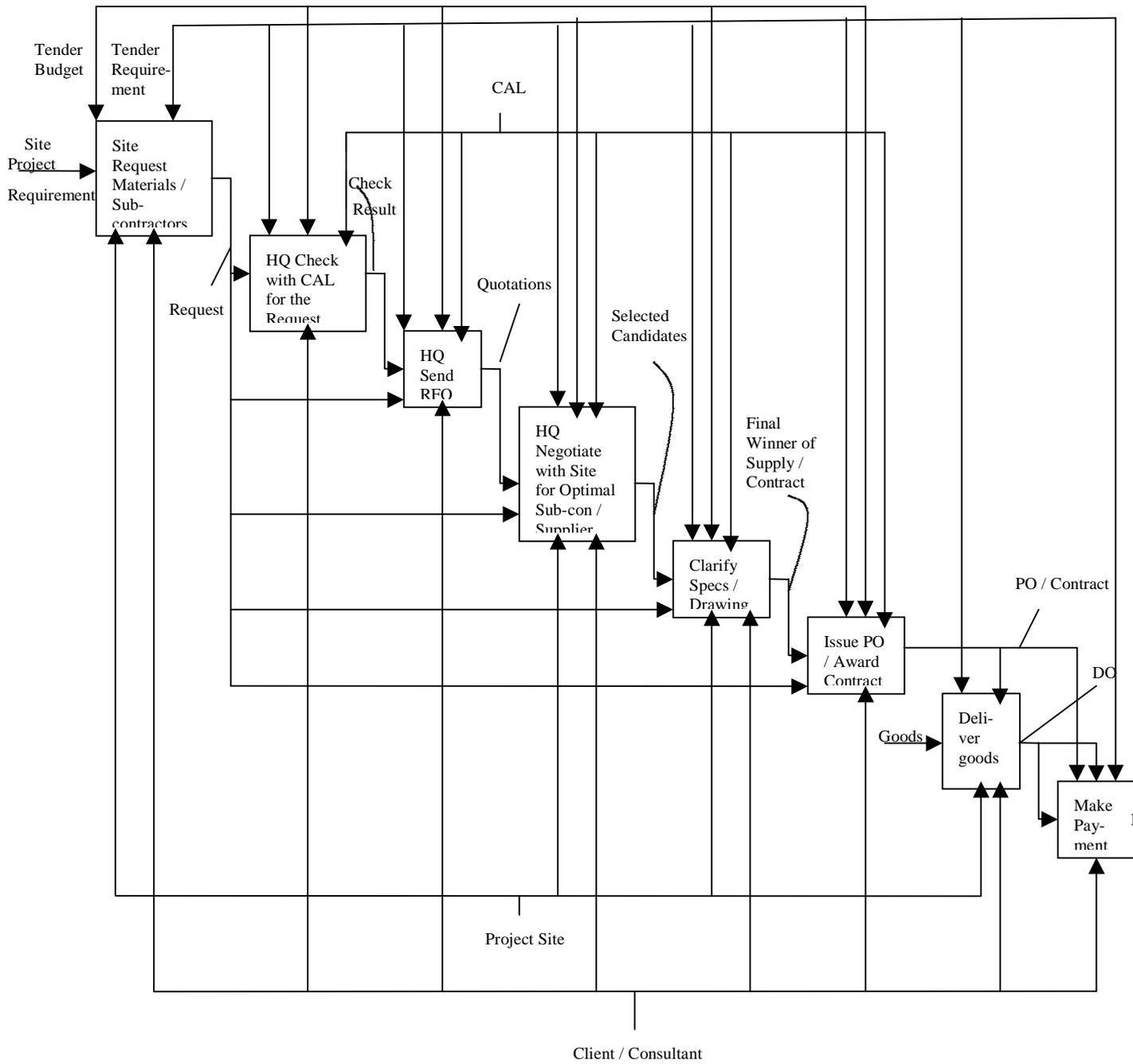


Figure 5 Traditional Procurement Process in Contract Stage

**E-procurement Services in Singapore**

Information Technology (IT) has been applied to the Singapore construction industry for many years. However, it was just a few years ago that the concept of E-procurement was raised. In 2000, Building and Construction Authority (BCA) launched a “project website pilot”, serving the

