Improving Construction Project Performance using Quality and Value Management

by Herawati Zetha Rahman

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Abstract: Construction industry plays a substantial role in a country's national economy, irrespective of the country's levels of economic development. Unfortunately, the issue of inefficiency and lack of quality in construction projects have been a major concern for construction industry players. Responding to this situation, this research is addressed a need to improve construction project performance using quality management (QM) and value management (VM) approaches. This research is employed the integration of design, construction and post construction stages in order to support holistic views on construction projects scenarios.

This research employs a quantitative approach through a questionnaire survey distributed to construction industry stakeholders. The questionnaire consists of three parts discussion include : the identification of critical success factors and barriers existed in each construction stage in building projects, identification of additional functions in building projects, and total investment cost for building project. As the significant findings, this research evaluates how the understanding of quality and its process is perceived and identifies the expected additional functions that can be applied to deliver efficiency and more value-added construction projects.

Keywords: Value Management, Quality Management, Performance, Construction Project, Innovation

1. INTRODUCTION

The construction industry is believed to be one of the business sectors that contribute significantly to national economic growth. The important role the construction industry viewed from multiplier effects which was created through extensive relationships (backward and forward) with other economic sectors. However, the construction industry faces numerous challenges and obstacles due to globalization of the world economy that demands the construction industry to be able to adapt to the changes and to meet client demand in terms of quality, efficiency and innovation.

Many construction companies are probably not fully aware of the values of improving quality apart from the production of a better product and consequently the misconception of an increased cost. The most important reason to improve quality is survival, i.e. winning contracts and getting repeated contracts. On other hand, inefficiencies in the management of construction projects can be found from the high wastage that leading to cost overrun and delays (Abdul-Rahman, et.al, 2007).

The complexity of a project requires effective and efficient process so as to reduce uncertainties associated with financial losses, wasted time, and low quality. The role of effective, efficient and high quality design in construction project is generally argued to be one of the most important key in creating and developing concepts and specifications to optimize the function, value, and performance of the project (Berawi, 2010). Moreover, the design process will offer new information gained through synthesis, analysis, and innovative work that are undertaken as a part of an integrated value-adding process.

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Quality management is a method emphasis on quality that can reduce a project's direct cost and indirect cost through minimization of non-cost-effective operations, effective resource allocation and utilization, reduced wastage, scrap, rework and repair (Abdul-Rahman & Berawi, 2002).

Many aspects of a construction contract such as the choice of labour, communication issues, material management, selection of subcontractor or supplier, etc., can be improved by using quality management.

On the other hand, value management is a proven method to measure and to improve product effectiveness and performance and to stimulate innovation in construction projects. Thus the integration both methods is expected to improve the project performance in terms of delivering high quality and innovative project. The issues of quality have existed since tribal chiefs, kings, and pharaohs ruled (Gitlow, 2005). In a project scenario, quality can be defined as meeting the legal, aesthetic (Arditi & Gunaydin, 1997) and functional requirements of a project (Berawi, 2006). Customers nowadays place more emphasis on the quality of products rather than the price which was the major concern in the past. Hence, a rapid expansion of international competition in quality has occurred (Tsiotras & Gotzamani, 1996; Abdul-Rahman & Berawi, 2002).

In terms of quality in construction industry, Turk (2006), citing Arditi & Gunaydin (1999), mentioned that 'high quality building project' includes factors like the design being easily understandable and applicable, conformity of design with specifications, economics of construction, ease of operation, ease of maintenance and energy efficiency. Zantanidis & Tsiotras (1998) and Abdul-Rahman & Berawi (2002) mentioned the expectations for quality construction projects will continue to grow rapidly as the number of affluent, educated and quality-conscious customers are increasing.

