

# **Electronic Construction Procurement System**

## **1. Project Background & Rationales**

This chapter is an overview on the procurement system, the rational and objectives behind the project and the whole endeavor. Project manager also displays the roles and responsibilities in addition with planning description for electronic construction procurement system. In order to increase the success over the system objectives, the must be a well-organized and comprehensive documentation planning as following.

### **1.1 Project Background**

#### **1.1.1 Manager Challenges in Construction Development Project**

Construction management is a set of guidelines and standards can be define through the combination of four major mixture of activities in separate phases of initiation, execution, monitoring and closure with the objectives of reduce the effort and time required for a quality unique product.

Managing a construction project is a challenge of management over nine knowledge areas and balancing the expectation of external and internal stockholders. Besides, manager must be aware of the changes and their impacts and necessary updates for other aspects of a running project.

Construction is one of the most successful industries using project management standards and approach with a relatively a high success rate in the number of projects and achievement. In procurement process, manager should be responsible to execute and monitor entire stages in procurement and sourcing a project. This can be start by gathering supplier information and external sources to evaluate and eventually select the most cost effective and quality set of suppliers according to project specification and requirements.

In huge construction developments, procurement manager should provide all raw materials and supply entire project, while in limited scope projects this process may undertake by independent individual and hence, project manager monitor progress through timely fashion reports (PMBOK®, 2008).

### **1.1.2 Construction in technological age**

Construction is a 3.9 trillion USD annually globally with accelerated growth; increase the industry size for a large number of markets including plumbers, transportation wood and many other industries (Barbara J. Jackson, 2010).

According to a higher level of complexity in construction projects, main competitive advantage in current market situation may be to reach higher degrees of effectiveness and timeliness over projects in compare with competitors. Now days with all technological advancement, construction managers is able to work on a web based platform and take the advantages of tight control over all aspects of the project.

## **1.2 Problem Statement**

While in software development labor and expertise dominate a significant part of the project and product development, in construction projects, procurement is the main major portion of budget allocation for overall project budgeting. Therefore, cost effectiveness achievement in construction developments would result in a great saving and can be translated as a competitive advantage in the whole industry.

This factor encourages and justify for developers to be attracted in any tools and techniques which can result in such huge cost effectiveness over projects. Besides, development managers would like to have an effective direct communication to suppliers and make it feasible to take raw materials with a fair price through negotiation and buying techniques. Therefore, any system with major marketing objectives can assist manager reduce the material price, increase the

quality over inbound and achieve a large amount of time cutting which can be describe as total project cost reduction (Harold Kerzner, 2009).

“Electronic Construction Procurement System” is a Web based commerce tools with effective marketing objectives and aims to create value to target market in development industry.

### **1.3 Project Objectives**

In Electronic Construction Procurement System like any other project, the main objective would be to stay on the time, resource and quality of the major deliverables. As an individual project, researcher is limited to information sources and a year time constraints defined for a final year project. In higher degrees of achievements, project can be maintainable and sustainable for further improvements and enhanced future functions.

#### **1.3.1 General Project Objective**

Basically, in this project lack of direct communication between construction manager and construction industry suppliers is the major concern. System would be capable of access to a wide range of suppliers and their products with sufficient information and details required for procurement managers in sourcing project. This is expected from the project to deliver a new business model capable of handling business processes in a higher level of effectiveness and efficiency. As a B2C digitalized commerce tool this is expected that organization reaches a higher amount of sales which can be translated to higher profit.

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System will create value through a well-designed accessible platform contain all required information related to products and functionalities required to create and support a sustainable source of development supplier in construction sector. This is expected from the project to deliver a new business model capable of handling business processes in a higher level of effectiveness and efficiency. As a B2C digitalized commerce tool this is expected that organization reaches a higher amount of sales which can be translated to higher profit. Besides, ease of management and higher level of integration would also apply to the company after digitalization of the procurement.

Beside all advantages of efficiency and effectiveness of direct communication and commerce in construction industry, system attempts to provide a great range of functionalities through an interactive platform for both managers and suppliers in an electronic selling channel.

### **1.3.2 Specific Project Objective**

In addition with the objectives above, system would be an effort to increase quality over projects through evaluative tools of procurement items as the main sourcing project platform. Specifically suppliers would have access to value provided reports which can indicate industry trends and use as an input for strategy driven effort.

### **1.4 Scope of the Project**

System major objective is to facilitating commerce of construction suppliers and gives the raise in services and offering to developers and project managers. Therefore transaction validation and other bidding issues would not be covered through existing purposed system and may be an effort for system futuristic.

## **1.5 Study Limitation**

### **1.5.1 Project Constraints**

According to nature of an individual project and limited amount of resources, project and study was successful to figure the relevant but not best set of requirements. Review on available literatures and updated materials were limited to time constraints as the nature of project.

## **1.6 Focus of the study**

According to domain topics and major objectives of the system, researcher focused on the level of interaction in electronic B2C platform and requirements of construction procurements in the center of supplier manager relationship.

## **2. Project Plan**

In planning stage, manager should take in consideration of setting a realistic and clear set of activities in a comprehensive documentation according to project objectives. However, planning should be always a subject to change and periodically review in every construction project. From this point, project manager should be a powerful change manager in result of any internal or external trend or changes in project scope and specifications.

### **2.1 Risks**

As explained in the PSF, manager should get ready to face a certain level of risk in any project. Risk management should be according to the likelihood and impact of the risk to the project and output a risk registry well documented plan.

Similar to other projects, manager must predict and prepare to reduce the risk and its impact indeed. Project risk can arrive through various changes, improvements or external factors. Manager should plan to identify and resolve higher likelihood events quick and efficient.

### **2.2 Development methodology**

Using methodology in procurement system can prevent developer to face multiple expensive reviews over development stages. A good methodology also gives a better alignment of project with defined objectives and increases the level of outcome quality over deliverables.

There are a number of methodologies can be used for this project according to requirements and specifications. However, according to time constrains and resource limitation in a final year project, Waterfall methodology gives a better outcome and meet key targets with a complete objective coverage over each phase of the development.

SDLC is a clear approach for system development and software implementation projects. Since a lot of Websites developed as online software and applications, there is no wonder if SDLC used in Web Development (Margaret S. Wu and Shih-Yen Wu, 1994).

System requires a higher degree of support and maintains and SDLC would be a quality approach for maintain based products. A part of support after system delivery would be a comprehensive documentation with enough detailed explanation over deliverable product.

### **2.3 Schedule planning**

Time management enables manager to check progress over all phases of project and update as necessary to meet the time deadline and resource availabilities. In this project, Microsoft project management is the main tool gives visually of time and task from beginning to the last stages of the project.

### **3. Company Background & Structure**

In the market, “Akitechnique” interior design products is a growing set of architecture sourcing of construction, which provide a comprehensive set of services and additional advantages to developers in Malaysia.

Over recent years, company tends its focus through providing a wide assortment of products and sourcing national based development in Malaysia.

#### **3.1 Company Mission and Vision**

After near one decade existing in the industry, company mission is focusing on customer needs not only through quality concern in product and varieties in size and range of items but also to increase the level of services, delivery time, shipping and quantity required for national developers. Company transfers its experience to all national based projects and assesses the level of customer satisfaction providing consistent support and consultant through best quality product and considering all ethic issues in this relationship. Company aims to become a world player in construction industry, in both private and public sector projects without communication and geographically constraints. Organization aims to reach a percentage of Asia industry market share and expand to one third of countries to cover all opportunities with quality solutions.

#### **3.2 Organizational of Staff and Company Structure**

“Akitechnique” is a relatively small organization with a manufacturer sector as the main operational segment. Structure of company is simple as a top manager over operation, marketing, R&D and sales department. General tasks such as recruitment and HRM would be handling through executive director and top manager control the results.



Fig. 3.1 - Functional organizational structure

### **3.3 Departments**

Company departments as it shown in table above, uses a simple hierarchy structure through a functional organizational structure. Since, company established one decade ago, still the scope of internal resources are completely limited.

### **3.4 Products and Services**

Products mainly divided in two groups of custom furniture and interior products. Custom furniture sector includes custom cabinet, kitchen and wardrobe, kitchen appliances and fitting, office furniture and products. Interior products include floor finishes, wall covering and soft furnishing, light fixtures and air purifiers.

### **3.5 Sustainable Development**

Continues improvement and sustainable product development considers a key strategically factor for the organization. As a key market player and according to company mission and vision, keeping in mind that “Akitechnique” cares to customer requirements and ethical and environmental business factors. Therefore, no wonder that organization has a significant contribution in building hospitals and other “quality sensitive” projects.

One of the invested effort areas could be mention as minimization of wastage and material consumption through flexibility of products according to

orders. Besides, company uses environmental friendly material to produce well engineered minimum environmental impact items.

### **3.6 Distribution Channel**

Currently physical channel is the only and major selling channel for “Akitechnique”. However there is a low level of technological and electronic engagement through an informative purpose website which cannot support any commerce and marketing activity. Website has a relatively low degree of interaction and minimum of functionalities without any CRM tool or interaction enhancement.

## **4. Literature Review**

### **4.1 Industry Snapshot**

The following section describes trends over construction industry through analysis of major financial elements and industry key factors. These key factors include major industry contribution in global GDP, spending geographical deviation and key success factors for construction developments and projects.

#### **4.1.1 Construction development industry**

In 2010, the whole industry experienced 1.6 percent growth and value of 6,077.6 million (Report Linker, 2011). This makes construction as a high level valuable industry comparing to the other trade markets. The value is not only in the construction itself, the industry give the raise to the other industries through direct and indirect values and communication. For example in a homebuilding project which does not carry a lot of complexity, there is hundreds of business which should get the effect of the project. Plumbers, steel industry, transportation and even government tax would be included in a simple construction project. According to accelerated growth of population and economic rate in recent years, industry faced to a rapid growth especially in Asia pacific nations like China and Singapore.

According to global construction spending figure by Davis Langdon China and USA have over 700 billion US dollar which indicates the increasing level of development (Davis Langdon, 2011). Considering spending growth in global scope, there is a shift of the rate from developed countries towards developing countries.

There are varies of majors in construction industry which architecture and civil engineering has its own definition of construction. Here, this process may include making and assemble of any type of infrastructure. Beyond only a single task, large projects in this industry can be consider as multitasking and this

endeavor should be managed by the project manager. Besides that, supervision of construction manager is also vital for project success. Planning considers a key activity for undertaking a project. Therefore, a successful project must have an effective planning and accuracy of execution.