purpose of creating an Internet-based environment for online sharing of project information and enhancement of cross-discipline collaboration and multi-party co-ordination. It also serves as a central repository of project information and focal point for remote communications through electronic means. This will reduce cost and time in the design and construction life cycle as the existing business and professional practices are re-engineered for greater efficiency. A similar E-procurement pilot programme was also carried out in 1999 to promote the application of the E-commerce in construction, which aims to enable effective e-commerce adoption by contracting and supply companies to streamline administrative and logistic related processes towards greater industry productivity, whilst positioning Singapore as a regional electronic procurement hub for construction resources. In May, 2001, leading industry practitioners from 21 large construction companies demonstrated their commitment to participate in this project.

In the private sector, many portals that provide E-procurement and related services have been set up. In the case of most private portals / websites, the contractors can get a lot of information from the website and make the transaction on-line after they register as members. These useful information include product / supplier information, by which they can locate any kind of product or any particular supplier by the on-line searching service. Consumers can even send RFQ on-line to certain suppliers for quotations and real transaction could be made by ordering through the web. Payment could be made by either the traditional method (e.g. cheque) or the use of the electronic payment system.

Another type of service that many portals / IT companies provide is the building of an intranet or web-based database system for a particular construction company, which is favoured by some big construction companies. In such a system, different company staff can access the different parts of the database, such as procurement section, progress payment section, scheduling section and so on. Compared with the above mentioned "project website" mechanism, or the "project based" system, which could be shared by different parties including the consultant, the client, etc., the company database does not allow others outside the company to access, and therefore such a system is, currently, commonly used by the leading construction companies.

Despite the fact that there are many players in this field and many are being planned to be put up on a daily basis, the E-procurement application today, in Singapore, is still very limited. Unlike the B2C E-commerce, E-procurement in construction is not a simple purchase as other parts of the whole process have to be involved, and this requires that a data flow be formed in a database system so that information could be stored and updated.

### **Process Modeling of E-procurement**

Based on the current procurement practice in construction, as well as the existing IT resources, it could be seen that E-procurement will benefit the construction company most only when the company has a web-based database system with particular project information. Since the HQ and the particular project site can access the system at any time, procurement information could be exchanged and updated from time to time. The database should also include all relevant procurement information, such as the tender requirements with specifications and CAD drawings, as well as the Company Approved List (CAL).

In such cases, both the project manager at the site and the procurement manager in HQ can access the database for procurement information, checking CAL on-line, sending RFQ at the E-procurement portal / website, and making real transaction (issue electronic PO) through the web. Such transaction information will be recorded by the E-procurement portal, and meanwhile could be transferred to the company database for record. Since all the specifications are

electronic and all the drawings are in the format of CAD soft version, almost every process could be done electronically. Figure 6 explains the process. The processes involved have been mapped out in Figure 7 and Figure 8.

