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# Strategies to Improve the Quality Parameter of Building Construction Projects in Sri Lanka

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## Cover Page Footnote

The authors would like to thank the industry experts who have actively participated in the surveys, interviews and discussions for this study.

# Strategies to Improve the Quality Parameter of Building Construction Projects in Sri Lanka

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## Abstract

Construction industry is a booming industry in Sri Lanka. Influence by the construction industry to the society in terms of both socially and economically cannot be underestimated since its contribution is high. Since this is a highly widening industry lots of beginners are coming to the industry as both investors and contractors. Every contractor is keen on increasing their market share. So, maintain the quality of these project is highly important in the current market. Poor quality in construction affects its every stakeholder. Safety issues, losing the strength of the structure, not enhancing the required appearance and additional cost for rectification has been some major issues due poor quality in the industry. Therefore, this research carried out to investigate strategies to improve the Quality parameter of building construction projects in Sri Lanka. Accordingly, mixed method research approach was selected. Accordingly, questionnaire survey was revealed imposing quality practices effect the quality in building construction projects, training and development of workers effect the quality in building construction projects, involvement of skilled staff and labour effect the quality in building construction projects, lack of skilled staff and labour effect the quality in building construction projects, utilization of new technology effect the quality in building construction projects, and quality of materials effect the quality in building construction projects are the critical factors affect quality of building projects in Sri Lanka. Through the qualitative approach it was recommended suitable practical solutions to control the above identified critical factors.

***Key Words: Building projects, Construction industry, Quality, Sri Lanka***

## 1.0 Introduction

The word 'Quality' can be defined as meeting legal functional and aesthetic requirement of a project(Arditi & Gunaydin, Factors that affect process quality in the life cycle of building projects, 1998). Further it contains various definitions under various circumstances(Chan & Tam, 2000). The usage and the necessity of the client gives a significant impact on the quality of the product(Charantimath P. , 2003). It may be greater or higher. Yet it is a vital factor considering all the aspects of the society(Dilawo & Salimi, 2019). According to Jain (2001), the degree to which a product meets the requirements of a customeris the simplest theory of defining Quality. Interpretation of the Quality was defined in various ways by various individuals(Loganathan & Viswanathan,

2016). The shortest way of defining by a comprehensive acceptance is quality is customer satisfaction(Charantimath P. , 2003). Therefore, the necessity for quality control and quality assurance covering every area of construction industry is vital at present(Arditi & Gunaydin, Perceptions of process quality in building Projects, 1999). Required and relevant control throughout the period at every stage should be carried out throughout the period to achieve a good quality product(Loganathan & Viswanathan, 2016).

The cost of poor quality is an immense problem faced by the in-today's construction industry(Atkinson, Weterhouse, & Wells, 1997). Hence it is crucial to identify the cost of poor quality so that one can determine the expenses associated with producing quality products (Waje & Patil, 2002).As Loganathan and Wisvanathan, (2016), emphasized there is great influence in economy by cost of poor quality on construction projects. If it is project done by government sector the government has to invest on same project again(Arditi & Gunaydin, Perceptions of process quality in building Projects, 1999). Further to that due to that every stakeholder who is involved to that project have to suffer(Dilawo & Salimi, 2019). Mashwama, et al. (2016), states success or failure in the construction in the construction industry drastically effects the socio-economic development and employment of the country.

According to Rumane (2011), cost of poor quality is cost faced due to production of low-quality services and products. Unsafe work structures, delays unskilled and non-suitable workforce, cost overruns and disputes in construction industry creates the poor quality in products(Martin & Thompson, 2011). As per Chandrasena (2003), using unskilled labour in construction industry, utilization of law quality materials e.g., low quality cement, bricks etc. are the critical factors that effects the quality in construction industry in Sri Lanka. In order to get rid of these problems proper quality control methods should be involved in building projects which is based on tender documents, working drawing etc(Chan & Tam, 2000). This quality control procedure should be long last from commencement to completion time of the project(Rumane, 2011). Therefore, it is already proved that quality control is a crucial aspect in construction industry(Chandrasena, 2003).