A project is not only controlled through planning and execution and furthermore; manager should know and balance the external and internal environmental factors and also stockholder's expectation. Resource allocation and supplement should be in a convenient form in a project and don't allow budgeting and scheduling negatively get affected.

The term construction in general may refer to different types of projects which could be divided to building and industrial project types which are different from the way of planning, team working and execution.

Building projects can be renovation or innovation of the existing or new project. The large percentage of the projects is those only aim to renovate an existing one. Interestingly, the owner may act in different projects roles such as planner, painter and designer due to the small scope of the project. Some types of activities are the same for all construction projects indeed. Commercial projects can be done through players in public or private developers and with utilization of different approaches. According to the risk associated with the projects, developers with more experience and skills may detail the entire projects variable which controls the risk and impact of any new change for the normal project process.

Developer must take the authorization for construction project in legal form and also ensure that materials are easy to acquire in the site area. Normally manager may calculate cost per meter for construction of project to get a more accurate estimation of the project budgeting. This number could be completely different from area to area and based on the material quality and the construction type according to customized order projects.

Construction project in an up to dated form of definition can be the conversion of a design to the form of reality through a well-organized planning and execution. A design team would be assigned to plan and integrate planning team

together in a project. The outcome for design team would be drawing and may include the required attributes of civil, mechanical engineers or other expert groups. Basically in a private project, all human resources acquire by the project owner. This also can have the form of bidding in which the most cost efficient developer team would take the award from the owner. Now a days, a construction firm may have experts in varies of fields and this gives a raise and higher degrees of competitiveness to such organizations attempt undertaking different types of projects. According to the higher complexity of the construction projects in today's infrastructure and market needs, building engineering provides a certain levels of training for different project phases along the technical team and manager task to increase integration and awareness over complexity hidden in the project.

#### 4.1.2 Development spending growth

Spending in different nations for a constructive project is a key factor assist researcher to analyses the level of national contribution and industry development. Below figure is a clear description of 13 main and major developed and developing countries in construction.



Figure 4.1 - Share of Construction Spending Growth

There are 3 types of trends in construction spending which researcher categorized countries according to them. First group had intensive growth over construction spending in projects align with national basis objectives. China and India will locate among above ten percent growth nations in 2011. Some countries like UK and Korea didn't face significant amount of growth and some other like Italy just had a relatively smooth decline in their spending. However a country like

Spain according to its social factors had around ten percent decrease for the value of construction spending.

Different attributes and elements in a development project should be considered by project manager. A large number of such factors are related to procurement and its significant share of budget allocation for construction developments. Poor planning, forecasting and estimation of cost and resource are other major factors with huge impact on construction project.

As projects become larger and more complex, the level of integration should be increase for managers. Otherwise, there would be increasing backlogs and the risk of over budget or overtime delivery executive.

One other key factor for industry analysis and overview is the share and its transformation from developed to developing countries.

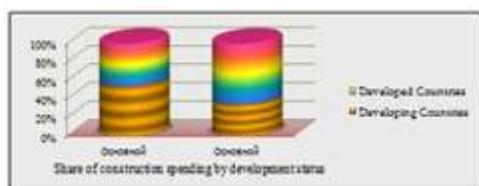


Figure 4.2 - Share of Construction Spending by Development Status

As it is indicated through above figure developing countries like China and India and also Middle Eastern region countries are transforming their share in construction industry from around 28 percent to more than 50 percent. The reason is because developed countries have already required established infrastructure and they don't need to spend on new development. Therefore, government may focus to spend in the other parts and areas which might be more beneficial for the national economic growth.

#### 4.1.3 Procurement market trends

Based on the unstable condition of global market and industry due to economic and political factors, risk of price fluctuation is crucial concern for each

project. However, managers would cover additional cost through marketing in a higher selling price.

#### **4.1.4 Construction and Globalization**

Current development trends in the Asian countries may lead us to get some new fact in construction industry. Now days there are more powered and stronger finance in construction projects belong to private sector. These types of companies are focusing the effectiveness and efficiency through right and high level of integration especially in vertical type. The advantages of such integration may obtain through integrated supply chain management and other sourcing system or management information system facilitators. Result of the technological and theoretical improvement of construction industry makes it more practical for foreign players and their effects in domestic market.

Some countries like Japan brought the technological advancement to entire global construction process. Hence, most of the developing countries took the benefits and increase the competitiveness for their running projects.

According to unlimited capabilities of technological enhancement industries are not limited to geographical scope. Suppliers obtained a greater chance of exporting material to different countries and through facilities of communication and additional online information for potential customers. On the other hand, projects also are not limited to team and location limitation. For instance, there are a lot of projects which should be done through resource and effort in separate and independent geographical location.

Progress in the worldwide economy, HR, ICT and management happened in construction industry growth and global management of the projects pushes industry to form globalizes indeed (Stephen O., Chotchai C., Pannapa H. and B. H. W. Hadikusumo, 2004).

During the last decade, globalization have affected the firms expansion and internationalization of the industry of construction and real estate and varies of project processes are dealing with no limitation in geographical constraints.

Especially in sourcing the project, it becomes a norm to diverse over cost effective and more reliable set of procurement from different firms in the world.

There are several elements such as technological advancement (online project planner tools e.g.) and transportation development which cause such a trend give value to construction industry. Easy trading and taxation, facilitate rules in commerce and legal attraction laws gives this opportunity to local firms going beyond existing expansion and serve multi location projects across the world.

The globalization should be consider and measure through appropriate measurement factors. In each industry globalization has 3 different task and phase. First type is the international trade for items and procurement which is provided by different manufacturers. Second type refers to cross- border investment for all products and services and distribution channels with elements of supply chain in construction industry. The third one is the portfolio of capital invested in the market to avoid any risk and negative circumstances.

There are also some issues in the industry globalization which a number of researches have been done about them. Raftery et al' (1998) have analyzed over trends in current market and had the main focus in some specific region in China and Japan which had result to some important findings. There are stronger and larger players are rolling the infrastructure in the national basis.

Vertical integration in the construction sourcing specially the phase of procurement and forms of packaging and transportation have been formed. Besides, there is a growing trend of foreign players in the market and industry comparing with the recent decade which increase the level of competition with the existing local players. Therefore, and according to the analyzed research there is a tendency to deregulation of construction industry which can be a sign of globalization and significant discrepancy with traditional business approach. This trend cause the financial and technological efficiency of the market raise and give the raise to other aspects of the business effectiveness.

If considering technology in developing countries and construction projects, there is a transfer of technology and enhancement in result of advancement and

knowledge gained in other fields of science. Industry should have concentration over improvement in other areas as well such as procurement, management and approach, methodologies and etc in both public and private sectors.

According to the merger and acquisition growing strategies, many industries now have a trend with the tendency to become major player in the field and compete in a more sustainable position relying on larger scope resource and company capabilities. Construction industry have the same growth strategy for those who are looking to gain a better market and benefits and increase their interest in a wider scope and focus.

Hence, for many firms like Private Finance Initiative (PFI) projects in the UK the strategy was based on increase the size and gain the larger number of projects according to their larger capability and for example PFI had stronger financial indices in compare with the past. Biggest players in international market belong to US and Europe. Table below indicates recent rank of construction contractors according to global revenue.

<b>1</b>	USA	Bechtel Group Inc	7.442
<b>2</b>	UK	Kvaerner PLC Group	6.54
<b>3</b>	Sweden	Skanska AB	5.984
<b>4</b>	France	Bouygues	5.007
<b>5</b>	USA	Kellog Brown & Root	4.721
<b>6</b>	USA	Fluor Corp	4.669
<b>7</b>	Germany	Hochtief AG	4.402
<b>8</b>	UK	Bovis Lend Lease	4.113
<b>9</b>	France	Vinci, France	3.6
<b>10</b>	Netherlands	Hollandsche Beton Groep NY	3.407
<b>11</b>	France	Groupe GTM	3.162

<b>12</b>	Germany	Bilfinger + Berger	2.514
<b>13</b>	France	TECHNIP	2.503
<b>14</b>	USA	oster Wheeler Corp.	2.24
<b>15</b>	Germany	Philipp Holzmann AG	2.1
<b>16</b>	UK	AMEC	1.958
<b>17</b>	Sweden	NCC	1.76
<b>18</b>	Japan	JGC Corp.	1.729
<b>19</b>	Korea	Hyundai Eng. and Const. Co.	1.633
<b>20</b>	China	China State Const. Eng. Corp.	1.545

As it shown in the table a large number of biggest international contractors in construction industry are those American and Europe nations which mainly enlarge their capability and resources through merging, acquisition and other growth strategies which make them get ready to undertake very large scope projects in the global scope.

As the conclusion construction is a growing fast paced industry towards deregulation and competitive strategically actions in the global financial and economic system. Although industry have a big trend, since construction cannot be traded across borders, the impacts of this shift and transformation of industry toward globalization is mainly obvious in the international contracts and communication related to industry.

#### Procurement methods in development companies

There are two different models of sourcing a construction project according to the type of required item and customization level for each item. Centralized units are in source or outsourced centers, departments or organizations which would be responsible to find source of suppliers, evaluate and purchase required material for project (Alberto De Marco, 2011). This is required more effort to get more efficiency and cost effectiveness. Therefore, this is a more suitable approach

for bulk material purchase since there should be a level of communication and negotiation to save project procurement cost. A centralized unit can feed numbers of projects at the same time.

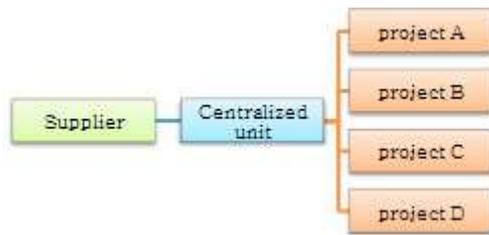


Figure 4.3 - Centralized Procurement Unit

Instead, some items should be customized or purchase in lower numbers. This would not be cost effective if management directs time and effort to this project. For this type, managers should directly connect to local sources of procurement and cover additional cost with increase last price according to the level of customization.

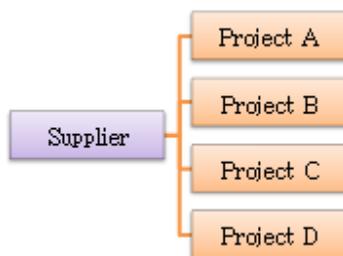


Figure 4.4 - Decentralized Procurement

For bulk items there is a significant time and cost required to get the efficiency for a significant part of budget. Instead, local purchase in decentralized system is not efficient. Besides, centralized approach is required to inventory area and management and could be happen with higher speed than decentralized approach. In fact, centralized unit is a suitable model which can be enhanced through using technological and digital advancement.

