International Journal of Engineering Research and Reviews ISSN 2348-697X (Online)
Vol. 5, Issue 1, pp: (32-37), Month: January - March 2017, Available at: www.researchpublish.com

Risk Based Life Cycle Costing Evaluation of Construction Projects in United Arab Emirates (UAE)

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Abstract: **Construction projects by its complexity nature have an impeded risk of late completion and running over budget. UAE construction investors take decision based on financial varaible of cost and return only without taking the risks or the total life cycle cost of the project into account. For this reason we have devloped this paper to identify other factors and varaibales to be considered when taking decesion of investment in construction sector in UAE**

Keywords: **Construction Projects, Risk, Life Cycle Costing.**

1. INTRODUCTION

The world's third largest re-export center after Hong Kong and Singapore, the United Arab Emirates is the most important trade center in the region. UAE has a total GDP of $570 billion (AED 2.1 trillion) in 2014, 71% of which comes from non-oil sectors. The construction industry, considered one of the key sources of employment, income and growth, contributed about 8 and 12% respectively of the GDP and non-oil GDP in the last 5 years. (oryxme.com, 2013).

To guarantee success in the construction industry, before embarking on any construction projects, proper risk analysis has to be done and the risk management techniques and tools put into play if necessary. The major challenge faced during a project's initial stages is the estimation of the project's total cost. This is where some project managers go wrong. The initial estimated cost of construction, design, and implementation should not be used to establish the project's final budget. There exist other costs during the project's life that should be put into consideration. Such costs may include maintenance, operation, and disposal costs. Project managers should thus beware of such costs and consider external risk factors and variables such as the time value of money and inflation.

In order to give the best available result from asset investment, companies must ensure that they integrate several factors in their decisions. For instance, issues of infrastructure, reliable data as well as uses the best available technology when constructing any building. Having holistic view on the manner in which asset is managed enables the available resources to be effectively used during the life space of a project (Jaafari, 2011). Thus, asset management requires an integrated approach so that the company can effectively manage its resources in a manner that it will obtain maximum utility from the asset.

2. LITERATURE REVIEW

Over the years, many researches have been done on the subject of life cycle costing of a project. The vast majority covers a lot of information that is important in enabling successful implementation of various projects especially in the construction industry. While narrowing down some of the article that has been captured in this study puts main emphasis on asset management, the life cycle costing of the project started to gain ground in recent researched among others. These literatures also use various methodologies to support their findings. In this discussion, the focus is put on the main points or areas that have been discussed in the literature reviews.

One of the most important factors brought about by these literatures is the procedures that are involved in the management of asset or even when doing cost analysis of the asset. The procedure defines the manner in which activities should be done in the construction industry so that objective of working on the asset can easily be obtained. Following procedures in asset management is important since it allows for proper planning to take place. When proper plan is taken into account then chances of wastages as well as risks are highly reduced.

The literatures clarify the importance of following procedures which is evident in many ways. In order to realize the objective of investing in asset one must follow a given process. For instance, process start with the conceptualization of idea, then feasibility study followed by the design process and finally the implementation process. The processes are very important since they mark the start and the beginning of various activities during the life cycle of the asset. These producers should exploit every avenue that covers the whole process of a life of asset.

3. RISK

The Project Management Institute (PMI) describes risk as an "uncertain event or condition that, if occurs, has an effect on at least one project objective. Objectives can include scope, schedule, cost, and quality" (2008, p. 275). It also states that project risk has its origins in the uncertainty present in all projects.

Uncertainty and risk are not considered synonymous terms by some authors. Chapman and Cooper (1983, p. 238) believe that risk is "an undesirable implication of uncertainty" while Motawa, Anumba, and El-Hamalawi (2006, p. 583) describe risks as "uncertain outcomes or consequences of activities or decisions when they are manageable."

Edwards and Bowen (1998) classified two groups of project and construction risks: natural and human related. Natural risk includes events created by weather systems such as hurricanes, floods, lightning strikes, et cetera, and geological systems such as earthquakes, and volcanic eruptions. Human risk includes the following categories:

1. social – criminal acts, civil torts, substance abuse;
2. political – war, civil unrests, industrial relations actions;
3. economic – materials' supply, labor supply, equipment availability, inflation, fiscal policies;
4. legal – contract clauses, regulations, codes;
5. health – epidemic, surgery;
6. managerial – productivity, quality assurance, cost control, human resource management;
7. technical design failure, estimation error, collision, accident, equipment and systems failure;
8. Cultural – religion, cultural custom.