With the globalization of economy, construction firms world-wide are actively engaged to achieve internationally accepted quality levels to ensure their position in the emerging international market especially in those developing economies. Thus, the need to have a proper system that ensures quality is critical, coupled with high level of attention paid to quality management in construction industry (Hiyassat, 2000; Abdul Rahman, Berawi, *et al*, 2006). Scholars indicate that quality management has been adopted by many countries in their construction industry including Hong Kong (Leung *et al*, 1999; Au & Yu, 1999 and Tang & Kam, 1999), Singapore (Low & Omar, 1999 and Low & Yeo, 1997), Greece (Tsiotras & Gotzamani, 1996 and Zantanidis & Tsiotras, 1998), Turkey (Turk, 2006), Jordan (Hiyassat, 2000), Saudi Arabia (Bubshait & Al-Atiq, 1999), Sweeden (Landin, 2000), United States (Chini & Valdez, 2003), South Africa (Rwelamilla, 1995) and Malaysia (Chew & Chai, 1996).

On other hand, the current situation can be further improved if the value and innovation improvement could be systematically managed in construction projects. The implementation of VM study theoretically can be implemented during the project life cycle starting from the concept stage with a large potential for cost savings than if carried out during the construction phase. This is caused by a high flexibility in making changes without the expense and additional time to redesign if implemented at an early stage of the project (ASTM E-1699, 2010). According to Dell'Isola (1997) the implementation of VE study is better conducted at the beginning of the project and if applied later will increase the investment and change resistance will exist.

A proper VE method as a systematic and multi-disciplined team approach to analyze the function (Berawi & Woodhead, 2005a; Berawi & Woodhead, 2005b) is expected to produce an optimum outcome for a project in terms of quality (Berawi, 2004), technology (Berawi & Woodhead, 2005c; Berawi, et.all, 2008), efficiency (Abdul-Rahman, Berawi, et.al, 2006; Woodhead & Berawi, 2008) and innovation (Berawi & Woodhead, 2008; Berawi, 2009). According to Value Standard (2007), the VM study generally encompasses three stages include pre-workshop (preparation), workshop (execution of job plan) and post-workshop (documentation and implementation). The purpose of the job plan is to guide the team through a process to identify and focus on the main functions of the project to create new ideas that generate enhanced value.

Based on these beneficiaries of QM and VM methods, therefore it is expected the integration of both methods can improve the current project performance. The main objective of the study is to improve construction industry performance using quality and value management. The first stage of the study will examine the critical barriers and drivers that exist in each construction stage in projects in Indonesian construction industry. And the next stage is to develop a model using quality management and value management in construction project.

2. QUALITY AND VALUE MANAGEMENT IN CONSTRUCTION INDUSTRY

2.1 *Quality management in construction industry*

Quality not only refers to the product but also the process. Arditi and Gunaydin (1999) stated that product quality in the construction industry refers to achieving quality in materials, equipment and technology that go into the building structures. Different authors have defined quality in their own ways, namely: Customer/client satisfaction (Wit, 1988 in Sylvester D. C. et al., 2011; Arditi & Gunaydin, 1997), Cost-effectiveness (Arditi & Gunaydin, 1997), Defect-free work (Arditi & Gunaydin, 1997), Product or services free of deficiencies (Juran , 1988 in Arditi & Gunaydin, 1999), Conformance established requirement owner, consultant and contractor (Bubhasait, 1994 in Sylvester D. C. et al., 2011; Juran (1988) in Arditi & Gunaydin, 1999), Fitness for purpose (Jenkins, 2008 in Sylvester, D. C. et al., 2011), Meeting legal and aesthetic (Arditi & Gunaydin, 1997), and Functional requirement of project (Wit, 1988 in Sylvester, D. C. et al., 2011; Berawi, 2006 in Hamzah Abdul-Rahman et. al., 2010).

In the terms of function, a high quality building project can be described by such terms as ease understanding the drawings, conformity of design with specifications, economics of construction, ease of operation, ease of maintenance, and energy efficiency (Arditi and Gunaydin, 1999). When carrying out construction activities, professional with different background interact to fulfill the customer's requirements. Through the stages the construction process, different problems may arise those can be affect the quality.