Galagoda (2017) stated that the most significant problem in local construction industry is lack of properly trained skill labour for machine operation. Further it conveys on the technological aspect of the country as Sri Lanka being a developing and traditional country is little reluctant to move forward with new technology because it is expensive(Jayalath & Gunawardhana, 2017). Hence in order to go beyond the traditional construction boundaries the Construction Industry Development Authority (CIDA) should introduce new technology and should uplift the industries with the collaboration of the contractor's union(Gunasekara, 2018). In addition to that Rajakaruna, et al. (2008) stated that major problem in local construction industry is lack of skilled labour and less skill level of fresh graduates. High demand for these professionals in the world, less salary in the local market increase their migration to highly paid countries like U.A.E and Dubai to overcome this problem proper training programmes should be conducted(De Silva, Sachindrani, Hatharasinghe, & Bogahawatte, 2015).

All above mentioned critical factors which effects the quality in construction industry(Arditi & Gunaydin, Factors that affect process quality in the life cycle of

building projects, 1998). These factors play vital role in increasing or decreasing the profit in the industry(Chan & Tam, 2000). Hence, identification of the critical factors affecting on construction quality is a one of major aspect to increase the profit of a project(Loganathan & Viswanathan, 2016). Therefore, this study intends to investigate the improvements need to adapt in order to improve the quality aspect in Sri Lankan building construction projects.

## 2.0 Materials and Methods

### 2.1 Materials

#### 2.1.1 Term of Quality in Construction Project

Quality is defined by number of researchers as per their point of view. Pheng and Hwa (1994) and cited Chan and Tam (2000) further elaborate that in the construction field, quality is defined as the sum of features demanded by a product to amuse a relevant need, strength for purpose. As Arditi and Gunaydin (1998) emphasized the quality in construction industry can be defined as catering the requirements of the designer, constructor and regulatory agencies as well as the owner. Hughes (1991) states the two conditions to the define quality. First, the characteristics of a product or a process can be defined as quality. A subjective reaction to something which is good is relate as quality. It is the second one. Difficulty in defining, difficulty in control are two main aspects of quality. Atkinson (1997) called time, cost, and quality criteria as the "iron triangle". Losses can be omitted through proper handling of success factors effectively these are the essential to a project success. In addition to that impact of quality to time and cost cannot be underestimated or neglect.

#### 2.1.2 Review of factors affecting construction quality parameter

As per Waje and Patil (2002), 6-15% of construction cost is found to be wasted due to rework of defective components detected during maintenance. According toMashwama, et al. (2016) revealed 20-40% of the defects in the projects are arising during construction phase whereas 54% of the defects are based on the use of unskilled workforce insufficient supervision in construction work. 12% of the construction defects are due to material problems and system failures. Further this researcher emphasizes that through keen inspection of construction sites these effects can be reduced. But defects arising due to discrepancies in material behaviour and sudden environmental changes are uncontrollable(Chan & Tam, 2000). Hence in order to avoid that proper inspection should be established in construction projects(Dilawo & Salimi, 2019). Various researchers have been identified following factors are the critical factors affecting quality of construction projects.

- Imposing quality practices for building construction projects

Rajakaruna, et al. (2008) in the research states ultimate goal of the construction industry is to complete the projects while achieving quality standards. If the work is well designed the expected quality can be met. In Oder to raise the buildability which achieves high quality there should be a close connection among contractors, suppliers, designers of the project. In order to achieve high quality, the quality standards of the project should be reviewed, maintained and improved yearly and the implementation of Total Quality Management is crucial(Jain, 2001). In addition to that from the employees' side providing them a career growth may motivate them and help to retain the employees in the organization for years. This gives them a good training on

their jobs which automatically increase the quality of the project(Chandrasena, 2003).

- Role of Project manager in building quality management

The project manager plays a vital role in project by taking policy decisions in site level(chan, Le, & Jin, 2015). In addition, project manager's involvement in site activities motivates his fellow team members and they start to work enthusiastically(Peter & William, 2002). In accordance with Tan and Goa (1995), attitudes of the project team and project manager matters a lot for achievement of quality. In addition, as per Mahmood, el at. (2012) use of skilled labour and proper supervision and assessment on project sites and providing effective leadership, cash flow are the success factors which paves the way to reduce cost of poor quality.

