CHAPTER I

INTRODUCTION

A. Background

As the construction industry continues to be one of the fastest growing sectors of any economy, be it in developed countries, developing or even under developed ones, the urge to deliver the best product output in terms of a well-designed building project, which is able to satisfy the clients and ultimate end users is becoming very important in the industry. This has again been added onto by the scarcity of resources, hence the need to put the little available ones to the best use i.e. producing the optimum design solutions. The latter being attained when we incur only costs that cannot be dealt away with on a project, a principle called “Value for Money (VFM)” in projects. It is therefore because of, this new VFM phenomena that there is a great tendency by most clients having their common initial question after giving a brief of their requirements, to be “what is it going to cost me?” often followed closely by “can we do it any cheaper?”(Cunningham, 2013).

The briefing stage is closely followed by building a project development phase which consists of various stages of project life cycle with every phase closely linked to the others. The major stages being project ideal conception, briefing, design development, tendering and procurement, construction phase and operation according to Royal Institute of British Architects (R.I.B.A). The first two stages are so important when it comes to influencing how the project will be i.e. the briefing and design development stage, because the designers are still in great control of changes to all aspects of the project while fulfilling their

responsibility to produce a building design solution which can satisfy the clients' needs, in a more economical way both constructing and operating. In connection with that therefore, it's hear that designers have a chance to influence on the implications of buildability and costs on the project since adjustments are still easy to make, considering the fact that the scope of work covered is still minimum

Furthermore, in line with that, researchers like Cyon Research (2003); and Maver (1970),defined this process called designing as repetitive process through which a set of clients' needs like; physical, aesthetic, performance, costs and so on are creatively manipulated, producing an outcome called a design(as in architectural blueprints, engineering drawings and so on). Hence, it's through this continuous manipulation process that it's made possible for the problems of function, form, shape and economy for building can be tackled (Pena and Parshell, 2001).This is why for Mao et al. (2007), they said in their research that designing process comprises of complex interaction of skills, judgment, knowledge, information, and time as governed by the client's requirements, as a result involves modelling manipulations. Therefore, it needs problem finding, solving, deductions basing upon drawing inferences, inductions, and creation of new concepts plus analysis and synthesis.

According to Ashworth (2004), this whole process of manipulations, modelling, adjustments has resulted into discovery of various ways, variables or parameters to achieve it. This meant that every building construction project is planned, designed and constructed differently in terms of plan shape and its complexity, building height and number of storeys and so on, with each way attracting different costs, but all outputting area of use/accommodation which is

equal, hence for that matter there is a necessity to do assessment of the different design alternatives so as to come up with ones which can be the best in terms meeting clients requirements and buildability of the project.

As a matter of fact, in attempting to find solutions for all constraints encountered during the design process, the design consultants team will always try to remodel or adjust on a wide range of issues(Baxter, 1983), especially to do with how best the building project could be delivered (i.e. cost management), without compromising the usable space, performance and quality, hence producing the optimum design solutions.

These design manipulations or call them modellings i.e. giving different ways of design combinations on putting together building elements, has been organized into parameters which have come to be known as building design variables.

According to Seeley (1996) in Ibrahim (2004),a building design variable was defined to mean a numerical input which can change during the design optimization, or that can be kept constant in another case, but is able to change in different other scenarios even while providing the same accommodation. They include plan shape, building size, circulation space, perimeter floor area ratio, storey height, and the total height (number of storeys) of the building among others.

This general practice of modelling building designs is aimed at achieving an optimum balance between the benefits desired from a project and the resources expended on its delivery, hence achieving what has come to be known as Value for Money (VFM) project. Furthermore, it’s this VFM concept that over the years

has come to be known within three most common terms that have been associated with it, i.e. Value Management (VM), Value Engineering (VE) and Value Analysis (VA) (Saleem et al., 2011).

According to previous research studies, perimeter-to-floor unit construction costs and overall project costs are affected by variations in these building design variables, a case in point, for example researchers have established that the more complex and irregular the building shape is, (i.e. the more it tends away from the square shape) the more expensive it becomes to construct(Seeley, 1996 and Ashworth, 2004); (Seeley, 1983); (Kouskoulas and Koehn, 1974); (Pena and Parshell, 2001); (Staedman et al., 2009); (Wing, 1999)as reported in Ibrahim et al. (2015).This is so because of the constructability problems that usually come up due to complexity/irregularity calling for expensive specialized skilled manpower and taking a lot of time construct, plus increase in quantities of individual building elements like external walling with their associated finishes, cladding, roofing costs, setting out costs, foundations, mechanical and electrical services among others(Ashworth, 2004; Ibrahim et al., 2015; Ibrahim, 2004; Ibrahim, 2007; Seeley, 1997; Ferry and Brandon, 1999).