The construction industry is characterized by its non-standardization (Rowlison and Walker, 1995 in Wong and Fung, 1997). Hence, no universal standard or specification can be applied to the product, which leads to difficulties in quality assurance. Changes to the details of the design of a project are typical and may be frequent throughout the construction process. They may be attributed to the lack of buildability of the design produced and contractors are asked for the redesign on the production. Quality is often at risk when there are excessive changes. The poor quality of construction project is evidenced most times by late delivery of projects to clients, cost overrun of project and poor workmanship.

The concept of quality management is to ensure efforts to achieve the required level of quality for the product which are well planned and organized. Harris & McCaffer (2001) in Tan & Hamzah (2011) explained that quality management has to provide the environment within which related tools, techniques and procedures can be deployed effectively leading to operational success for a company. The adoption of TQM in construction industry has been promoted and the ISO 9001 standard developed to ensure the quality of construction project. Tan & Hamzah (2011) explained about the construction companies have some reasons to get certificate of ISO 9000 are qualify for public work tender, meet client's/customer' expectation, improve the quality of project done and improve the competitiveness.

Certain problems have been observed in relation to the quality management implementation, based on interview conducted in Sweden, Landin (2000) argued that in construction process, many of concepts in ISO 9001 are experienced as being too abstract and too difficult to comprehend. He also argued that its appears difficult for a company to improve its competitiveness and be more efficient by use ISO 9001 alone in view of many stages of construction process encompassed and the diverging interest represented (Tan & Hamzah, 2011).

2.2 *Value management in construction industry*

Value Management (VM), is a systematic and structured process of team based decision making. It aims to achieve best value for a project or process by defining those functions required to achieve the value objectives and delivering those functions at least cost (whole life cost or resource use), consistent with the required quality and performance (Hammersley, 2002). In a brief account of the early history of VM development contained in SAVE International value standard (2007), there's a philosophy that provided simplicity to understand the concept of VM. VM method was developed to provide a way of managing value and improving systematic innovation to create competitive advantage of a product. This method focuses on the understanding of function from each component of an engineered product, because products were bought for what they can do (function of a product), either from what function they can deliver or aesthetic quality they can offer.

To focus on the understanding of function, it should be defined using the combination of active verb and measurable noun that can give characteristic benefits from the intended function. Therefore, VM puts the function analysis as the key foundation of its method. Function analysis are still developed and becomes a tool to help individual and team to manage how to understand a concept from its functions to then decide whether the design can be improved or is there any other material or concept that can fulfill this function.

In various countries like USA, UK, Australia, and Japan, the application of VM has solved many problems in the construction industry and further application of the VM application has increased their competitive advantage (Nakagami, 1996; Daddow and Skitmore, 2003; Berawi, 2004; Berawi and Woodhead, 2008; Berawi, 2008a; Berawi, 2009a; Berawi, 2009c; Berawi, 2009d; Yeong, 2009). The ability of VM in increasing the competitiveness of construction industry in some countries can't be separated from the enormous benefits that VM can give for construction projects. VM ability in making right decision at the planning stage is one of the benefits that can be given. Furthermore, this right planning decision will increase the efficiency in building construction project execution (Robinson, 2008). It clearly explained that this benefit is very much in need by inefficient building construction project with unnecessary cost.

According to SAVE International (2007), VM method is defined as a systematic process used by teams from various disciplines to enhance the value of the project through function analysis. The success of VM application is influenced by many factors mentioned those are spread from pre-workshop to post-workshop phase (implementation) which covers issues such as activities related to the job plan, the function analysis, the VM team, top management support, etc. Understanding of the critical success factors of VM application is necessary to ensure the success of VM studies (Robinsion, 2008; Male and Kelly, 2004; Shen & Liu, 2003; Hammersley, 2002; Padhye, 2000; Pucetas, 1998; Nakagami, 1996; Connaughton & Green, 1996; Kasi & Snoodgras, 1994).