#### Procurement combination model

As it was explained, for each type of procurement unit, there are a set of advantages according to required item and level of efficiency for purchase amount. If a company wants to reach benefits of all models, this system should be capable of flexible purchase according to purchase amount.

In new model delivery time is the main factor which is tightly related and dependent to the overall efficiency in construction project. New system can handle both customized and bulk items to get maximum efficiency required through just in time order and item delivery.

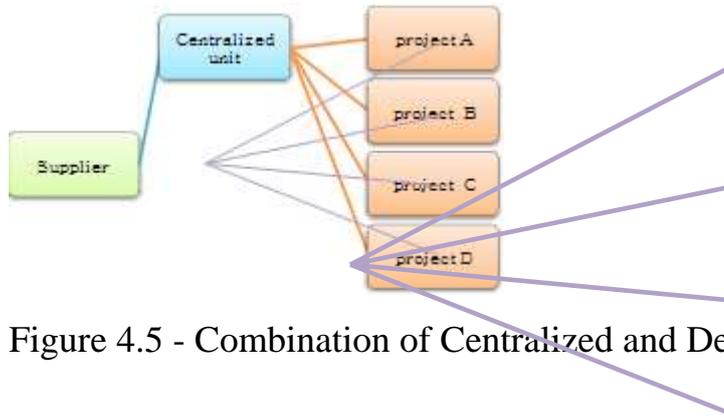


Figure 4.5 - Combination of Centralized and Decentralized Procurement

#### Procurement stages and steps

Flow of procurement process is like purchase behavior process in single B2B relationship and simple pre-transaction set of behavior. First stage developer should send request of purchase to get as much as possible invoices related to required fields. In next step, there should be an investigation stage to find related potential suppliers. This is the time that procurement manager should send the bidding request to encourage competition among all available suppliers. After receiving all bids and offers, manager should select the suppliers and update database if supplier is new to our database (Fisk ER, 2003).

The general information flow of the procurement stage

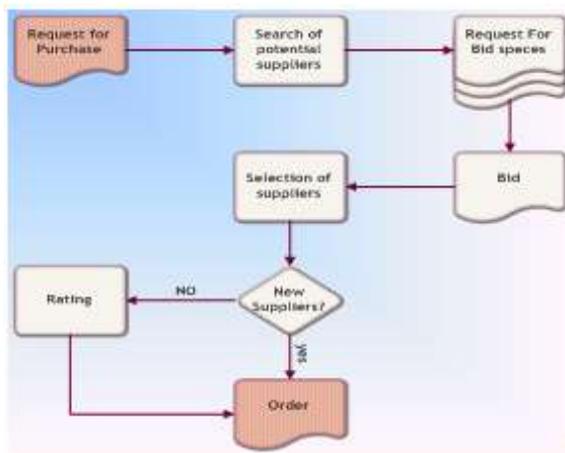


Figure 4.6 - General Information Flow of Procurement Stage

The agreement should be include of all required bidding details with the most clear perspective including shipping, delivery, warranty and other required confirmed details of transaction. This agreement would be then a part of important procurement documentation which should be deliver to financial department and also cost control related areas in the organization.

#### 4.1.5 Procurement Processes and Tools

Procurement considers one of the main parts in a construction project. In this phase, project manager have a primary outline of what should be sourced into the project. Next stage for project manager is to clarify from which source information should get obtained. Varies of records would be then utilized for selection of the best choice and combination of suppliers in which project management or recruited agent get ready for negotiation or bidding.

According to main objects of the project in timeliness and being cost effective, management should provide a list in which approved set of suppliers are available for all current and future project. Of course the entire list would always be a subject to change. Means that in the case a supplier increase its level of delivery or improve contribution to project cost effectiveness could be used in future development projects by manager.

This has been an option for construction developers to digitalize the ASL and remove redundancy over suppliers. This gives them also better chance of sorting and evaluation of existing vendors.

#### **4.1.6 Cost control for developments**

Company should be concern of the elements and factors which can negatively affect the overall; budget and time required for the project. For instance in the first stage of establishment a construction project, lack of reliable estimation and resource management, resource allocation and prioritization of entire WBS activities can easily harm the project outcomes. Management should avoid some popular paradigm in cost cutting. For example, reduce required budget may decrease the cost of activities in the first glance, however the effect might be on the quality and time of deliveries and outcomes.

Along the execution phase in construction projects, manager takes some activities as control over cost including procurement variance analysis through consideration of discrepancy between planned cost and actual spending for raw materials. This is crucial to make judgment according to analyze the cause of the difference and take the best solution to minimize these negative trends.

Basically all above could be ended in consideration of internal and external influencing factors in addition to figuring out the most appropriate strategy. Analysis and comparison must be undertaken without any delay. In transaction negotiation stage management should keep in mind to clarify all aspect of the bidding with entire required details. Vague specification may take into the advantage for some suppliers as they could deny benefits of developer from transaction.

There are two different strategies for controlling cost of procurement in a project. Corporate procurement strategy is the dependency of procurement activities to organization and its objectives. Project procurement strategy would be more concern to the relation of procurement activities (such as gather information,

evaluation, selection and bidding) and internal environment of a project (Harold Kerzner, 2009).

#### 4.1.7 Purchase process and evaluation

Negotiation is a personal skill which is required for all procurement managers and agents as a major key factor in efficient outcome. There are different objectives for negotiation beyond just to reduce the cost of purchase to minimum and take the advantages of a better pricing. Negotiators are looking to transfer the risk of transaction to the other party as much as possible.

The other objective could be to receive more and higher reliable set of services beside the required items. Warranties and transportation are very important for managers and a portion of effort in bidding must be spent to clarify these factors.



Figure 4.7 - Negotiation Processes

Negotiation includes some stages as the following figure, which outcome the agreement as a major documentation in project delivery documentation. These activities starts through an introduction for finding and agreeing on a basis common interest and should be end by details documented in the final agreement.

#### Key factors of evaluation

One of the major factors in evaluation is to clarify all responsibilities and roles of both parties contribution in bidding. This is also required for procurement manager to set methodologies and standards of sourcing project and agree on the

exact price for major raw materials in each purchase or bidding (Ferraro, Gary P., 2002).

#### 4.1.8 Applications in sourcing a project

Application in sourcing of construction project facilitate for manager to have a consistent and borderless access to procurement products and their suppliers from site office or any other area. In addition manager can have a fast and efficient access to updated details such as price as well as communication or transaction itself when approved.

Such procurement system is also capable of generating some value information in the form of decision support reports for managers and supplier industry players itself. Financial procurement control provides a tight monitoring atmosphere for analysis of discrepancy of estimated procurement cost with actual spending for each specific (George J. Ritz, 1994).

#### 4.2 Construction Project Management

Management over construction projects includes all divisions of pre project activities and in addition with required set of execution and closure activities. There should be also more concern to external factors in logistic, legal and other industry attributes.

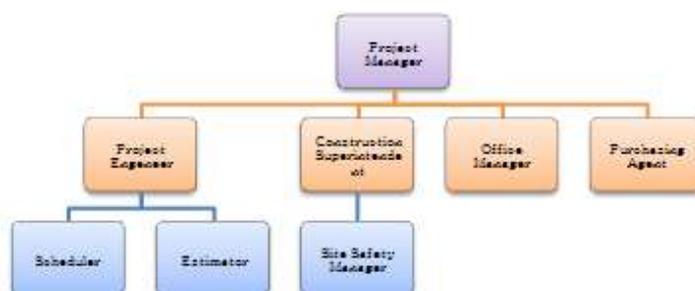


Figure 4.8 - Organizational Chart-Pre Construction Phase

This is the major reason which makes manager support the other levels and provide enough credibility to empower team working and reaching key targets. Project engineer should be aware of estimation and timeliness required for all activities. He should also be master in change management and impact analysis required as the result of improvements and external factors.

#### **4.2.1 Project Management and Procurement**

##### **Project Procurement Manager Roles**

As it was figured through analysis and revision in procurement approach, this is crucial to categorize project according to scope, size and major specification before selection of the right procurement method.



Figure 4.9 - Project Procurement Manager

Procurement manager could be agents, in home or outsource departments which are responsible to undertake the data gathering, evaluation and selection of the best sources in the market and industry.

In large scope construction development, there is normally a center of procurement cost and quality control called QS (quantity survivor) which attempts to reach higher degrees of overall project performance.

##### **Procurement cost control**

Procurement in construction consists of purchasing process for products and services with two basically objectives. First is to create new construction including the site and entire associated sub processes. Second objective have focus on the phase of maintains required for the execution phase of the project.

For management to get the best performance and result from services in the market, the best approach is full involvement of the client in entire stages of the business. A successful project is meeting the objectives in time, cost and quality as it was defined and agreed between the firm and client. In procurement stage, there are a lot of task and attributes which may have a huge impact on these 3 success factors in the construction project.

Costing in a construction project is mainly dominated through the elements of procurement and human resource required for the project. Not similar to software project which have dominated budget with human resource, construction projects have the main budget allocation to sourcing and required items. This made the cost control topic one of the main concerns for managers to reach a higher level of competitiveness and effectiveness.

Major challenges of cost control in a construction project for management of the procurement department would be to reach a reliable and accurate estimation and best evaluation, selection and bidding over required material in a project. As it discussed in the previous sections, negotiation process for procurement would be successful when the result form an agreement which represent a win-win situation.

Most of the time manager should overlook the resource selection and allocation to ensure the project is cost effective in compare to similar specification developments. Sometimes, this would be a tight control over cost associated for each single resource which might affect the project outcomes negatively.

Saving in procurement cost is a very effective way in project cost reduction since a large portion of budget is dominated by sourcing construction. Regarding this factor, delivery time is an important point to be noticed when manager select and evaluate supplier in bidding process.

Negotiation also considers an effective way to reduce cost or improve quality. Basically manager should spend more time and skill to get effectiveness in bulk items such as concrete, metal and frequently using items in construction buildings.

### **4.3 Business to Customer Relationship**

Recent decades have more focus on the level of relationship strength rather than short term sales objective. Now a day's business should care to sustainability factors and increase the level of reputation among the competitors to remain safe and successful in such competitive and effective business market relationship.

After cyber age in the beginning of the 21st century, B2C relationship becomes an applied topic to major industries. The B2C relation considers a powerful tool to create and achieve a better relation and effectiveness for exactly what is needed between two business parties.