Political risks are usually given a hand in interfering with the success of projects due to frequent interferences which might be internal or external risks (Ashley, D., & Bonner, J. 2012). Political risk traditionally described as war, civil unrest, or change in rules and regulations as described above, but modern and recent political changes that affect UAE need to be addressed. Positive change in relations between USA and Iran following latest nuclear deal, considered as a blow to the traditional USA GCC relations. The new law known as "Justice Against Sponsors of Terrorism Act (JASTA)" although aimed against Saudia Arabia in particular, but can easily open door of lawsuits against many other nations including UAE. There are so many other political risks directly affecting UAE like; Arab Spring and the aftermath in Egypt, Libya, Syria, and Iraq, war in Yemen, and the newly elected US administration with the Republican Party combining the presidency with both congress chambers of Senate and Representatives.

Risk Management:

Risk management on construction projects involves "risk management planning, risk identification, risk assessment, risk analysis, risk response, risk monitoring, and risk communication" (Baloi & Price, 2003, p. 262). Project Management Institute, PMI describes project risk management as "the processes of conducting risk management planning, identification, analysis, response planning, and monitoring and control on a project". (PMBook 2008,p 273).

Identifying a risk involves doing a proper assessment to come up with a plan of identifying the root cause of a risk and on the other hand, risk handling involves coming up with solutions to deal with risks and to ensure that risks do not affect the performance of any project. (Perera, B 2014).

There are various ways that can be used to manage project risks such as accepting the risks, accommodating the risks, transferring risks and eliminating the risks (Abdou, O. 2010).Some methods of managing risks may not work out depending on the nature of the project.

Managing risks in construction projects involves use of various techniques which involves the use of risk management software's, use of professional advice, insurance, training of the contract personnel and proper asset management (Hansson, S., & Zalta, E, 2014). The risk sharing or transfer by using insurance is the most common practice in UAE and it is in most of the time imposed by the lender or government regulations, however the role of insurance companies and their expected contribution to compensate for losses when occurs, is looked at with a lot of incompetency, the perception is that insurance company are allowed to use lengthy and complicated compensation procedure, and vague and ambiguous policy terms and conditions lead in most cases to the beneficiary abandoning the tiresome chase of the promised reimbursement.

4. LIFE CYCLE COSTING (LCC)

The concept of Life Cycle Costing was born at 1965 when the United States Logistics Management Institute used the term Life Cycle Costing in a military-related document. This document describes Life Cyc1e Cost as follows:

In the truest sense, the life cyc1e cost of military equipment is the total cost incurred by the government from the moment the investigation of its generating idea elicits manpower usage within or without the government until every piece of the equipment is eliminated from the mi1itary logistics system. The term thus embraces all costs associated with feasibility studies, research, development, design and production, and all support, training and operating costs generated by acquisition of the equipment.

LCC concept usage in construction project globally is relatively new, it is not well known or adapted in UAE academia or work place as of yet, even in UK a study and a paper by (Olubodun, F., & Kangwa, J. 2013) suggests that over 50 % of the people being studied implemented the LCC and demonstrated a lack of understanding of the technique and the absence of a standardized methodology. (Jaafari, A, 2006) argued that Life-Cycle project management has impact in any project as it helps in ensuring that a project undergoes all the key phases which include initiation, planning, execution and closure, however the components of different phases of a project may vary depending on the nature of the project, for instance the construction projects follow the phase sequence of feasibility study, design, construction, operation and maintenance, and demolition.

It is becoming essential for successful project manager to have a holistic view of the project and use approaches that integrate different project phases. Project life cycle integrated management systems helps in determining an effective way of ensuring that proper risks are identified and dealt with so that they do not affect the projects life cycle, (Wang, J., & Tian, J, 2009). All project stakeholder need to be aware and have contribution towards the adoption of Life Cycle Concept and vision to ensure successful project outcome, special emphasis put on design professionals as Kirk, S., & Delsola, A. suggest, Life Cycle Costing for design professional is important as it helps architectures and other building designers to develop designs which are unique when coming up with projects as well as developing designs which will save on costs (Kirk, S., & Delsola, A. 2015), similarly Dhillon, J. emphasized the role of engineers, he states; The main finding that can be drawn is that engineers should come up with methods that will reduce the costs of projects by applying simple methods or using tools which will not complicate the construction processes (Dhillon, J. 2015). The downside or the shortfall is that few researches have been done on the concept of life cycle costing, and the literature is not yet strong and robust.