All processes in VM study should be facilitated and managed with the right way in order to achieve success (Shen & Lie, 2003; Hammersley, 2002; Nakagami, 1996),. To ensure that all processes will be facilitated and managed right, this study should be led by a VM facilitator whose specific competence. The commitment from the parties involved need to built to seek the best value of the project during the workshop. The other critical success factor is conformation with the international standard methods that meet international standards of implementation of a structured job plan, the function analysis, the use of skills and techniques (such as FAST, brainstorming, etc) will influence the success of VM study. Failure to obey all the rules in every phase of the job plan will result in cost reduction studies rather than value improvement studies. In order to ensure that VM study is in accordance with the structured job plan, facilitator who can manage and control all VM process and could direct the proper techniques used is very much needed.

2.3 Integrating quality management and value management

Quality management (QM) and value management (VM) have been widely accepted as methods for effective project management, and based on their benefits, it is expected that the integration of both methods can give new approach in improving the current project performance. There were already several researches discussed about synergizing the quality management and value management methods. Zlotin and Zusman (1998) proposed a Hybridization of Value Engineering and Quality Engineering Based on the Theory of Inventive Problem Solving (TRIZ) known Value Quality Engineering, Ong (2003) introduced the element of VM into QMS, called Value-Managed Quality System (VMQS), Jariri and Zegordi (2008) came out with the integration of Quality Function Deployment and Value Engineering on their research, Ried (2010) in his paper described the successful application and implementation of a combined Value Engineering and Zero Defect program for a leading European automotive supplier and research from Mandelbaum et al (2010) concluded that VE techniques are sometimes better equipped to lead to improvements or solutions complementary to those identified through a DMAIC/DFSS approach.

2.3.1 Value quality engineering

Zlotin and Zusman (1998) consider bridging the gap between VE and methods of quality control through applying the Theory of Inventive Problems Solving. According to the authors, Classical Value Engineering and Quality Engineering are still successful in some areas. For example, VE is very popular in oil drilling. The reason is that this technology is very old, is has not being evolved for a long time because the oil companies did not have any reason for cost reduction. Value Quality Engineering (VQE) approach developed in Ideation International Inc. is based on this experience. Besides TRIZ, VQE utilizes all useful and interesting approaches from Value Engineering, FAST diagrams, Quality Engineering, Fish Bone diagram, Taguchi method, QFD, DFMA, concurrent engineering, FMEA, etc.

The primary objective of VQE in general improvement of the system directed to simultaneous improvement of its quality, effectiveness, reliability, etc., and cost reduction. In terms of TRIZ, this direction is named "Increasing the Ideality of the System". More specific objectives, like cost reduction without quality loss, or quality improvement without increasing cost, can be pursued, as well.

2.3.2 Value-Managed Quality System (VMQS)

Value Management (VM) has taken a broader context and applications, moving from the usual "hard" to "soft" VM applications in the construction industry. Ong (2003) provided a brief overview of the application of "soft" VM in quality management system (QMS that reports the VM process and outcomes from a VM workshop and its follow-up sessions for a Group of Companies in Malaysia who has since achieved their ISO 9001:2000 certification.

The use of VM in developing a better quality management system is another example of VM shifting from the traditional or conventional "hard" applications into "soft" system applications. By integrating VM into a quality management system, called "Value-Managed Quality System (VMQS)", that complies with the recent ISO 9001:2000 quality standard; it is possible for construction companies to achieve better effectiveness and efficiency, as well as fulfilling the continual improvements requirement of international standard.

2.3.3 Integrated Framework of Quality Function Deployment, Value Engineering, and Target Costing

Jariri and Zegordi (2008) incorporated three famous design cost management methods, called: Quality Function Deployment (QFD), Value Engineering (VE) and Target Costing (TC), which each of them performs very well in the area of cost management, into a mathematical programming model in order to achieve the maximum benefit of each method. The model, essentially, optimizes customer satisfaction subject to target cost.

The tool is a mixed integer zero-one nonlinear programming. The unified model has been proposed to prevent a non-optimal solution when methods interact with each other. The practitioner should be condent that the quality solution would be achieved in contrast to when the methods are applied sequentially. A simple automobile design example was formulated and solved to show the performance of the model. The roadmap for this integration is shown in figure 1.