According to the concentration of today's management on the utilization of technological tools and up to date approaches, there are several trends and transformation for construction industry which form a competitive methodology and increase the sustainability in current market. Centralization of customer data and increase the power of information generation over existing form of decentralized data gathering can assist business to reach information which should be involve in the selection of strategically offensive or defensive movement in front of competitors. Segmentation of customers and target groping of potential unreached market is also a crucial way of saving cost and effort over communication required in the business. This clustering approach make the communication reach maximum of effectiveness and responding action. Therefore, after segmentation the service focus must be on the highest value customers and try to make them retain in firms share. The clustering approach gives the firm opportunity to lowering the cost of relationship and spends the rest of money to find more customers and increase its customer base.

No wonder industries faced to a higher level of adoptability, revenue and profit. Tools enable firms to communicate in a more effective way and without geographical barriers and time constraints. The effort required for such relation was less than traditional approach and quality increased for major industry rivals. System empowers firms to communicate and link old suppliers in a better and

efficient ways in addition with lowering the cost and hence, for large firms this kind of saving, may reach to millions of dollars (Anon., 2006).

#### 4.4 E-Commerce and Industry Tools

Electronic network raise the business opportunity to ignore constraints of traditional commerce in today's market. In a perfect commerce platform, tasks and activities would be reviewed and presents through a fully integrated commerce system and therefore, there are some key features to fulfill this commerce set of objectives.



Figure 4.10 - Marketing and Industry Tools

#### 4.4.1 E-commerce and procurement

##### Digital Procurement Model

Advantages of procurement system on business cost and time consumption is a justified argument for today's business in competitive industries. Especially in large items this type of cost saving considers to be more a necessity rather than being a choice. Table below explained the advantages and value elements of procurement system to a normal scope project in construction sector.

System value features

Record keeping

Supplier evaluation

Selection of best vendors

Linkage and negotiation

Support documentation

Timeliness

The advantage area

Time and cost saving

Efficiency

Standardization

Best relation and result

Accuracy

Prevent overtime outcome

## 5. Research Methods

### 5.1 Research Organization

A well-organized data gathering tool selection should have the outcome including sufficient and reliable set of relevant and required data. Then in analysis stage, business requirement analysis should be conducted to reach the most close customer satisfaction for the final output.

There are several phases for researcher in data gathering need to be undertaken carefully as following.



Figure 5.1 - General Steps of Research Organization

In each stage, manager should monitor and control over accuracy and relevancy of the key target achieved. This is crucial for manager to ensure the selected tools are completely justified. This means that there must be a set of requirements in system and projects which is better fit to one or more methodologies. Manager should also consider the effect of external factor to the results of research. Some factors may cause bias and change or mislead the result of the approach.

## **5.2 Choosing suitable method**

Despite varies of available data gathering approach, not any method is appropriate for construction system. Each technique has a set of advantage and disadvantage which make the project reach different degrees of requirement. Therefore manager must find the best mixture of tools and techniques which response the specification and uniqueness of the endeavor. Interview for instance is a good method according to it higher degrees of reliability. On the other hand questionnaire would be a cheap, quick and easy data gathering tool which has better and faster analysis. According to time and resource constraints in student projects, researcher needs simple planning and quick techniques (Jimme A. Keizer and Piet M.Kempen, 2006).

In this project, there would be one interview with development project manager to derive the system requirement in terms of functionalities of a B2B business. The rest of the requirements would be gathered through the design and implementation of interactive interface according to user preferences.

### **5.2.1 Collecting primary data: Interview**

Interview is a very high reliable qualitative tool appropriate for explanatory projects and detailed requirements. Procurement system requires a set of narrative data about the difference between the standards of sourcing a project and what is practicable in the current market.

Manager can take the opportunity of describe business model and market without any involvement in writing. Besides, interviewer should ask for more details regarding the vogue answers to make all findings as clear as required.

#### **Interview objectives**

Interview questions have been set according to the objectives and requirements of the procurement system. Major objective of the interview for this project is to find out required details of current business model in sourcing construction projects. Therefore manager were asked about the gap between

planned and actual time and budgeting of the procurement and key challenges of project sourcing.

Setting out the objective division for procurement manager interview, the objectives can be divided into the areas such as Level of engagement of the process in electronic enhancements and tools, required purchase details, Risk management, Customization, Time constraints and Entire planning activities in procurement.

### **5.3 Research limitation**

According to the nature of an individual final year project, and based on the time and resource constraints of the effort, the outcome may not be close enough to the real set of user expectations.

Based on the time, budget and resource constraints of the project, manager would not be able to gather primary information from all relevant users and developers in construction industry. Keeping in mind that managers and industry players in construction industry are not easy to interview. They are busy and their time has real value in working hours. However, according to higher reliability of interview in compare with other tools, gathered information would be sufficient to fulfill entire academic propose.

## 6. Analysis and design

### 6.1 Procurement Manager Interview

#### 6.1.1 Respondent Interview Impression

Respondent had the feeling and willing of taking apart for exploring the details of interview. There is a great opportunity for procurement manager to describe key challenges and risks of sourcing a construction project. He also aims to enhance the process of procurement according to the practical experiences and current gaps in the whole set of activities.

### 6.2 Interview Questions

Question	Objective Area
Please explain in details how much is your planned and actual procurement costs are aligning together?	Estimation Process
How much project procurement engaged digitalization?	Level of engagement
What are steps in the procurement processes you are currently using for project sourcing?	Process
In a common procurement process what are the required activities should be done?	Steps
Do you think that electronic and digital supply system can change the balance of transaction risk?	Risk Management
How can you control the price of customized items?	Cost control
A summarized management challenges over development	Major Challenges

### 6.3 Primary Feedback

Requirements	Description
Organization name	Akitechnique
Respondent	Mr.Rashid bin omar
Respondent position	Procurement manager
Interview Method	Direct Face to Face
Date and time of interview	01/28/2012 at 2:00 pm

Please explain in detail show much is your planned and actual procurement costs are aligning together?

Initially, for every project in construction field, this is almost not possible to reach the time and cost key targets for more than 90% projects. There are a lot of variables in procurement and project sourcing which affect the result of project outcomes. Material price fluctuation and delivery time considers as the most important and influential among them.

However, in planning stage there is always a percentage allocated to these trends of time and budget. This is what we call variation order (VO) which could be set around 5 percent of the overall budget.

How much project procurement engaged digitalization?

The only electronic platform have been used in the organization is the informative website which does not carry any functionalities. Therefore, the single channel for selling procurement and communication is still the physical one. We have transaction with internet and our own agent to increase the sales and profit. But we still work with a traditional business model.

What are steps in the procurement processes you are currently using for project sourcing?

We are following the direct seller communication. According to what BQ department figure about the level of procurement quality, items would be selected and communication should be form with the other party. Here the participants are seller and buyer which may include middle men for shipping item when the delivery time is tight and under management consideration.

For emergency items or highly customized requirements, trading company may send an individual to provide through the local market. This cannot happen for bulk items and there are some restrictions of such type of purchase. Normally the permission should be given through the senior management.

For each project we are supposed to deal with hundreds or more suppliers and when we want to order something we will make a call to related specific supplier. There is no tight controlling on raw material price when a project needs to

deliver output in the constraints over delivery time. However, materials in most of the areas have specific and standard prices.

In the market most of the developers have a contract to deal with supplier centralized units which are mainly concentrating on the project sourcing and procurement. Sometimes these companies should undertake to maintain the quality in a certain and specific degree.

In a common procurement process what are the required activities should be done?

There are some important attributes in the sourcing process such as standards of the material, delivery time and pricing. Major services such as warranty should be also considers as an important purchase factor. Besides, the quantity also considers an attribute with a lot of effect on the price and level of services. Obviously, larger scope purchase would be more cost effective and service oriented purchase.

Do you think that electronic and digital supply system can change the balance of transaction risk?

The amount of risk in the transaction is tightly depend if what is the purchased item so when you buy material from China for instance, manager should be more carefully due to lack of quality in most of their production. Actually China is following the worst standard in the world. Their products are quiet worthless and low quality.

Normally what we should do in transaction is to share the risk of purchase between seller and buyer. This is the equal risk acceptance from both parties.

How can you control the price of customized items?

Our main policy is not to go for customized products. For example we are trying to make construction according to popular market products and don't take the risk of customization. These types of products are very expensive and besides, there is no substitute if something happens for these products. For example most of them just produce for a relatively short time in manufacturers. Items have eventually a short lifecycle.

## A summarized management challenges over development

Sometimes developers have a complexity and levels of barriers due to pressure of project supplement. There is always required to purchase hundreds of items and not all of them would be on time and meet the deadline of project millstones.

In company we are not allowed to purchase without following the governed rules and restriction over procurement and thus, this would take a lot of time for organization to reach a certain level of progress and buy entire required items.

Resellers are able to provide very cheap material with the lower degrees of services. Therefore, we don't take the risk and contract with a centralized unit to ensure all services provided are quality and in time. Because we should maintain the quality in a certain level and sustain in the market.

## **7. Analysis & Design**

### **7.1 Interview Report**

There is a high rate of 90% unsuccessful project in terms of staying on the defined budget. Means that major of construction companies would almost always over budget and the main reason is related to the attributes of procurement such as price, delivery time and quality.

Some other procurement risk such as price fluctuation and logistic are also contributing as the failure factors in construction developments. For this purpose, variation order must be apply for procurement items which are normally by the rate of 5% of budget defined.

In headquarter of development companies, they use internet channels to reach some informative propose and unlike selling channel this would be according to major marketing objectives for long term growth.

Developers must deal with the centralized units which are responsible for providing procurement and required items. Developers try to make the quality consistent through the quality department in such centralized units. Besides, they would take the responsibilities of all purchased items.

Cost control in procurement is a part of BQ (Bills of Quantities) department which is the only center which tracks the attributes of ordered items. This is where suppliers would be evaluated according to the price, quality, service and delivery they have offered. These elements can be considered a kind of standard applied to the industry.

Obviously, urgent and customized items should be acquired through local shopping. Therefore, centralized unit is playing a major role in procurement of multi projects because number of suppliers and specification of items are important when make complexity high.

According to interview, Certification, cost, quantity and quality are major factors which should be provided for developers in private and public sectors.

Delivery time based on the impacts on the project outcome, considers the main factor in this area and hence, manager have the special attention to timely suppliers.