- Affect from adequate monitoring and feedback

In accordance with Dale, B.G., (2003) frequent monitoring and feedback in each stage of project are two key factors that gives high quality finishing. Therefore, good communication among stake holders is highly essential.

- Affect from Team spirit of the construction team

As per Hassan, el al. (2000) team is combined with its own internal structure with team leader on the other hand structures of translation and multi-party relationship. Team does not have an appointed leader and the teamwork towards achieving the goal of quality(Moshini & Davidson, 1991).

- Affect from Involvement of owner

As per Chan and Tam (2000), owners should monitor and evaluate the real work in the site, inspectors from clients' party work with the contractor to implement good quality control procedure before the work is done. Furthermore, Poor coordination and communication among coordinators will end up with waste, delay and excessive cost(Faridi & El-Sayegh, 2006). To have proper bond in-between these two parties the presence of the owner is required(Srinivasan & Dhivya, 2020).

- Effect from Coordination among Stakeholders.

The lack of awareness about the construction process by the clients is one of the major issues in the present(Thabani, 2019). The ultimate measure of construction quality is the client satisfaction(Rashid & Khairuddin, 2017). Good quality improvement systems and strong relationships between stakeholders is critical when achieving high quality of a construction project(Watermeyer, 2012). Every person construction field must be inspired and supported every time to obtain good quality in construction(Low & Tan, 1996).

- Affect from training and development

Rajakaruna, et al. (2008), in order to fill the gap between skill and knowledge training and development should be implemented. Limited allocation of funds for employee training one of the major problems faced by every organization today(Chandrasena, 2003). According to present situation of the country this training need is halfway quenched through National Apprentice and Industrial Training Authority (NAITA) ICTAD, and few other technical colleges owned by the government, which is not enough to cater the demand. Thus, I may suggest universities to get involved in this process(Rajakaruna, Bandara, & Silva, 2008).

- Affect from Lack of Skilled Staff and Labour

Rajakaruna, el al. (2008), the major problem in local construction industry is lack of skilled labour and less skill level of fresh graduates. High demand for these professionals in the world, less salary in the local market increase their migration to highly paid countries like U.A.E and Dubai to overcome this problem proper training programmes should be conducted(Chandrasena, 2003).

- Affect from Regulations of construction.

Galagoda (2017) stated that Construction Industry Development Authority should be given exclusive funds and facilities inorder for them to perform well in registering contractors, training laborers, determining limitations of raw materials etc.

- Affect from new Technology

Sri Lanka being a developing and traditional country is little reluctant to move forward with new technology because it is expensive(Samarakkody & Perera, 2021). Hence to go beyond the traditional construction boundaries the Construction Industry Development Authority should introduce new technology and should uplift the industries with the collaboration of the contractor's union(Sandaruwan, Hadiwattage, & Jayasinghe, 2021). Apart from that local contractors should be given an opportunity to collaborate with international firms in order to enhance their skill, knowledge and capabilities along with the new technology (Rajakaruna, Bandara, & Silva, 2008).

- Effect from Quality of Material

Galagoda (2017) in his article elaborates on the effect of material quality being used for construction in Sri Lanka. Mostly major materials used for construction are cement, sand, metal and steel(Ralegaonkar, Madurwar, & Sakhare, 2016). These factors determine the strength of structure in construction(Rameezdeen, Kulatunga, & Amarathunga, 2004). In order to achieve high strength concrete finest quality cement should be used(Al-Thani1 & Park, 2020). For that standardized techniques should be used instead of importing low quality cement for lower price(Akadiri, 2015). High quality sand is also another important aspect when comes to material quality(Chan & Tam, 2000). Using quality reinforcement is also a key factor for controlling quality in construction. High demand and competition in market has caused in production of low-quality reinforcement at present. Therefore, keen eye on this material is vital when considering material quality(Galgoda, 2017).

## 2.2 Methods

Dawson (2002) identified that research approach can be considered as a general principle which would guide the research and address the aims and objectives of the study. Creswell (2014) described the key research approaches as qualitative, Quantitative and mixed method approaches. As per Fellows and Liu (2008) there are several benefits of using mixed methods approach. Adding possible questions in the future, variation of respondents, necessitated awareness of other data sources, standard methods of confirmation and comprehension are several(Fellows & Liu, 2008).