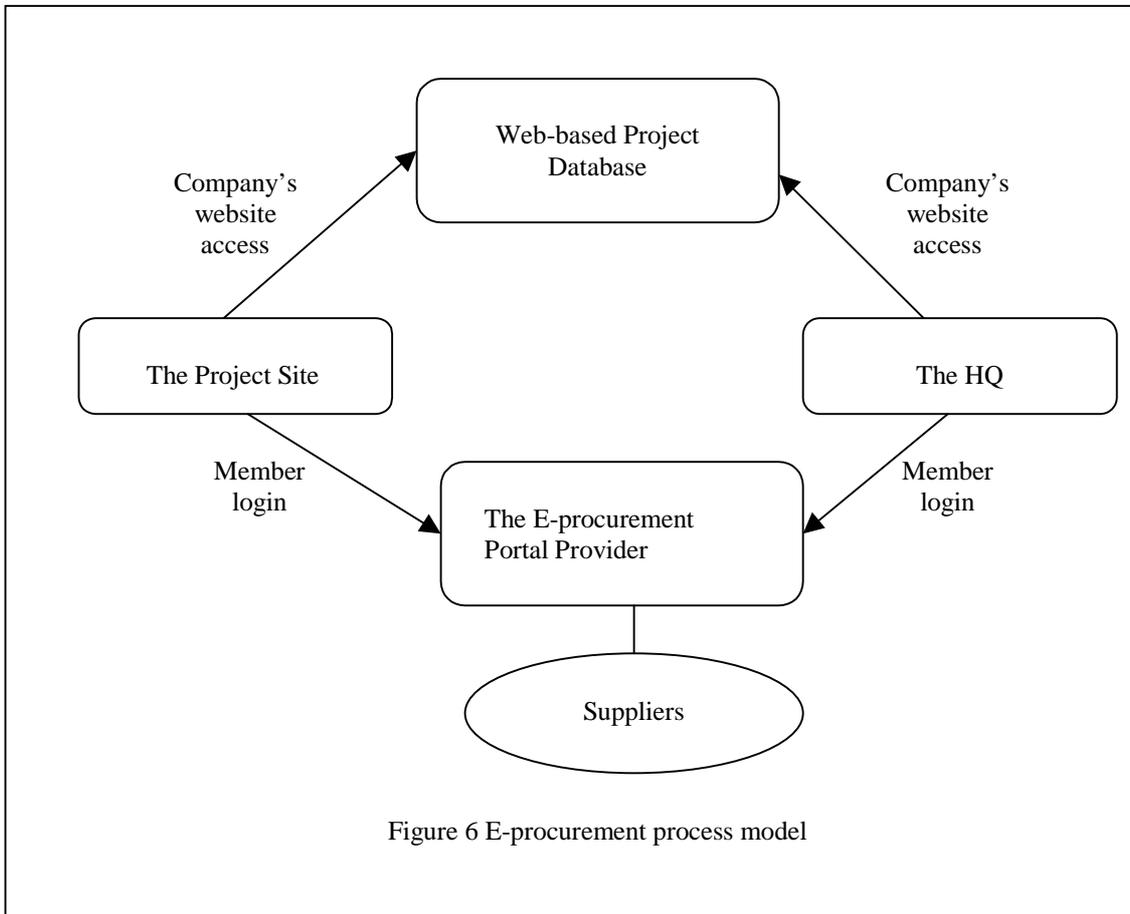


Figure 6 E-procurement process model

**Conclusion**

Construction procurement is an extremely complicated practice with many different parties involved, such as client, consultants and suppliers. The process itself covers many activities in both the tender preparation and construction stage. As the main focus of this research is on the IT application in construction procurement, from the viewpoint of the construction companies, i.e. to answer the question of “How to buy more efficiently and effectively”, the process model and mapping are mainly focused on the buying process, with little emphasis on the processes of delivery, storage as well as logistics aspects.

With the expansion of the Information Technology development, more and more construction companies are investing and keeping their investments in their own company's information management system to achieve cost reduction and higher efficiency with paperless work. Being “conservative” is one of the reasons why IT application did not proliferate in the Singapore construction industry, but enough attention should also be paid to the process nature of the industry. It is on this basis that the model in this paper was developed. The benefits that IT can bring to the construction industry will be shown in the near future, not only in the construction procurement area, but any other aspect of construction project management.