In terms of customized products, and according to market demand, developers try to design the popular products to avoid customization. Project manager have high range of complexity to deal with the procurement and this might affect the quality and services which could increase organization competitiveness.

## **7.2 Analysis Summary**

According to discussed challenges in development and supplier challenges in construction, efficiency of supplier business in relation with their customer is tightly dependent on the level of effectiveness and tools or techniques for their communication. Physical channel obeys the traditional rule which does not carry any competitive advantage in today's market. Therefore, an interactive usable cyber platform with the objectives above only informative activities and awareness could empower the existing communication which then can be translated as reaching higher degrees of success and becoming a major industry player.

## **8. Environmental analysis**

### **8.1 Dealing with competition (Porter's five forces)**

In this research, the whole construction industry has been analyzed through porter's five forces as an effective external industry analyses tool. Porter has divided the industry trends to five major forces which are included buyer and seller power and industry rivalry and competition forces.

In this analyze, two major players in the industry are suppliers and project managers which can be private developers, homebuilder companies and government programs and projects. This relationship determines the balance of power and industry trends which currently forms the whole aspects of businesses.

#### **8.1.1 Supplier Power**

There are different factors in developer-supplier relationship which affect the balance of power towards increase or decrease of supplier power in construction industry. In this market, construction sources get the power through become more integrated and union, when the number of sales item and amount of each is more significant for customer, differentiate items and create enough hooking power and switching cost for the existing customers and new comers.

If there are only few good suppliers in the industry and there is growing demand over procurement material, and also there is a high switching cost for existing customers, then suppliers would have a greater power and can reach their short and long term financial objective and increase their customer base easier. Especially when a supplier has a tight control and effect in the market price, its flexibility for making market trends would be more and more.

Almost everywhere, industry of procurement in construction is completely fragmented and this is not usual for them to become a powerful union. Therefore they would try to compete and cut the price as much as possible to sustain in the

market. This would be a barrier for them and the opportunity for developers to go for cheapest and service guaranties in each particular material.

One of the main concerns for management and market key trend is the purchase volume. According to the nature of projects which is mostly high scope for construction material purchase, developers usually are required to buy in bulk for those necessary required items. High purchase would be negatively affection factor for suppliers which may force them to providing more varieties of services in the industry. Customers in this market have more information and are required to spend enough time and investigation before purchase and its evaluation.

Beside land, homebuilders are required to purchase varies of materials defined at the beginning of project. According to the standard market for some of these items, the price may not be negotiable for managers. For example oil and gasoline are those required standard price materials which can be assume as the project fix cost. However, there are certain materials which the price have been set through suppliers and can be changed out of government and public policy. Some regular cost cutting ways for home builders include gaining better bids when buying in bulk, acquisition of cheapest labor and more expensive managers and expand the geographical access to overseas market to take better price and services.

Subcontractors which consider as industry suppliers have a relatively low profit margin. For them, this is crucial to have an accurate and reliable estimation for all resource required for a task or a project. In the case of neglecting of right estimation, they may face to project failure and loss profit or their own investment. This case sensitive situation make them to get weak in front of industry customers and their power is low for their customers in public and private sector.

Other significant part of budget allocation would be set and estimated to human and expertise resources in a construction project. Those with high skill and capacity which are involved in a project are relatively expensive for managers to hire. According to the rapid growth of construction and increase the demand for skill in this industry, in some countries, industry faced to the shortage of human

resource. This powerful force in industry may increase the labor cost for human resource and expertise required.

### **8.1.2 Buyer Power**

Currently in almost any country, there are banking packages and finance facilitators for home and real estate market. This makes average people to get into purchase more easily and demand for new developments would increase. Those customers are looking to buy large development projects and also have low switching cost to go for competitors, have a higher power over developers, especially when market is fragmented and saturated by development side.

Customer market is also fragmented in this industry, means that each family would be looking for the cheapest price. In private group of customers, this is not routine for customers to become a union for purchase a larger part of the product and get more power over suppliers. Because they are looking for more personalized and customized factors in the development.

Customers have constraints of access to vary of geographical locations and their huge switching cost. For example families have to be near children school and their own workplace. Therefore, this makes them remain limited to the certain region market and products. Although the switching cost for buyers is relatively high, there is still the opportunity to rent an apartment or home in any required or selected location. But as real estate considers an investment with a relatively large scope, there would be so much switching cost for owners of the apartments.

Besides, according to the growth of population and economic in recent decades, an intensive growth in market demand in addition with immigration makes market to have greater and more reliable potential for serving customers with new and customized products in each economic and social segment.

### **8.1.3 Barriers to Entry (Threat of Potential Entry)**

Any new comer in an existing industry aims to get a high amount of market share to sustain in the industry. Since demand for product is not affected positively

through number of suppliers and industry players, this would be a fact for existing players which they lose their share to new comers in result of this movement.

According to discussion above, new comers are a big threat to an industry without significant rate of growth. Industry entry barriers makes industry secure of facing intensive competition and also may prevent new businesses which aims to get share in a short time. Some factors including the economics of scale, the level of differentiation in products, start up and switching cost and also entire restriction over industry governed by public sector would significantly affect the construction market. These forces change the balance toward or against developers within industry and its players.

Naturally, construction projects are required a significant rate of investment and this can be a natural barrier for those who attempt taking industry share. This amount of required money sometimes for huge projects may reach to billions of dollars and not an average company can deal with such huge barrier. However a lot of people may be able to invest in smaller project and/ or take the partnership benefits in collaboration and team working with smaller development companies.

Along with the required capital, a certain level of knowledge and expertise is also required for those wishing to enter construction market. This phase of requirement also would be expensive enough to consider as a barrier for those new comers. For such projects, manager should supply the initiation with a large enough appropriate legal land with acceptable condition for development. All these requirements increase pressure over new developers and may keep market away from rapid saturation and new comers.

In addition with all mentioned factors above, government rules and restriction may control new comers and filter market for constructive projects. For example zoning rules and difference must be considered before through government and developers to get align with pre-defined objectives of urban infrastructure.

#### **8.1.4 Threat of Substitutes**

Threat for substitute products refers to the switching cost associated with customers and customer attitude and selection over products features. There is always alternative for customers to rent an apartment to get rid of purchase risk and difficulties. However, majority of customers prefers to have this type of investment and buy their customized apartment and get stability they need in their life.

Fortunately government rules and restriction for loan services related to those developed and developing countries almost make majority of people to have ease of purchase and even the right to go for best development through banking facilitates. Especially these types of services are available for first time buyers which enable them to own the apartment and home and pay through installation. Therefore, there is less intention for people to get the risk of rental and live without required stability. Beside all facilitators provided through government, demand is also positively affected through and in the results of population growth and immigration in most of the countries. With the minimum of interest rate associated to loan services, there is no significant gap between average purchase powers for buying a premium priced apartment.

#### **8.1.5 Degree of Competitive Rivalry**

In different parts of the world, construction is a fragmented market and according to population growth and other immigration factors which cause a higher degree of demand in the market, the level of competition would be in a highly rank in comparison to other industries. These are motivating factors which attract a large portion of business industries to engage construction market. However, there are also some barriers for industry which makes it difficult for average person to start the development of a project. Industry requires a huge capital for a project and also there are always zoning factors which might limit industry to get involve with flexibility.

These elements don't allow a large number of developers to exist in construction market. Hence, the likelihood of market saturation would not be very high since not everyone can be in the business. This works especially in the larger scope projects and developments.

### 8.1.6 Conclusion

For further analysis by researcher, a set of reliable marketing research tools would be essential and helpful to get a more accurate set of clues about the existing opportunities and threats refers to the industry and its players.

According to the conference of construction in the Harvard Business School at 1989 and the statements of Michael Porter, "There have always been lots of companies in the industry and so there has always been an active situation of rivalry. But again there was plenty of room."

Sources powers		Factor	Industry
		level	power
Bargaining power of Suppliers	Unity of sellers	Weak	Weak
	Differentiation of product	Weak	Weak
	Saturation of suppliers	Strong	Weak
	Employee	Weak	Strong
	Buyer group size	Strong	Strong
Customer power		Factor	Buyer
		level	power
Bargaining power of Buyers	Purchase volume	Weak	Weak
	Demand size	Strong	Weak
	Cost of Switching	Strong	Weak
	Differentiation of product	Strong	Strong
	Saturation of Buyer	Strong	Weak
Barriers of new entrances		Factor	Effect on

			level	developer
	Construction growth	Industry	Strong	Weak
Threat of new entrance	Sales volume		Strong	Weak
	Capital required		Strong	Weak
	Cost of Switching		Weak	Weak
	Government policy changes		Strong	Weak
				Factor level
Substitutes in the market				
	Availability of alternatives		Weak	Weak
Substitute	Differentiation of alternatives		Strong	Weak
				Factor level
Rivalry effects				
	Developer group size		Weak	Weak
	Construction growth	Industry	Strong	Weak
Rivalry	Unity of market		Strong	Weak
	Barriers to Exit		Weak	Weak
	Similarity of existing products		Strong	Strong
	Construction market growth		Strong	Weak

## 8.2 SWOT Analysis

In this part of the research, the whole construction industry has been analyzed through SWOT as an effective internal and external industry analyses

tool. SWOT has divided the industry trends to four major forces which are included strengths, weakness, opportunities and threats.



As it shows in the figure above, company has a well management and expert staff for team working and project execution. Based on the growing market, there are benefits of economic of scale and company can gain the benefits of cost effectiveness associated with that. However, a single online informative channel with no functionality, broadness and interactivity beside market tradition and lack of improvement technology can be a decline factors for the firm. Manager should consider government policy and trends of industry made by offensive or defensive competitor's action.

### 8.3 Competitor Analyze

Competitor analysis assist the overall industry analysis to position organization in the right place of the market with in depth overview of external and internal factors for home builders and its major competitors. This analysis is essential to get the best set of user requirement at the last stage. The objectives of competitor analysis will assist system functionalities in two ways. This analysis would take the best package of system attributes and tries to improve the existing functions with some value provided differentiation.

In this stage, researcher would determine what are the internal strengths and external weakness of the system in compare with its competitors according to a benchmark.



Figure 8.1 - Online Project Plan Processes

According to the limitation of the resource and scheduling for this project, researcher conducted an analysis over GUI attributes, design principles and system functionalities in 4 same sized competitors to undertake it according to measures and metrics in a reliable manner.