Furthermore, this can be because if a certain shape layout has increased size of the building and surface areas, it will in turn influence also energy requirements like cooling and heating i.e. mechanical and electrical services elements. This is made possible due to the fact that, a building loses most of its heat through walls and roof, as the less complex its shape is by avoiding shapes like “T”, “H” and “L” and the more compact it’s blocks are, the lower the occurrence of heat loss during its total life cycle. This is due to fact that it

presents fewer thermal bridges and, generally, smaller contact areas, reducing of heat transference medium between its inside with the surroundings, because as depicted from the formula, Heat flow is equal to Transmittance U * Surface area, A * Temperature differences, ΔT. Hence, need for better planning and management of their costs(Zima, 2008).

B. Problem Identification

The design process in many projects has been found out not to produce optimum designs, in that on many occasions a great number of them have been found to result in wastages during construction as a result many unnecessary costs and resulting in low value for money *(Nilai Manfaat*) of projects realised. This has not only affected owners of new projects but also contractors who end up earning low from projects, hence threatening the continuity of their business.

As a matter of fact in Indonesia this problem was the background upon which ministry bye law (*Peraturan Menteri PU, Nomor: 06/PRT/M/2008 tanggal 27 Juni2008)* was issued, about the guidelines on implementation and supervision plus checking of construction works. It was decided that if the department of public works PU discovered existence of inefficiencies or wastages resulting from unnecessary construction costs, poor type of form of construction, poor cost estimates, and even the method of construction itself, then it becomes incumbent on owners and service providers to do Value Engineering (VE).

In connection with this is the rapid growth of economy which has seen problem of economics take centre stage now on infrastructure developments. This can be seen to have resulted in birth of design variables (parameters), and their corresponding impacts on costs. A case in point is study of Seeley (1996), who

established after comparing two buildings of rectangular and irregular shapes, each of them with similar area of floor. The Irregular shaped building was found to have 6% more external walls to enclose the same floor area, setting out costs increased by about 50% by 20% and drainage cost by approximately 25%.

In addition, the fact that general 80% of costs for any building are established during designing while only 20% by construction, then much emphasis needs to put to modelling this design process to ensure that adequate optimum designs are obtained, something that can greatly save resources expended on a project("Designing Building," 2015).In line with that, that's why many of the past studies put emphasis on defining the right problems and afterwards workout various possibilities to solve them, which can be choosing the best building design variables (parameters), after analysing their cost implications (value management), a practice to minimize on unnecessary costs(Ashworth, 2004). This is because it does away with specific building components having no real function or avoiding spending on unnecessary materials, to achieve this, design consultants need full knowledge of major aspects of the user requirements for the project, and have capacity to compare the final costs resulting from the many possible alternatives a project design can take and be constructed (Allsopp, 1983; Coombs, 1983).

In perspective of Indonesian building construction industry also many traces on this practice of how to achieve value for money are reflected in application of value engineering, for example findings of (Priyatno, 2010);(Johan and Lillyana, 1998); (Mahendra, 2006); and (Peter and Elfran, 2013). However important to note from their findings is that they discovered that limitation of

knowledge is a major hindrance in application of Value Engineering application (*Rekayasa Nilai*), by practitioners in the construction industry.

Therefore in order to contribute to this area of development in building construction industry whose growth according to report by *Badan Pusat Statistik* (BPS) 2014 was estimated at 15,64 percent, and to develop within the great economists assertions on economics like, *John Ruskin (1819- 1900) who said "It is not the cheaper things in life that we want to possess, but the expensive things that cost less"*, in Landow (2000).

Therefore, a research on clear analysis of the parameters of the building (design variables) and how they affect costs, while providing the same space accommodation and quality standard has been suggested as it would be of much importance to development of Value Engineering practice in turn attaining value for money projects. This is because it could provide solutions to designs as early as the initial stages of design development.