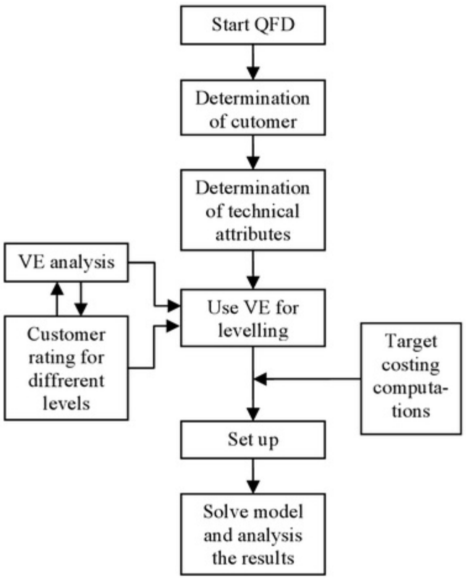

Figure 1: Model integration of QFD, VE, and Target Costing. Source: Jariri and Zegordi (2008)

2.3.4 Combining Value Engineering and Zero Defect

Ried (2010) describes the successful application and implementation of a combined Value Engineering and Zero Defect program for a leading European automotive supplier. The challenge was to solve enormous manufacturing quality problems as well as the totally unacceptable delivery time delays. The supplier has about 8 key customers, of which one had a total share of 70% of all deliveries. This client announced a total cut back of his orders, if the quality and delivery problems would not be solved with a period of 3 months.

The consequent and comprehensive application and implementation of a combined Value Engineering and Zero Defects Program has supplied really outstanding results for their client. The client has enabled to develop and manufacture quality products according to the high expectations of the car manufacturers. Delivery times are now also in order. The accountability and reliability of our client has been very much improved, which guarantees the existence of this company in the future.

2.3.5 Value Engineering Synergies with Lean Six Sigma

Lean Six Sigma (LSS), its Design for Six Sigma (DFSS) variant, and Value Engineering (VE) were developed as business process improvement initiatives. This paper explores synergies between LSS, DFSS, and VE by identifying opportunities where they can be used together to increase the likelihood of obtaining improvements beyond the capability of just one approach. In order to examine these synergies, Mandelbaum et. al. (2010) describes the steps and activities within each of the methodological phases to provide the reader an appreciation for the logical flow of events that transition smoothly from one activity to another, working toward a solution. These descriptions are also used to identify similarities and differences and construct a cross-reference mapping between VE and Lean Six Sigma.

Based on the authors' comparison of the methodological approaches and the examples of synergies discussed in the literature, it concluded that in some circumstances, VE techniques are better equipped to lead to improvements or solutions that complement those identified through a DMAIC/DFSS approach. These opportunities for synergy include the following:

- Function analysis and the FAST diagram. The disciplined use of function analysis is the principal feature that distinguishes the VE methodology from other improvement methods. Function analysis challenges requirements by questioning the existing system, encouraging critical thinking, and developing innovative solutions.
- Cost focus. VE only develops alternatives that provide the necessary functions. By examining only those functions that cost more than they are worth and identifying the total cost of each alternative, VE explicitly lowers cost and increases value.

VE does not take the place of Lean Six Sigma efforts, but it does present significant opportunities to enhance Lean Six Sigma -developed options. Therefore, the authors recommend that Lean Six Sigma training be augmented to include the VE approach to function analysis, creativity, and associated elements of evaluation and development to identify candidate solutions as part of the Analyze and Improve Phases of DMAIC. As far as Design for Six Sigma (DFSS) is concerned, VE tools should be explicitly used in the process.

3. RESEARCH METHODOLOGY

In order to achieve the objective of the research, the research methods are divided into 2 main phases (see figure 2). Stage I is employed in order to define whether there really is a problem. Stage II is conducted in order to address the findings of Phase I. The research employs a combination of quantitative and qualitative approaches (Green & Caracelli, 1997). The quantitative approaches are characterised by the use of control variables and objectivity through statistical methods. The qualitative approaches (Creswell, 1998; Miles & Huberman, 1994) will be conducted using a participative action research that surface critical assumptions and enable learning (Argyris et al., 1985; Carr & Kemmis, 1986) and a grounded theory (Glaser & Strauss, 1967; Glaser, 1978; Strauss & Corbin, 1998).