5. CONSTRUCTION AND PROJECT MANAGEMENT

Planning phase considered crucial in any project, failing to plan is the best plan to fail. Planning before the commencement of any project especially the construction projects is important in ensuring that the projects run smoothly and shortfalls are minimized (Lee, S., & Park, M, 2006). Project management is vital in ensuring that projects run in a proper way as well as ensuring that risks are identified in a project and dealt with. It also ensures that there are enough materials needed for the project. The common practice in UAE is to allocate minimum time and resources to planning phase, there is a perception that it is a time waste and there is always rush to start the work, and hence most of the planning is either ad hoc or runs alongside other actual construction activities.

Clients play an important role in construction projects by overseeing the implementation and providing the necessary resources for execution of projects. (Cherns, A., & Bryant, D. 2006). Client in UAE construction projects, especially in

private sector and family owned businesses, overplay his role by negative intervention and multiple scope changes, delay in project completion and risk of running over budget is inevitable. In contrast the role of the client in some mega projects in UAE is not known or not defined, even though this role is expected and needed in such a kind of projects, it is in most cases a role of a sleeping partner or delegated to a project manager or project management firm, and the client prefer to be unanimous for political or social reasons.

The definition of developed and developing countries is somewhat misleading, there is no agreement on one definition or benchmark, it rather a set of parameters that make a country perceived to belong to this group or that, these parameters could be for instance the economic factors of GDP, per capita income, minimum wage and so on, or political factors like the form of governments, freedom of express, and the like. Construction and architectural development are considered historically as a measure of any nation development. Most countries in the world are really developing due to increased construction activities evidently in UAE as well as china (Jaafari, A, 2011), however Construction cannot be individually used as a measure of development.

Terotechnology:

Terotechnology is the maintenance of assets in optimal manner. It is the combination of management, financial, engineering, and other practices applied to physical assets such as plant, machinery, equipment, buildings and structures in pursuit of economic life cycle costs. This is the concept which is usually applied in ensuring that assets are optimized. Again Terotechnology plays a major role in ensuring that the life of an asset is maximized. (Gorvin, T. 2011).

Terotechnology is important in plant engineering especially in the management of assets in ensuring that assets are optimized in terms of their use. (Kelly, A., & Eastburn, K. 2012). Terotechnology is an important aspect in asset management especially in ensuring that assets in any business organization are optimized and also ensuring that assets are used depending on their designs (Belak, S. 2014).

For UAE the Terotechnology concept is new and difficult to understand and apply.

The Risk Management Factor:

Following risk management procedures enable risk to be reduced as from the inception stage of an asset to the final stage of asset life, namely asset retirement stage. In the literatures it is evident that risk is a common issue that emerges during any project life cycle from cradle to grave. There is various kind of risk that can be associated with the asset management life. Some of the most common risk in asset life cycle includes financial risk, political risk, health and safety risk as well as technical risk among others (Hansson & Zalta 2014). If asset managers follow the correct procedure, then they will be in a better position to do evaluation of the real cost of an asset. An early stage of asset associated risk proper evaluation is a vital tool to enable stakeholders to minimize any wastage during the asset life cycle. The financial risk covers a lot of aspect of an asset in the construction industry. First, the available finance should be satisfactory to cater for the cost of the project from the initial stage to the final stage. The notion of construction project life cycle includes stages of project or asset construction, asset management and operation, asset repair and maintenance, and finally asset retirement or demolition.

The other risk that has been discussed at length in the literatures is how to minimize health and safety risk. Health risk is majorly concerned with the live of workers as well as those who will use the asset or the building once it is completed. The safety of workers must be guaranteed so that they can work comfortably to ensure that the asset is developed and completed within the required time schedule. Additionally, it is important to use the right technology and resources in order to build strong and reliable buildings. Investing in good technology in any asset management is important as it minimized technical risk that may arise during the project life cycle (Brown & Brown 2016).