Key elements	Liquid Planner	Project Management	Tom's Planner	Ganttzilla
Principles of Design				
Visibility	Perfect	Perfect	Acceptable	Perfect
Feedback	Perfect	Perfect	Perfect	Perfect
Constraints	Acceptable	Acceptable	Perfect	Acceptable

Affordance	Perfect	Perfect	Acceptable	Perfect
Mapping and Placement	Acceptable	Perfect	Acceptable	Acceptable
Consistency and Harmony	Perfect	Perfect	Perfect	Perfect
Design Factors				
Space	Acceptable	Perfect	Perfect	Poor
Texture	Acceptable	Perfect	Acceptable	Poor
Form	Acceptable	Acceptable	Acceptable	Perfect
Color	Acceptable	Perfect	Acceptable	Acceptable
Navigation	Acceptable	Perfect	Acceptable	Perfect
Innovation	Poor	Perfect	Poor	Poor
Functionalities of Planning				
Schedule	Perfect	Perfect	Perfect	Perfect
Resource	Perfect	Perfect	Perfect	Perfect
Budget	Poor	Poor	Poor	Poor
Communication	Acceptable	Acceptable	Acceptable	Acceptable
Risk	Poor	Perfect	Poor	Poor
Quality	Poor	Perfect	Poor	Poor
Document	Poor	Perfect	Poor	Acceptable
Reports	Acceptable	Perfect	Poor	Acceptable

A package of positive attributes and factors like usability, higher degree of performance and options can be motivation for those developers and managers of buildings to get their personalized platform through this interactive system of project management. Researcher objective is to design the system as close as possible to the real user requirements and cover required functions which can provide additional values in construction industry.

Competitor analysis in this market includes the evaluation for some predefined metrics which gives strength or weakness and makes players different in obtaining market share. According to the websites and online informative or selling channels, they have different hooking power for potential visitors and customers.

## **9. Analyze of Proposed System**

### **9.1 Market Introduction Planning**

Before start to design and implement of the system, and according to the predefined goals and key targets of the project, a planning over product and its introduction to the market should be a part of the project not only to clarify the future path for product but also to ensure the capability of the project itself in gaining market share. This planning mostly focuses on the monitory requirements of the product management and marketing plans according to the following sub targets;

Product should be promoted to more than 80% of online potential customers.

An expertise team should be hired for implementation.

SEO and marketing through the internet should be followed accordingly.

#### **9.1.1 Procurement System Target Market**

New purposed system attempts to increase the level of effectiveness and efficiency for both developers and project managers through a reliable and accessible platform in which raw materials and related information would be presented in an interactive way. For developers this system brings more accessible and updated set of information and also connection with direct selling source which can be translated to saving both time and money. Manufacturers also can be assisting through having such usable platform which gives them opportunity to present their products and services with maximum effectiveness and efficiency. Therefore, for system design and development, researcher must identify and analyze over target market for both sectors in industry.

Being a part of construction market players supply chain is a crucial necessity for system which would be considered in design and development. Suppliers of construction industry are those who manufacture distribute, sell and

resell all required items for homebuilding. This amount of interaction would assist our future database for system adoption and improvement.

System would be a communication tool for project managers, team members and other contributors of construction development sector which gains effectiveness through a clear and controlled path to all industry suppliers bypassing geographical limitation of physical channel.

### 9.1.2 Target Market Accessibility and Communication

For marketing propose, there are a wide range of marketing tools which project manager should get the best of them, after an in depth analysis over benefits or disadvantages associated with each of them. Measurement should be based on essential factors mentioned in the table which could be a base for selection of tools and techniques of marketing.

Although there are different tools and techniques capable for conducting a marketing plan, researcher have been selected a number of effective approaches for this propose as the following.

Marketing planning of the product	Search engine optimization	Awareness campaigns and seminars	presentations	Training	Factors
Development Companies	3 months	Monthly	Monthly	Monthly	Frequency
	1400\$	7700\$	8200\$	6600\$	Cost
	Strong	Limited	Limited	Limited	Scope
Private Developers	Monthly	-	-		Frequency
	500\$	-	-		Cost
	Med	-	-		Scope
Sub	Monthly	yearly	3 months	3 months	Frequency

Contractors	500\$	12000\$	11000\$	7000\$	Cost
	Med	Limited	Limited	Limited	Scope
Total periodic cost	0\$	12,000\$	0\$	0\$	Total yearly
	5,600\$	0\$	44,000\$	28,000\$	Total Seasonally
	12,000\$	92,400\$	98,400\$	79,200\$	Total Monthly
Total marketing cost	282,000\$ monthly + 77,600\$ seasonally+12,000\$ yearly = 471,200\$ per year				

### **9.1.3 Developing SEO and Keyword Strategy**

As a new product in electronic network and unrecognized set of functionalities, SEO is a great tool for system and awareness of capabilities. SEO make it feasible for system address link to get presentation in right search engine. For this matter, this is a crucial topic for marketer to find the appropriate set of keywords which bring user to the direct link.

### **9.1.4 Training**

Based on the new functionalities of the system and for achieving the right levels of awareness, this system should be presented through a right training sessions and in addition with the right tools to spread the required information for system users. With enough information, usage of system would be easier and product would be introduced to the market shorter. Therefore, with an appropriate training program, system would be market in a more cost effective way and user would acquire a higher level of understanding and this might lock user through system hooking power.

## **9.2 Web Development Methodologies**

System design and development quality is tightly dependant on the methodology chosen by the designer. Considering the limitation of a final year project, right method would be a factor for project success and the degree in which the quality of outcomes would be. For example, using spiral methods would have focus on improvement over analysis of user requirements and design of new system while SDLC would be more powered to producing a comprehensive and strong documentation.

There are a large number of methodologies capable of delivering quality websites or software applications which can be use for propose of the project. However, not all of them are appropriate for the nature of final year project with the topic of a system for improvement over construction supply market. For

evaluation and selection of the best methodology, this is a crucial factor for manager to align the attributes of the project with the capabilities of each method.

### 9.2.1 Key factors of methodology comparison

From varieties of methods, each one would be evaluated through key factors which have significant impact to project and project management. Researcher have been conducted an in depth evaluation through analysis over the following factors.

Quality achievement in design and development through using methodologies with iteration.

Outcome in a comprehensive and strong documentation.

More effective change management.

Suitable for projects in different sizes and specification.

The area which would be more strong in deliverables.

Methodology name	Methodology Iteration	Methodology Documentation	Methodology Flexibility	Project size	Focus
Waterfall	Phase by phase	Powerful	Low	Big	Each phase Key Targets
SSADM	Analysis and Design phase	Medium	Medium	Big	Analyze and Design phase
Prototyping	Design phase	Low	Powerful	Small	Interaction
RAD	Design phase	Low	Strong	Big	Rapid
Incremental Prototyping	Design phase	Low	Strong	Big	Functionalities
WSDM	Phase by phase	Low	Medium	Big	User Specification

Agile	All Phases	Low	Powerful	Big	Quality of Delivery
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SDLC is more suitable when developer needs more support for the product through strong documentation and the size of project is relatively big. SSADM based on the information presented above, is more advanced version which has iteration on the analysis and design phase. Prototyping is a useful method when system requires achieving a higher level of interaction, touch and feeling for user groups. In the time limitation, rapid methods assist developers to finish a product in a shorter time and achieve an acceptable quality of outcomes. Incremental prototypes is continues improvement over a hi-fi or lo-fi prototype which would be more suitable when system should be examined in different ways. Agile has a tight focus of quality achieving through iteration in the design phase.

### 9.2.2 Define Methodology

According to the clear set of project specification and user requirement for electronic supply channel in construction industry, SDLC seems to be more suitable and appropriate technology which outcome a comprehensive and strong documentation based on the deliverable importance of a final year project.

Based on the clear set of key targets at the end of each stage of the methodology, developer would be assure that the quality of the system and documents is relatively high and there are higher level of maintains available for system future lifecycle.

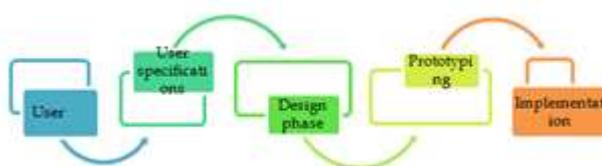


Figure 9.1 - Waterfall methodology

### **9.2.3 SDLC phases in Website development**

Based on the materials available, there is not a unique order and number for SDLC phases. Different analyzers have different argument of SDLC phases. However, the flow would be started in data gathering and will continue by analysis, logical and physical design. This would be continued by the testing and the required level of maintains.



Figure 9.2

## 9.3 Data Flow Diagram

### 9.3.1 Context Diagram

In this part, the general information flow has been described through a context diagram. There are two entities as user group of customer and admin which send and receive general member details to/from the system.

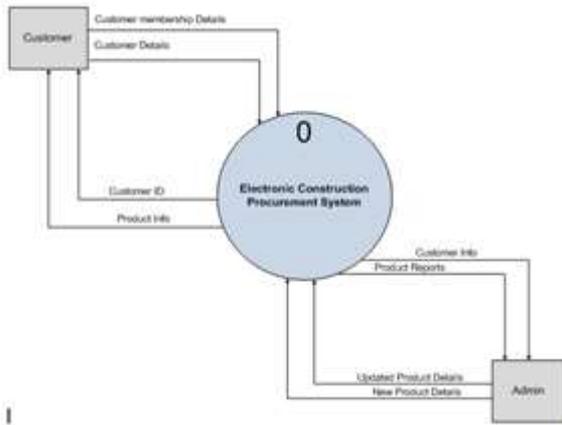


Figure 9.3

### 9.3.2 Level 0

System has seven processes which are in communication for generating new member and identification of old members, record and report the products and CRUD (create, record, update and delete) for all entities and form in the platform. There are also two databases for data repository which are holding information of members and products in separate data stores.

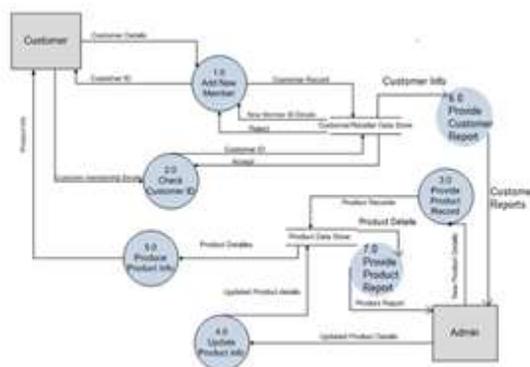


Figure 9.4

### 9.3.3 Level 1

If more in depth of process number one, to create membership and sub processes, there are two smaller processes which create and check ID of members to avoid duplication and register with unique Identity.