After considering the nature of the study and the characteristics, the mixed research method was selected for this study. Through extensive literature review quality factors were identified and a quantitative questionnaire was carried out to identify the critical factors which affect the building

construction quality in Sri Lanka. After conducting series of interviews, a content analysis was carried out to elaborate the factors and provide necessary recommendations. The qualitative approach was first used to learn about the concept and then by using the quantitative approach the outcome was developed and factors were identified and ranked using Relative Important Index (RII) method.

$$\text{Relative Importance Index} = \frac{\sum Wi \times Xi}{A \times N}$$

Where,

i = Reaction classification index 1, 2, 3, 4 and 5

Wi = Weighting provided to the factor I by the respondents

Xi = Frequency of the response

A = The highest category of weight

N = Cumulative number of respondents

The range of the Relative Important Index is between 0 and 1(Arditi & Gunaydin, Factors that affect process quality in the life cycle of building projects, 1998). Then each factor was categorized based on the RII value and importance level of each factor. According to Akadiri (2015), five important levels are transformed from RII values: high (H) ($0.8 \leq RII \leq 1$), high-medium (H–M) ($0.6 \leq RII \leq 0.8$), medium (M) ($0.4 \leq RII \leq 0.6$), medium-low (M-L) ($0.2 \leq RII \leq 0.4$) and low (L) ($0 \leq RII \leq 0.2$) (Akadiri, 2015).

As the factors were ranked only significant factors were selected. High professionals who involved to the related field were asked comment on causes, and recommendations for the topic.

## 3.0 Results and Discussion

### 3.1 Background Information of Questionnaire Survey Respondents

As per the above-mentioned analysis the factors identified in the literature survey was validated through the questionnaire survey. Respondents of the survey were experts in the construction field in different fields. Project managers, engineers, architects, facility managers, and quantity surveyors were the main target. Accordingly, 150 construction industry professionals were selected as a sample of this study. Consequently, 117 completed responses were gathered, with a 78% of response rate. It is evident that the respondents of the questionnaire survey were consisting with sixty-six (66) quantity surveyors, twenty-eight (28) engineers, eight (8) architects, three (3) facility managers and twelve (12) professionals in any other category as shown in below Figure 01.

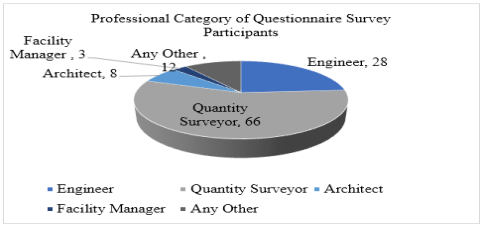


***Figure 1 - Professional Category of Questionnaire Survey Participants***

Furthermore, seventh (7) professionals had experience in over 15 years, thirty (30) professionals had 11-15 years working experience and forty-two (42) professionals had 6-10 years working experience in Sri Lankan building construction sector. In addition to those thirty-eight (38) professionals had below five years working experience. However, seventy-nine (79) professionals had over five years of working experience in Sri Lankan building construction industry as shown in below Figure 2.

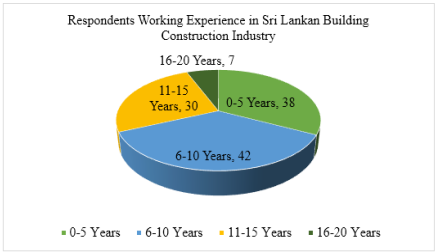


***Figure 2 - Respondents Working Experience.***

### 3.2 Factors Affecting Quality Parameter of Sri Lankan Building Construction Projects

As discussed in Methods section, all the respondents were asked to rank the factor from strongly disagree to strongly disagree. Accordingly, received results were shown in below Table 01.