Risk Reduction:

The literature revised suggested some of the possible ways of reducing the risk. In order to reduce the life cycle cost and realize the goals of a project, it is necessary to reduce the risk associated with such projects. Risk is always evident and unavoidable in every construction project. Among the risks some of them can be avoided or eliminated from the asset life cycle. This implies that managers of construction projects can make rational choices such as avoiding engaging in any project that is in an earth quake prone area, or in the context of UAE, they can avoid projects that are not funded or guaranteed by the government. Additionally, managers can transfer risk through taking insurance cover so that in case of any damage or injury during the construction work they can claim for compensation of the insured risk. Risk can also be shared through terms and conditions with suppliers and subcontractors that cover for hikes in material prices or delay in delivery time. Some rules that are unique to UAE and the region that regulating working hours during hot summer and

during the month of Ramadan, found to be useful in reducing risk of labors fatigue and heat strokes (Proske, 2008). When managing risk it is important that project managers have proper measures in place. First, mangers should have software like Primavera or MS Projects that can be used to simplify work process despite the complicated nature of the work at the construction site. Secondly, it is important to ensure that more training is offered to both workers and managers during the construction project. Workers can get training from professional groups who can guide them on how to proper use certain machine especially those that requires technical skills to operate. Through doing this managers will be limiting the risk of causing injuries to workers as well as using more money in maintenance.

Risk management can also be done through using the right technology like modern cranes and lifting equipment. This will ensure that both time and space are saved at the construction sites. Using the right technology also means that chances of incurring financial risk is hugely reduced. Latest technology and modern equipment will have less maintenance cost less down time caused by repetitive machine failure.

Cost Factor:

Life Cycle Costing keeps in mind the logic that money changes in value over time, insinuating that expenses that are incurred during different periods are not necessarily the same. The concept of time value of money, therefore, forms the basis for Life Cycle Cost Analysis (LCCA). Risks that exist in the construction industry immensely affect the investment decisions and the time value of money. In a high-risk industry, the time value of an investment today is very much likely to be different from that of next month's investments, for example in smart phone industry Samsung struggling to cope with iPhone new inventions, one month seem to be a very long time if you want to stay ahead of the game. The focus of UAE on economic diversification manifests its intention to beat Singapore and Hong Kong so as to position itself as the world's largest export center.

Increased Project Life Cycle Cost:

Literature review reveals that several problems undermine the life cycle of an asset particularly in its implementation phase. Some of the problems discussed in the literatures focus of specific areas such as improper maintenance of asset (Srour, et al., 2007). The perception in UAE and the whole Middle East area for maintenance is that it is an extra cost that can be saved or minimized, rather than the fact that it is a long term cost reduction and value added strategy. On the other hand construction sector in the region looked at as a low scale job that are only for expatriates from certain countries, labors from mainly Indian subcontinent with low or no education, represents the majority of the labor force in this sector, this resulted in a lack of proper knowledge and experience about the construction and operation of the project and tools and equipment's in hand. Inadequate knowledge about the operation of an asset implies that the asset cannot work within the range that it was designed for or cause damage to the asset.

Technology:

UAE face no problem in adapting latest technology in construction field. UAE is a rich country that enjoys stable political system, and has good relations with the international community. A considerable number of multinational construction companies operate in UAE. In the modern construction industry, technology plays a major role in ensuring that reasonable efficiency is achieved during and after the construction process as well as minimizing the risk that is associated with the project life cycle. Technology determines how maintenance should be done. However the technology used also depends on the user and his capabilities. In some cases, it becomes important to give workers training especially when they are dealing with sophisticated technical machines so that they can improve of performance as well as minimize the risk associated with the work.

6. MAIN FINDINGS

The research majorly focused on identifying the various examples of risk management tools currently utilized in the UAE construction projects; investigate stakeholder Risk perception and Life Cycle Costing awareness and adoption. The literature review was exploited to determine why some project managers are yet to adopt maximum utilization of the risk management tools. The concept of risk in construction projects looked at from UAE prospective and unique risk factors, like family owned businesses, demographic composition of population where nationals represents only 15% of the total population, as well as the negative perceptions by locals towards working in certain sectors including constructions. Political risk which is usually defined as change in political system, new regulations, and civil unrest, is been updated to cover new threats like; terrorism, Arab Spring, war in Yemen, US Iran deal, new administration in USA and the like.

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