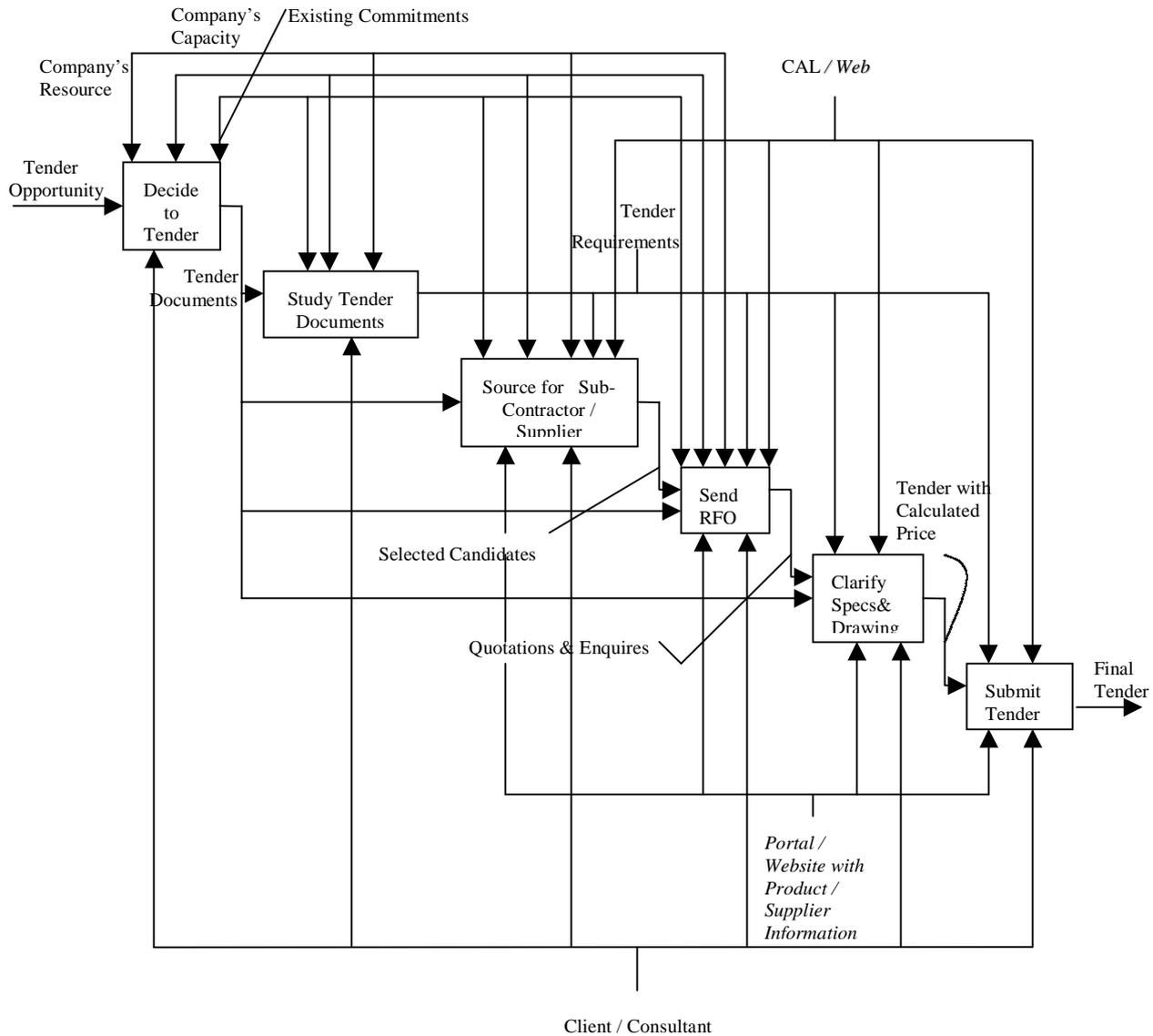


Figure 7 Electronic process of tendering for suppliers for materials / equipment