***Table 1–RII value of Factors Affecting Quality of Sri Lankan Building Projects***

| Group Factors | Numbers of Responses | | | | | | RII | Importance Level |
|---|---|---|---|---|---|---|---|---|
| | SA | A | N | D | SD | Total | | |
| Imposing Quality Practices effect the quality in building construction projects | 88 | 17 | 4 | 2 | 6 | 117 | 0.906 | ***H*** |
| Role of Project Manager effect the quality in building construction projects. | 60 | 25 | 3 | 1 | 28 | 117 | 0.750 | ***H-M*** |
| Adequate monitoring and feedback effect the quality in building construction projects. | 45 | 30 | 7 | 22 | 13 | 177 | 0.723 | ***H-M*** |
| Team spirit of construction team effect the quality in building construction projects. | 55 | 18 | 5 | 35 | 4 | 117 | 0.745 | ***H-M*** |
| Involvement of owner effect the quality in building construction projects. | 48 | 26 | 21 | 11 | 11 | 117 | 0.752 | ***H-M*** |
| Coordination among stakeholders effect the quality in building construction projects. | 35 | 42 | 26 | 5 | 9 | 117 | 0.752 | ***H-M*** |
| Training and Development of workers effect the quality in building construction projects. | 91 | 17 | 2 | 6 | 1 | 117 | 0.926 | ***H*** |
| Involvement of skilled staff and labour effect the quality in building construction projects. | 95 | 18 | 2 | 1 | 1 | 117 | 0.950 | ***H*** |
| Regulations for Construction in the country effect the quality in building construction projects. | 50 | 33 | 11 | 16 | 7 | 117 | 0.776 | ***H-M*** |
| Lack of skilled staff and labour effect the quality in building construction projects. | 86 | 18 | 3 | 3 | 7 | 117 | 0.896 | ***H*** |
| Utilization of New Technology effect the quality in building construction projects. | 83 | 25 | 2 | 5 | 2 | 117 | 0.911 | ***H*** |
| Design Changes affect the quality in building construction projects. | 56 | 21 | 24 | 14 | 2 | 117 | 0.797 | ***H-M*** |
| Quality of Materials effect the quality in building construction projects. | 98 | 15 | 2 | 1 | 1 | 117 | 0.956 | ***H*** |
| Where :SA- Strongly Agree, A- Agree, N- Neutral, D- Disagree, SD- Strongly Disagree | | | | | | | | |

| No. | Profession | Working Experience |
|---|---|---|
| 01. | Civil Engineer | 20 Years |
| 02. | Civil Engineer | 07 Years |
| 03. | Civil Engineer | 14 Years |
| 04. | Quantity Surveyor | 06 Years |
| 05. | Civil Engineer | 12 Years |
| 06. | Civil Engineer | 15 Years |
| 07. | Quantity Surveyor | 10 Years |
| 08. | Architect | 07 Years |
| 09. | Quantity Surveyor | 15 Years |
| 10. | Architect | 10 Years |

According to the results shown in Table 1, it is revealed that imposing quality practices effect the quality in building construction projects (RII = 0.906), training and development of workers effect the quality in building construction projects (RII = 0.926), involvement of skilled staff and labour effect the quality in building construction projects (RII = 0.950), lack of skilled staff and labour effect the quality in building construction projects (RII = 0.896), utilization of new technology effect the quality in building construction projects (RII = 0.911), and quality of materials effect the quality in building construction projects (RII = 0.956) are **Highly importance** factors affecting quality of building construction projects in Sri Lanka. Accordingly, highly importance factors were selected, and an interview series was conducted.

### 3.3 Background Information of Interview Participants

The interview series sample size was comprised of various specialists such as civil engineers, quantity surveyors, and architects, as stated in Table 02 above. As a result, five civil engineers, three quantity surveyors, and two architects offered their expertise to this project. When the interviewees' work experience in the Sri Lankan construction sector is considered, seven professionals have more than ten years of experience and three professionals have less than ten years of experience.