The instrument of research is structured questionnaire used in the survey for data collection. The questionnaire identifies the perception of construction industry stakeholder (limited to building construction) about the implementation of quality and value management. The data collected from questionnaire survey will analyze using Statistical Package for Social Sciences (SPSS) 20.

4. RESULT AND DISCUSSION

Data processing was performed based on the results of the respondents' answers in the questionnaire survey which has been framed structurally hence the respondents could comprehensively complete the survey. The structure of the questionnaire consists of three parts to include key success factors of quality in building project, identification of additional functions in building project, and total investment cost for building project.

4.1 BACKGROUND OF THE RESPONDENTS

In this section, the questions asked were in the form of employment information, education level, position in the company's and their experience within the company as well. The largest part of the respondent works in contractor firms with a coefficient of 31%. The second largest part of respondents works in consultants with a coefficient of 29%.

Data about respondents' working place is required as a consideration in analyzing the questionnaire survey data. Educational background of the major part of the respondents is under graduate with coefficient of 66% followed by graduate with coefficient of 23%, while other educational background with coefficient of 11%.

Most of the respondents' position in the company is largely coming from architect/engineer with a coefficient of 46%, while the level of director is with coefficient at about 9%. With the data above, the questionnaire has already been able to touch the middle level & manager level positions.

The working experience of the respondents in the companies is mostly in the range of 1-10 years with the coefficient of 69% followed by working experience in the range of 11-20 years with the coefficient of 20%.

4.2 KEY SUCCESS FACTORS OF QUALITY IN BUILDING PROJECT

This part tried to get the perception regarding to the comprehension of quality in terms of its key success factors and barriers for the success of a building project. The factors that influence the process of quality at the life cycle of the projects are also determined in this part.

4.2.1. Factors of performance indicator for the success of a building project

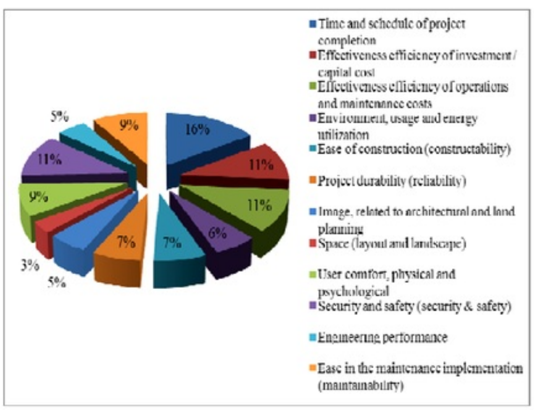

Figure 2: **Factors of performance indicator for the success of a building project**

From the data above, it can be seen that the dominant factors of performance indication for the success of a building project to include: time and schedule of project completion, effectiveness efficiency of investment / capital cost, effectiveness efficiency of operations and maintenance costs, security and safety (security & safety), ease in the maintenance implementation (maintainability), and user comfort, physical and psychological.

4.2.2. Barriers for the success of a building project

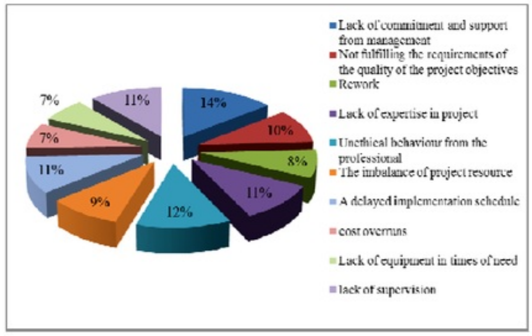

Figure 3: **Barriers for the success of a building project**

From the data above, it can be seen that the barriers for the success of a building project to include: lack of commitment and support from management, unethical behavior from the professional, lack of supervision, lack of expertise in project, and a delayed implementation schedule.