Another problem, this study is sought to solve is that basing on previous studies they have been largely focused on how design parameters affect overall total cost of building, so as an improvement this research sought to go an extra mile to ascertain how individual elements of foundation, walling, roofing, finishes, services among others are affected by the design variables.

Therefore, this was proposed to help in going a long way onto providing in depth information which could help designers on producing value for money (VFM) designed projects by being cost cautious of their design projects and putting resources to their best use.

C. Problem Formulation

In trying to tackle this problem generally faced by construction Industry as far as producing well evaluated designs and giving value for money to clients' projects in developing countries like Indonesian is concerned, this research sought to provide answers to the following pertinent questions which form the basic research problems that this study attempted to answer:

1. What are the general clients' expectations and priorities for any building design?
2. What are the building design variables/parameters adopted by design consultancy firms in modelling the cost of the design so as to remain with in financial constraints of clients, while providing the best design variable combination, hence value for money?
3. How does the building design variable/parameter of building plan shape affect the overall total project costs and individual element costs of a building project?
4. Which building elements a greatly impacted on costs while modelling shape of building that need to be highly controlled so as to be able to easily adjust designs or reduce unnecessary costs in order to have well valued projects?

D. Objectives of the Study

The aim of this research study was to analyse the implications of building design variables as areas of cost modification so as to attain value for money in building projects, hence to achieve this goal the following were set as research objectives:

1. To investigate the building construction design process in order to identify the main client priorities on any building project and design variables considered by designers in relationto adjusting costs and adding value for money.
2. To analyze to what extent the design variable of plan shape affects costs of building project construction.
3. To make recommendations to those involved in building design development, on possible areas of cost saving and adding value for money, for clients in building construction industry of Indonesia.

E. Scope and Limitations

The following restrictions were imposed on this study because of time and cost constraints:

1. The statistical sample of respondents selected to participate in the questionnaire survey was restricted to design consultancy firms and clients in Surakarta and its surrounding areas, with the questionnaire being administered to a population of 30 respondents.
2. The case study analysis was limited to two sources of data i.e. projects construction plans and cost estimates that is “Rencana Biaya Anggaran, RAB” of selected completed building projects in Surakarta and surrounding areas.
3. The case study analysis was only to deal with cost implications of design variable of the plan shape, and restricted to regular shapes.
4. The costs from the building considered were only restricted to elements related to the shape of building i.e. concrete frame, walling, plastering,

painting and PVC pipe, hence the likes of external works, site preparation, foundations, interior designing, windows and doors, roofing, floor screeds, mechanical and electrical services are not included.

5. The analysis was also limited to building case study projects whose level of technology was with in range as observed from the number of floors which are comparable interms of structure requirements which are as a result of loading.
6. The other non-measurable factors like esthetic considerations are not considered.
7. The research was set to be carried in a period of only nine months beginning with three months proposal writing, then six months to include data collection, analysis of results and discussion, presentation of thesis and paper publication.

F. Justification and Benefits of the Study

Having seen that the building construction industry is one of the fastest growing economic sector according to *Badan Pusat Statistik (BPS)* report, the requirements by most clients are shifting from having to cost a completed design and then do cost control on it during construction, to designing to a cost i.e. having cost on the best design alternatives, elements, materials and construction methods, in line with *John Ruskin's quote (1819- 1900)* (Landow, 2000). This new trend needs to be enhanced by rigorous studies and how to cope up with it.

In line with that is Value Engineering or Value Management or Value for Money technique as it may be called in the different construction industries, was recommended by PU, and previous researchers having identified the application

of this technique in the building construction industry in Indonesia but with a major constraint of limited knowledge on it (Priyatno, 2010; (Johan and Lillyana, 1998) etc.). Hence this research was deemed necessary because by achieving the objectives of it would provide the following benefits to the industry:

1. Indicate the different building design variables which when well modeled have great impact on overall costs of a project and hence of benefit to designers and clients to make informed choices in Indonesia, while setting out project priorities.
2. Since according to Ibrahim (2004), the accuracy and ease of estimating exercise is highly dependent on the amount and quality of information available to the estimator or the designer, this study would also benefit estimators by availing information of cost engineering.
3. It would help to illustrate to what extent these variables can vary in effecting overall costs and individual costs of elements, during design by analysing selected case study projects.
4. Indicate the accuracy level on previously completed projects as far as value for money on built projects is concerned, which will in turn highlight the extent of improvement needed to improve the next phase of project designs and techniques to use.