### 3.4 Influence of Identified Factors to Quality of Building Construction Projects in Sri Lanka

As shown in Table 01, highly importance factors were selected, and interview series was conducted. The data collected through interview series was analysed using the content analysis. For the ease of analysis these six factors were taken into discussion under major three categories. As the influence from the quality of materials, influence from the quality of labour and the influence from the quality of methodology and technology. Factor "Quality of Materials effect the quality in building construction projects" was used to analyse the influence from the quality of materials. Factor "Involvement of skilled staff and labour effect the quality in building construction projects", "Training and Development of workers effect the quality in building construction projects" and "Lack of skilled staff and labour effect the quality in building construction projects" was used to analyse influence from the quality of labour and factor "Imposing Quality Practices effect the quality in building construction projects" and "Utilization of New Technology effect the quality in building construction projects" was used to analyse influence from the quality of methodology and technology.

- Quality of Material

Every respondent was mostly concern about the quality of materials use in the current market. Unavailability of proper quality control method is the major reason for quality reduction in construction. ISO

standards and CIDA certification now available for several materials. But major materials like bricks sand and metal which can be categorized as major materials, still don't have a proper quality control method. The observations done with experience by engineers and skilled labours prove the quality of those material by appearance of those and other physical methods which they are often in practice. Even for the natural sources such as clay deposits, proper method of quality control is not available which would eventually affect the quality of the bricks as well. In addition, the stipulated time duration of the project also affects the quality of it. Large scale buildings are planned for less contract duration. Therefore, a large-scale frequent material supply should be delivered to site within shorter period of time. This results in production of low-quality materials since proper quality control method cannot be implement due to limited time for production and production of a large quantity. Further the demand and the high competition in the market results in high production. This results in production of materials without proper inspections and quality control methods by the supplier. Contribution of Labour force in material production is also a key issue which paves the way for low quality output. For example, brick, block cement and ready-mix should be produced with sufficient knowledge of the mix proportion and required quality. If the material production team fails to address these factors this results in production of low-quality materials.

Environmental condition also makes a huge impact on the quality of materials. Scarcity and Unavailability of some resources in the county effect the quality of materials. Clay deposits, Metal crushers, sand dunes, lime deposits are not available in every part of the country and cannot be extracted at any time. Hence, this results in two ways. First one is due to high demand since they are not readily available suppliers' demands for higher rates. Therefore, they use illegal methods for mining and supply low quality materials. Apart from that due high rates and scarcity of the materials contractors go for alternative methods. The quality of these alternative methods cannot be guaranteed. The alternative methods may not meet the required quality standards or clients' satisfactions since the client's satisfaction is also a good yard stick of quality. Use of recycled materials is also a major issue for low quality material supply. For example, use of recycled steel for reinforcement production by a certain company is one of the highly addressed topics recently thus so-called brand was belted with a bad name in the industry for the production of low-quality steel. In addition, storage and transport majorly affects the quality of the material. Considering the easy means of payment methods and procurement most contractors tend to purchase bulk materials and store at construction sites. The quality of storage facilities cannot be fully satisfied. Due to dampness, heavy rains, floods, insects' materials may get damaged. As a consequence, construction industry enriches with low quality materials. Also, during transport and unsafe packing materials may tend to damage the quality of the material. Moreover, contractors use low quality materials for construction due to high taxes on import materials.

- Quality of Labour.

Quality of labour is another crucial factor which influence the quality of building constructions. In this study certain areas were highlighted which conveys the social and economic background of the country. Unskilled labour creates a huge impact for the quality flaws due to labour. The problem of unemployment prevails in the country is the major reason to cause unskilled labour.