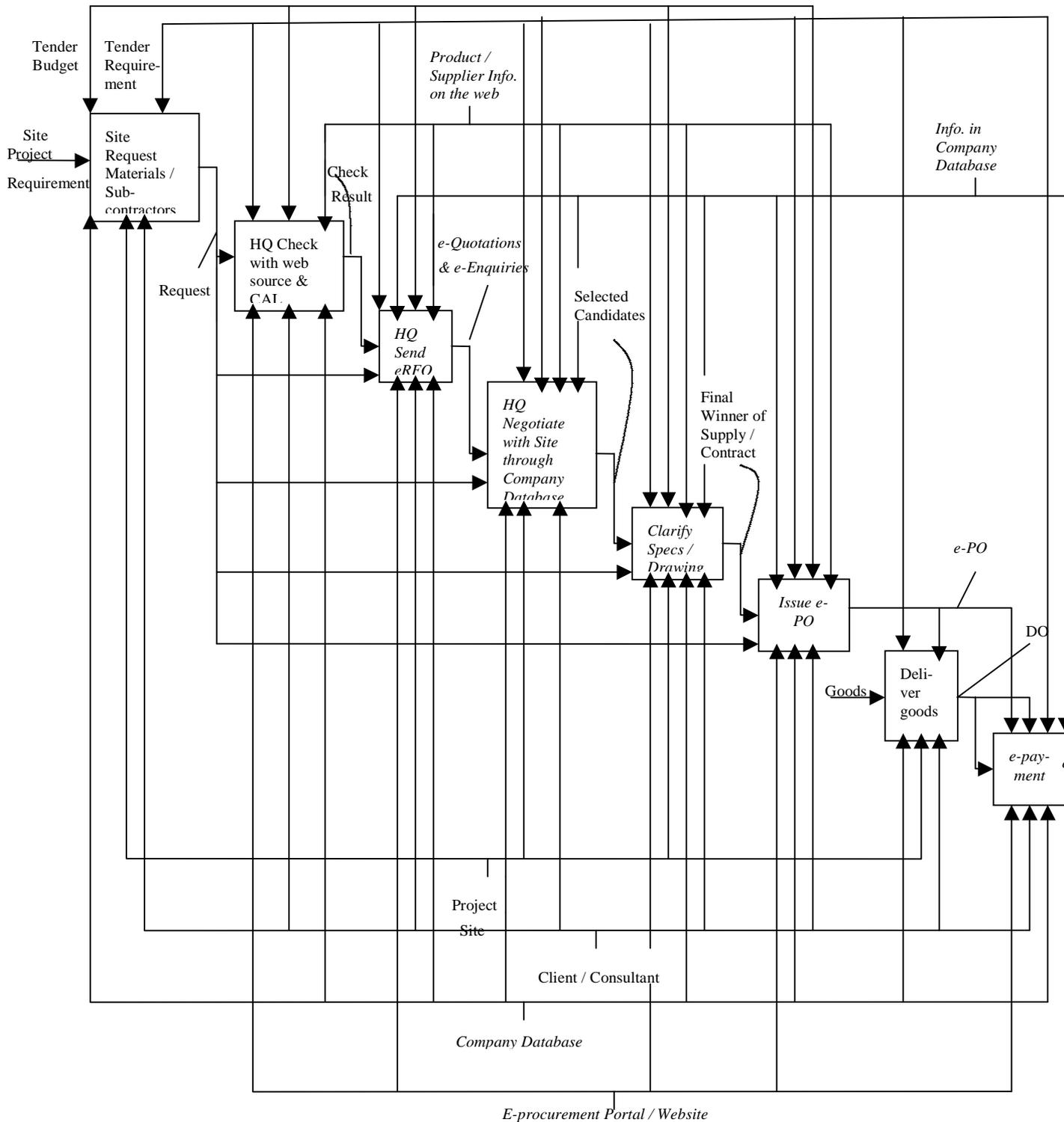


Figure 8 Electronic Procurement Process in Contract Stage

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