4.2.3. Factors in considering the conditions and limitations from building project at the design stage

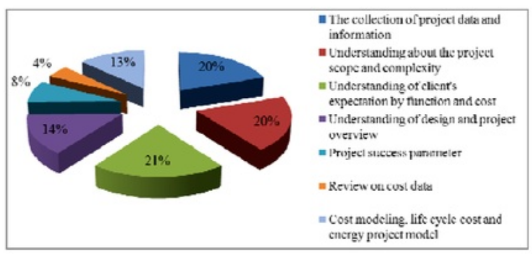

Figure 4: **Factors in considering the conditions and limitations from building project at the design stage**

From the data above, it can be seen that the factors in considering the conditions and limitation from building project at the design stage to include: understanding of client's expectation by function and cost, the collection of project data and information, understanding about the project scope and complexity, and understanding of design and project overview.

4.3 ADDITIONAL FUNCTION IDENTIFICATION (INNOVATION) IN BUILDING PROJECT

The survey results showed what kind of benefits and the applications expected by the respondents on each additional function. The result can be seen in the following table.

Table 1: Expected Benefits of Additional Functions

Additional Function in Building Design	Expected Benefits
Energy efficiency	- Reducing electricity cost - Lower maintenance costs - Resource efficiency - Avoiding global warming - Encouraging the use of renewable energy - Considering the building aesthetics
Environmental friendly	- Energy efficiency and conservation - Protection for the area around the construction site from the environment destruction - Creating a healthy environment for the user - Economic benefits (saving money) - Improving air quality - more durable and long lasting building
Security & safety	- Increasing sensitivity to fire - Controlling the entire system technology equipment installed - Reducing total life-cyce cost - Protect users from unwanted attacks
Comfort & health	- Comfortable controlled environment - Integrated control for the resource elements through one system - Regular temperature that can be controlled to adjust to user needs - Quick service for the user - Submission of a rapid and precise communication
Accessibility & mobility	- Controlling access to a building in a flexible - Ensuring the privacy of users building - Track and trace the movement of the use / visitor to security - Controlling the opening and closing access to the use of the building as you wish - Accessing the parts of the building without using a key and PIN code that is shared by many users
The effectiveness of the operations and maintenance (Maintainability)	- The use of intelligent systems to reduce costs through energy efficiency - The integrated system providing ease of centralized control - Extend the life cycle of a building - Lower operational cost for human resource (for maintenance activities, service, and security) - Reducing capital expenditures and operating costs over the life cycle of a building - Better data to maintain and operate the building

The most expected benefits from the concept of efficiency energy on building projects that have been identified based on the responses from the survey to include reducing electricity cost, lower maintenance costs, resource efficiency, and avoiding global warming. Benefits largely expected from concept of environmental friendly to include energy efficiency and conservation, protection for the area around the construction site from the environment destruction, and creating a healthy environment for the user.

From the security & safety functions, the most expected benefits that can be obtained for the design improvement of building projects to include increasing sensitivity to fire and controlling the entire system technology equipment installed Major part of the respondents expect benefits from the design improvement by optimizing the functions concerning the comfort & health on building project that have been identified based on the responses from the survey is comfortable controlled environment. In the function of accessibility & mobility, the most expected benefits are to controlling access to a building in a flexible, and followed with ensuring the privacy of users building. Benefits mostly expected by optimizing the functions of effectiveness of the operations and maintenance on building project are the cost reduction which can be led by the use of intelligent systems through its energy efficiency and ease of centralized control provided by the integrated system.

Table 2: Application of Additional Functions

Additional Function in Building Design	Applications
Energy efficiency	- Planning for efficient artificial energy saving lighting - Planning for artificial efficient and energy-saving cooling - Planning for appropriate building envelope - Use of renewable energy - Selection of efficient vertical transportation
Environmental friendly	- energy efficiency - water efficiency - Improving the quality of the space environment - Optimizing operations and maintenance - Structure design efficiency and placement - material efficiency - Waste reduction
Security & safety	- Procurement of fire protection systems - Integration of accident prevention through the use of building materials and construction techniques - Occupant emergency evacuation planning system