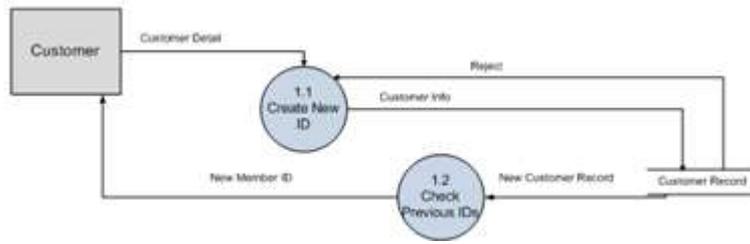


Figure 9.5

### 9.3.4 Process Description

There are nine processes in EEPS data flow diagram which describes the system through process oriented presentation. Following table have a detailed description on each process and associated functions.

Process No.	Process Name	Process description
# 1	Add New Member	This process makes system capable of receiving information of new members.
# 2	Check Customer Id	For this part, system compares new input with historical ID database.
# 3	Provide Product Record	This process allows user to add new product record for system presentation.
# 4	Update Product Info	Enable system to update or modify product records.
# 5	Produce Product Info	Generation of product information from data and records of database.
# 6	Provide Customer Report	Allows manager to access reports of customers and members of the system according to the required information specification.
# 7	Provide Product Report	Allows manager to access reports of products of the system according to the

required information specification.

### 9.4 Logical Entity Relationship Diagram for EPPS

Based on the system functionalities designed in the logical stage, there are three entities of users, products and rating in the system. Product to user, user to rate and rate to product have one to many relationship presented in the diagram. Each entity has its own required attributes which make related record of the entity.

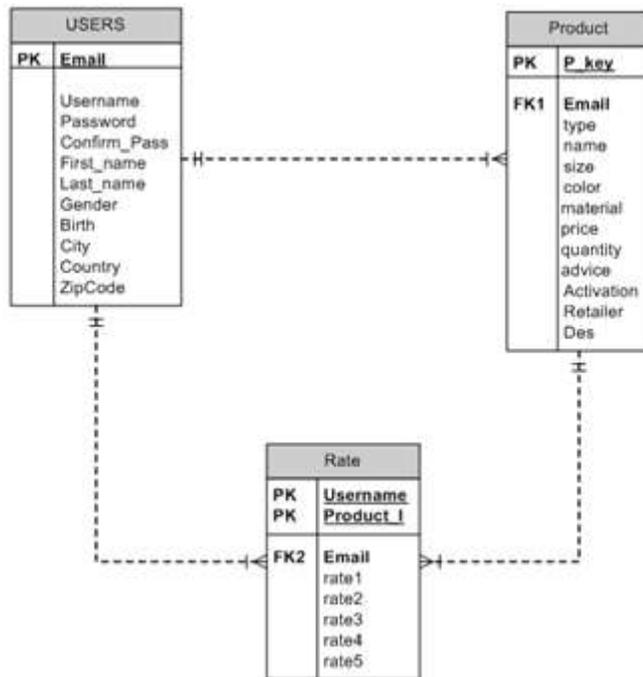


Figure 9.6

### 9.5 Data Dictionary

In this section, a detailed description of each pieces of data have been provided through the data dictionary. This reference of data describes the type, size and other properties for each single attribute of the each entity. This table describes product entity divided into all attributes with required details of each single set of data.

Product Table	Item procurements are available for customers are informed from new products with details information and Prices.					
Data Member Name	Description	Type	Additional Type Information	Default Value	Mandatory	Unique
P_key	The unique identifier of the number of product	nchar	Length (min:1, max:100)	Not Null	Yes	Yes
type	Several types of products such as windows & Doors	nchar	Length (min:1, max:50)	Not Null	Yes	No
name	Name of products	nchar	Length (min:1, max:50)	Not Null	Yes	No
size	Different size of windows & doors	nchar	Length (min:1, max:50)	Not Null	Yes	No
color	Different color of windows & doors	nchar	Length (min:1, max:50)	Not Null	Yes	No
material	Different material of windows & doors	nchar	Length (min:1, max:50)	Null	Yes	No
price	Sales price & promotion price	Int	-	Null	Yes	No

	of each product					
quantity	Different quantity of windows & doors	nchar	Length (min:1, max:50)	Null	Yes	No
advice	The user leaving comments	nchar	Length (min:1, max:50)	Not Null	Yes	No
Email	User Email Addresses	nchar	Length (min:1, max:50)	Null	No	No

This table describes user entity divided into all attributes with required details of each single set of data.

Electronic Construction Procurement System						
Printed On: 05/24/2012 18:15						
Users Table	Detailed information about system users.					
Data Member Name	Description	Type	Additional Type Information	Default Value	Mandatory	Unique
Email	The unique identifier of the users Email	nchar	Length (min:1, max:50)	Not Null	Yes	Yes
Username	Used for login to	nchar	Length (min:1,	Not Null	Yes	No

	system		max:10)			
Password	Used for login to system	nchar	Length (min:1, max:50)	Not Null	Yes	No
Confirm_Pass	Onfirm the user password	nchar	Length (min:1, max:10)	Not Null	Yes	No
First_name	Customer First name	nchar	Length (min:1, max:10)	Not Null	Yes	No
Last_name	Customer Last name	nchar	Length (min:1, max:10)	Not Null	Yes	No
Gender	Customer Gender	nchar	Length (min:1, max:10)	Not Null	Yes	No
Birth	Customer birth of day	nchar	Length (min:1, max:10)	Null	No	No
City	Customer living city	nchar	Length (min:1, max:10)	Null	No	No
Country	Customer living country	nchar	Length (min:1, max:10)	Null	No	No
ZipCode	Customer zipcoad	nchar	Length (min:1, max:10)	Null	No	No

This table describes comment entity divided into all attributes with required details of each single set of data.

Electronic Construction Procurement System						
Printed 05/24/2012 20:09						
On:						
Comment Table	An item in the product, forum and media pages that is available for customers to write their opinion about the clothing promotions.					
Data Member Name	Description	Type	Additional Type Information	Default Value	Mandatory	Unique
Username	Unique identifier	nchar	Length (min:1, max:10)	Not Null	Yes	Yes
P_key	F_key from product table	nchar	Length (min:1, max:100)	Not Null	Yes	No
Email	F_key from user table	nchar	Length (min:1, max:50)	Not Null	Yes	No
rate1	Low rate for each product	nchar	Length (min:1, max:10)	Null	Yes	No
Rate2	Low rate for each product	nchar	Length (min:1, max:10)	Null	No	No
Rate3	Medium rate for each	nchar	Length (min:1,	Null	No	No

	product		max:10)			
Rate4	High rate for each product	nchar	Length (min:1, max:10)	Null	No	No
Rate5	High rate for each product	nchar	Length (min:1, max:10)	Null	No	No

## 9.6 Story Board Scratch Design

Story board assist designer to avoid multiple costly revision of changes before the implementation stage. This approach doesn't have touch and feel because this type of paper prototyping is only for designing the scratch. Instead this type of lo fidelity prototyping is very easy and cheap to conduct.

## 9.7 Interface Design Principles

### 9.7.1 System Interaction and Hooking Power

In a B2C system, one of the major concerns in design and implementation is to reach a high level of instructiveness and create power of locking user into the platform. For designing the procurement system, manager decided to focus on the interaction specially for presentation of the product and associated information.

### 9.7.2 Usability Goal Setting

According to what stated by Nielsen regarding the usability and engineering of the system interaction, in designing system, designer should provide additional interactive tools and functions in addition with the old functionalities (Nielsen J., 1993).

### 9.7.3 Usability Attributes

Learnability: in terms of learn ability of the system, it is considered in the design which procurement system should simplify the process and make a simple front end for users.

Efficiency: System provides accurate outcomes for records, presentations and reports. Functions are designed and tested to ensure system has enough level of efficiency.

Memorability: System has been designed based on the current framework of construction material websites and platforms.

Errors: Based on the feedback provided for each button, this is expected that system face to minimum user errors and confusion.

Subjective satisfaction: easy to use, new design and light and pretty patterns in the system make user become satisfy of the interaction.

#### **9.7.4 Usability Design Principles**

Required level of usability depends on the requirements, type of users, objectives of system and so many other internal and external variables. In a procurement system accuracy of information, interaction and presentation of information is major designer focus.

## 10. Implementation of procurement system

### 10.1 EPPS Physical Database Design

System physical design including three entities was conducted through using SQL which is a flexible and powerful database tools for management of the database.



Figure 10.1

### 10.2 Interface Design and user guide



Figure 10.2



Figure 10.3



Figure 10.4



Figure 10.5



Figure 10.6

## **11. Testing**

When system is physically implemented, this does not mean that the project is finished. Manager should ensure that the results would meet the user requirements in real world conditions. Besides there should be some levels of support for system since future might have different specification required for the system.

### **11.1 Objectives of Testing**

The main objectives of testing for electronic construction channel are to ensure that project meets the requirements of all user groups. For example, if different users have been chosen to work with different browsers, would the system be a compatible one to support all required function. In addition test manager should verify that system levels of interaction are enough to create hooking power and developers wish to use it for the procurement process.

Testing objective is to create a guideline and measurement for system evaluation and make sure that potential users are able to reach the system a high level of availability and functionality. This guideline would be used to show the criteria in which project is a successful achievement. Researcher must make sure testing environment is similar to the real working environment. According to Bryan, John and Brett in 2008, to setting up a method of viewing a Website offline so to make minor changes and preview them (Bryan, John and Brett, 2008). User also should be able to use different types of browsers and present system with different resolutions.

## **11.2 Scope of Testing**

For this phase of the project, this was required for manager to simulate the real environment through using some assumed data making sure that system limitation would not affect the functionality required in real practical environment.

## **11.3 Types of Tests**

In this section there are several testing types which test manager have been selected and conducted to ensure the quality of the product and its compatibility with the network's environment.

Compatibility testing: this type of testing refers to the website presentation and functionalities while using varies of browsers by users. In a successful compatibility testing, manager should get the result of functional and well presented system with all available browsers.

Functional testing: this type of testing refers to the website functionalities which have been designed to do some specific actions or behaviors. In a successful functional testing project manager would figure out that website is usable.

Design and user acceptance testing: this type of testing refers to the website usability and HCI concepts or principles of the design. In a successful design testing project manager would determine that system is interactive and has enough hooking power.

### **Heuristic Evaluation**

Based on what has been stated by Jakob Nielson and Rolf Molich, Heuristic evaluation is a cheap and quick method to structure the critique of a system using a set of relatively simple and general heuristics (Dix A. et al, 1998).

This is expected for this type of testing to generate and determine a set of problem which system can be improving its usability by solving them. This is like system criticism and problem finding which has emphasizes on the principles of design and interaction tools.

## Summative evaluation

Summative testing measures the effect of Website on the users through analyse the output of the product (Bhola, H. S. 1990). In a successful summative testing, project manager or test manager would Figure out if the functionality of the project works properly.

### **11.4 People Who Tested**

In a system testing there must be different people in different roles each have a significant contribution for the testing objectives.

These groups can include users, project manager, developers, data entry team etc. test manager should be aware of external factors and their effect on the results of the endeavor.

Crucially, test manager should be in a tight understandable communication and manager the integration required after testing.

### **11.5 Design Testing Environments**

One important testing manager concern is how to simulate the testing environment become so similar to the real world atmosphere.

This concern would increase the reliability of the testing outcome and make the outcomes accurate.

## 11.6 Results of Testing

### 11.6.1 Compatibility testing

	Google Chrome 13
	
	Internet Explorer 8
	
	Mozilla Firefox 8.0.1
	
	Opera 11.52



Safari 5.1.1



### 11.6.2 Functional testing

Page	Function	Expected result	Actual result
Home	Presentation info	of Well organized	pass
	Navigations pages	of Correct navigation	pass
About us	Presentation info	of Well organized	Pass
Contact us	Presentation info	of Contact and communication	Pass
admin	Create	Add new topic	Pass
	Update	Edition	Pass
	Record	Generate records	Pass
	Delete	Delete records	Pass

Login	User authentication	Recognize all user groups	Pass
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### 11.6.3 Formative testing

no	Area	Description
1	System Visibility	Controls are in a highly visible place.
2	system controls and the real world	Metaphors in the system
3	control and monitor	Control all system functions
4	System Consistency	Similar patterns and layout
5	Error and error management	validates
6	Recognition instead of recall	Utilization of the combo boxes.
7	Flexibility in the system	Match exceptions
8	Help and assists	Tooltips
9	Design	Best selection of the pattern, design and color
10	Documentation of the system	User manual documented

### 11.6.4 Summative testing

1. How was Website navigation?

Very Good    Good    Average    Bad    Very Bad

2. How did you find organization of the information?

Very Good    Good    Average    Bad    Very Bad

3. Do you think pages are consistent along the website?

Very Good    Good    Average    Bad    Very Bad

4. Do you think the buttons are in the right place?

Very Good    Good    Average    Bad    Very Bad

5. How was system interaction and hooking power?

Very Good    Good    Average    Bad    Very Bad

6. Is everything easy to find in the system?

Very Good    Good    Average    Bad    Very Bad

7. How was record generation in the system?

Very Good    Good    Average    Bad    Very Bad

8. How easy was to communicate as the developer?

Very Good    Good    Average    Bad    Very Bad

9. Do you think supplier was interacted to developer with enough interaction?

Very Good    Good    Average    Bad    Very Bad



Figure 11.1 - Summative Testing

### 11.7 Testing Errors

Based on the compatibility testing table, the results indicate that website is still well presented and functional no matter which browser is the user going to use. A formative testing result indicates that HCI concepts, elements and principle of design have been utilized in a proper way. Based on the summative testing, the level of interaction has been determined in a right degree and developer can ensure the amount of required hooking power is in the designed product.

## **12. User manual**

User manual is a part of maintains guide and would be an effective support tool for users, developers and other target groups to independently learn how to use system. Such directory would assist new users to get system concept in a relatively short time. User manual is also an effective advertising tool for indicating the functionalities of the system and its uniqueness.

### **12.1 Introduction**

In this part, according to the system instruction and guideline, functionalities and commends of using system have been described in details.

### **12.2 To Register**

Through the login button, user would be able to generate its record and access to the system functionalities as a genuine member.

### **12.3 Logging as an admin**

Admin is the one from internal environment of the organization which controls the record and information provided through the website. Therefore, admin in the website is responsible to organize the information so that provide an updated set of product package details to the normal users.

## **13. Critical project appraisal**

In fact, evaluation of the digital procurement system is dependent on the discrepancy of the pre defined objectives of the system with the achieved set of targets. Besides, as an accomplished product, this is very important for developer to mention added value of the project in the form of knowledge, experience and skill in each phase of the topic.

In addition to all above, this is crucial for researcher to get to know what can be improved for next experiences and what was learned from the whole initiative.

### **13.1 Accomplished Phases**

For each phase, project manager must determine if he or she got the reliable set of expected deliverables. System was designed through using the SDLC methodology which has clear and separate phases. In this methodology each stage should deliver a set of key targets. According to set of project and methodology phases, researcher has conducted the following evaluation over desirable key targets.

#### **13.1.1 Project planning**

In the planning stage, this was expected to reach a comprehensive planning which has covered entire project dimensions in terms of risk, time, cost and other project knowledge areas. These dimensions of the project have been outlined in the project planning properly.

#### **13.1.2 Project research and literature review**

In the phase of research, manager has been provided the industry information and document updated set of trends in the market.

Then manager provided an overview on the market suppliers and key challenges in the raw material industry which affect the developers and development.

### **13.1.3 Analysis and setting out the requirements**

In a final year project, and as the part of solution, this is very important for project manager to reach an accurate set of requirements balanced with the user expectations and requirements. Project outcomes must meet what user actually wants and needs.

### **13.1.4 Design and development**

For this system, design and development starts from a logical engineering and followed by the physical implementation which had an intensive focus on the instructiveness and functionality for meet the specification of analysis.

### **13.1.5 Testing and maintenance**

In testing the achievement, there were three types of testing handled by test manager as below.

Compatibility testing with different browsers.

Functional testing to determine the level of functionality.

Design and user acceptance testing for determine the degree of usability.

## **13.2 System Benefits to end user**

System would create a value atmosphere with a lot of benefit for both suppliers and customers in construction industry as following. According to discovered problem, Electronic Construction Procurement System should be able to create major business values for the organization as following;

Tangible benefits:

Reduce marketing procurement cost through providing borderless geographical access.

Eliminate cost of manual and paper work procurement process.

Providing a faster approach to find and evaluate market sources.

Intangible benefits:

Reduce required time and investigation effort to market products

Overseas market accessibility and increase organization competitiveness

Simplify communication for suppliers company and customer

Increase the quality of the services and push organization to position in a higher level of CRM

Increase the competition among industry suppliers

Increase the level of commerce integration

Minimize required procurement recognition and memorization of products

### **13.3 Challenged faced**

The specification of the system was derived through investigation and data gathering from supplier market and project managers. This was the main emphasize for managers to get the most reliable set of user requirements in the whole project lifecycle.

### **13.4 System limitation**

There are also some areas that system would not be able to support;

The payment and bids legalization

Transaction validity

Customizable data formats

### **13.5 Learning experience**

Electronic Construction Procurement System need researcher to get master in below requirements;

Website interface cosmetic tools

Required algorithms and coding

### **13.6 Value of learning experience**

The nature of project management for a student final year project would bring a lot of experiences and learning for different phases of endeavor and researcher and investigation required for different parts of the project.

### **13.7 Degree of success**

In the following, project manager conducted an analysis over success degree for both project and the product to measure how the pre defined objectives and in what degree are achieved.

#### **13.7.1 Electronic procurement system**

System evaluation requires comparing functionality package and interaction level with the expected designed solution. As project outcome includes a comprehensive documentation and a fully functional website, it seems that the key targets of the project have been met. System will create value through a well-designed accessible platform contain all required information related to products and functionalities required to create and support a sustainable source of development supplier in construction sector. This is expected from the project to deliver a new business model capable of handling business processes in a higher level of effectiveness and efficiency. As a B2C digitalized commerce tool this is expected that organization reaches a higher amount of sales which can be

translated to higher profit. Besides, ease of management and higher level of integration would also apply to the company after digitalization of the procurement.

Main functionalities

Project procurement management and external supplier levels of accessibilities.

Present suitable information format of procurement items.

Enhance marketing and commerce of supplier organization through a well-designed platform.

Enhanced functions.

Record keeping.

Provide immediate and reversible action and effective system navigation.

Special features.

Decision support procurement reports for organization management and strategic movements.

### **13.7.2 Electronic procurement project**

In Electronic Construction Procurement System like any other project, the main objective would be to stay on the time, resource and quality of the major deliverables. As an individual project, researcher is limited to information sources and a year time constraints defined for a final year project. In higher degrees of achievements, project can be maintainable and sustainable for further improvements and enhanced future functions.

### **13.8 Possible Future enhancement**

System can be enhanced in future through mobile applications which broaden the scope of access and coverage for organizational information.

### **13.9 Improvements for same project in future**

If developer has the second chance to implement the system, there were several areas which were under higher level of emphasizing. First, to investigate the updated material developer intends to get more literature and interview more people and players in construction industry. Second area of focus is the development and tool or techniques used in the application. There are a lot of functionalities which can be added to the system through using more updated tools and techniques.

## **14. Discussion Recommendations and Conclusion**

### **14.1 System Discussion**

The effectiveness of the project depends on the amount of vendor information available to evaluation and selection by project manager. Although the scope of the project and eventually the required procurement are clearly defined in project procurement planning, the system with effective marketing objectives can help the manager to reduce the material price and increase the quality of inputs with a significant time cutting which can be translated as the overall reduction in project cost (Harold Kerzner, 2006). With such significant value in project procurement, supplier firms should apply technological tools and enhancements to create a better communication channel with a larger amount of available information for customers.

Digitalization of the procurement process in Development Company applies an important competitive advantage to the organization. The ability to shift the global market for supply is another advantage for a project to increase the competitiveness (George Ritz, 1993).

### **14.2 Future Recommendations**

System can acquire a wide range of functionalities according to the user requirements in future. Based on the industry trends and new customer needs and wants, system can reach a great set of achievements to perform beyond an informative website. In addition with product description, system can handle transaction and become a one step procurement solution in the market.

### **14.3 Conclusion**

Well procurement system can increase firm's revenue through using information and advantages of digital channel in addition with the maximum efficiency results of technological advancement. Procurement has a significant contribution in development overall budget in construction projects. All procurement strategies are frameworks by which an organisation attains its objectives (Harold Kerzner, 2006). Electronic Construction Procurement System makes it feasible for developers to gain an effective evaluation area and negotiation communication tool. Homebuilders may obtain the benefits of this Web-based system to increase the level of control over project with a large amount of raw material information.

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