	- Building design which reduces the possibility of accidents - Installation of integrated security system - The use of controlled access system (authorized entry system) - Handling system against the threat of cybercrime and information technology
Comfort & health	- Optimizing the system of HVAC (Heating, Ventilation and Air Conditioning) - Reducing the impact of toxic material in space - The use of work systems and automation control - Integrated communications system - Development of comprehensive network access in the building - Energy metering, automatic monitoring system integrated to the billing of energy usage - Entertainment
Accessibility & mobility	- Comfortable mobility system for handicapped / disabled people - Provision of easy access to public space / emergency assembly point - Control of vertical transportation systems
	- Setting vehicle access system into the building - Access gate supervision - Door locking arrangement
The effectiveness of the operations and maintenance (Maintainability)	- Easy to operate and low maintenance design - Easy to maintain and energy-saving equipment usage - Easy to operate maintenance systems - Implementation of a centralized operational monitoring system

The concept of efficiency energy can be applied to improve the design of the building project by planning for efficient artificial energy saving lighting, planning for artificial efficient and energy-saving cooling, and planning for appropriate building envelope, while the concept of environmental friendly can be applied in such these ways to include conducting energy efficiency and water efficiency.

The function of security and safety can be done by applying the procurement of fire protection systems, integration of accident prevention through the use of building materials and construction techniques, occupant emergency evacuation planning system, building design which reduces the possibility of accidents, installation of integrated security. To obtain the function of comfort and health, the applications should be able to optimizing the system of HVAC (Heating, Ventilation and Air Conditioning) and reducing the impact of toxic material in space. Applications that can be set on in order to optimize the design of a building project are comfortable mobility system for handicapped / disabled people, provision of easy access to public space / emergency assembly point, and control of vertical transportation. Easy to operate and low maintenance design, easy to maintain and energy-saving equipment usage, easy to operate maintenance systems are some of applications that put on the building project to obtain the optimization of its design from the function of effectiveness of the operations and maintenance.

4.4 TOTAL INVESTMENT COST FOR BUILDING PROJECT

Additional functions attached to the building project will impact to the increase of investment cost as well. Based on the responses to the survey, it is found that the increase of cost that still can be tolerated with the additional functions in the building project is 0 -15% from total investment cost of the building.

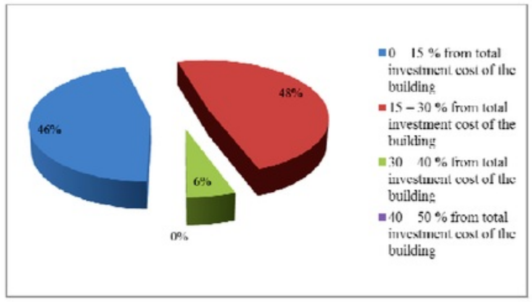

Figure 5: Increase of investment cost of building project with additional functions

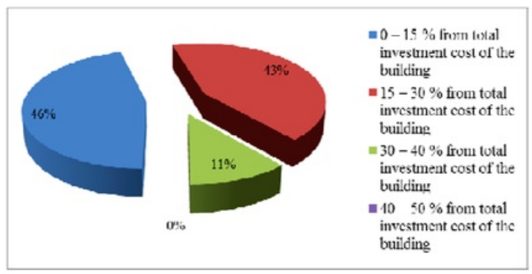

Figure 7: Cost efficiency of building project without additional functions

Based on the data above, it can be seen that the cost efficiency expected by the respondents is of about 0 - 15% from total investment cost of the building.

5. CONCLUSION

The quality and value issues still arise not only the end-product but also the process of construction projects. Poor quality, accidents, late delivery of projects, poor workmanship and cost overrun will affect project performance. Construction industry players believe that they need to pay attention about quality to ensure their position in the emerging market both national and international market. Scholar indicate that quality management and value management has been adopted by many countries in construction projects to ensure effort to achieve the required level of quality of project. Quality management and value management are proven method to improve project performance which could be systematically managed during life cycle projects start from planning and design to operation or execution of a project by adding innovations to the project. Further development of this research will produce a guide to improve project performance using the integration quality management and value management. The contribution of the research is expected to improving current situation of construction projects to be more efficient, effective and innovative.

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