Due to this lots of people who are not qualified to work in a certain field work for construction sites. They barely have the relevant knowledge about the construction industry. If proper supervision is not carried out regarding them, it may cause for defects in the design or a false work. Similarly, this results in lack of skilled labours to work in a site. The main cause for this is not having proper certification for these skilled workers. The label for skill or unskilled is given by the construction site. Although they claimed as skilled labours, they may not have sufficient knowledge or talent to do the work with required quality. They don't have proper training progmmmes or workshops which they can expand their knowledge regarding the relevant field they practice. If the workers are skill enough, they demand for high salaries where some companies cannot afford due to the limited budget they have. Hence, migration of these skilled labours is unavoidable as they earn more salaries in foreign countries. Another reason for lack of skilled labours is the attitude gap of workers. Construction industry is known as a fast-track industry. Hence the workers rarely have a work life balance. There are instances where they have to work for long hours. In addition to that the risk they are taking in construction sites cannot be underestimated. Therefore, these factors cause them to move for more flexible jobs than working as skilled or unskilled labour in a construction site. Less professionalism given to labours in the country is also another factor which avoids skilled workers from entering into construction field as a professional. Although they are skill enough and poses with unique skills since they don't have a proper certification to relevant professions, they are reluctant to stay in the construction industry. This results in lack of quality labour in the construction industry. Age of the workers is also another factor which affects the labour quality. Apart from labour rules there is no specific age limit for construction workers specified. Hence, the productivity of young construction workers cannot be achieved from older construction workers. Therefore, their quality of tends to decrease due less productivity. The impact from local and foreign labours also a major concern for the labour quality. As per a study by a respondent, foreign labours are more enthusiastic and energetic than the local labours which directly effect in their quality of work. Unfriendly payment methods by some companies are also cause in reduction of skilled labour working in their sites. If the labourhas stuffiest skill, they have a good demand thus they move on to a new building construction project which has a fair payment scheme.

Having a set of skilled labour itself won't increase the quality of construction. Proper supervision by the contractors'staffs also a major factor which affect the labour quality. If the workers don't get proper supervision their work may results in false work or defects. Unreasonable targets from management due to tight schedule is an issue for poor labour quality. When the labours are demanded to complete their work within given stipulated time period, achieving quality targets may cause some problems. Therefore, this result in poor quality of labours. In addition to that employing less experience staff for low salaries by some companies is also a major issue poor quality of labour. Due to Lack of experience proper instructions cannot be addressed and defects cannot to be identified. Hence, the labours work is not properly monitored. Hence results in poor quality in construction due to poor labour.

- Quality of methodology and technology.

Use of Quality methodology and technology is also another factor which highly effect the quality of building construction technology. Sri Lanka still being a developing country is very much reluctant to use new technology. This is most because of the lack of exposure and high cost of implementing new technology. Lack of skilled staff to use new technology has been a major issue for the contractor to implement new technology and methodology for building constructions. This result in using conventional methods for construction which result in false work and wastage. For example, use of bamboo jacks and local formwork methods for formwork, timber shoring works and etc. this results in poor quality in construction. In addition to that lack of awareness by the client party affects the factor. Most clients don't aware about the life cycle costing of a project and reluctant to invest money on high quality products. Therefore, they are discouraged to invest in high quality material as it increases the initial cost of the project. This results in low quality building constructions. There are occasions where clients don't hire a consultant party as it cost more. They form an in-house team with engineers' architects, quantity Surveyors and relevant technical team and do the project. Since there is no one to monitor and the quality of the output quality of the product collapse. Furthermore, even the consultant team is hired there are occasions where the contactor does not follow standard documents like FIDIC, SBD, NRM, SLS 573 and Specifications. Hence required quality cannot be achieved in the output.

Contractors influence to maintain the required quality also highly affect this methodology and technology factor. Most companies are reluctant to get quality certificates since the initial cost is high. Therefore, the use of quality procedures is not seen. The attitude of the contractors' staffs also affects the quality of the project. Their necessity to do the task with high quality result in the quality of the output. Contractors' staff is responsible in using quality materials and proceeding proper methodologies. Documentation part in the construction process is also a vital factor which determine the quality of the project. Lacking relevant and required documents results less focus of the project. With the high demand and competition in the market for building constructions contractors have practiced getting projects from low bids. This result in discouraging contractors to minimize the budget of the project. Hence, the budget allocated for maintaining quality procedures is very low.

### 3.4 Strategies to Improve the Quality of Building Construction Projects in Sri Lanka

The critical factors which were identified as most influential causes for building construction quality were elaborated under above discussed categories. Every respondent's idea was that the quality standard of the building construction industry in Sri Lanka can be enforced if the stakeholders pay much attention to above mention critical factors. The inability to address above issues significantly cause for poor quality in construction. A Quality output will always give a good market share for the contractor, satisfaction to the client and also good reputation and brand name for the Sri Lankan construction industry.

To enhance the material quality in the market implementing new technology for material production, use of high-quality alternatives to avoid natural resource depletion, conducting more research and work studies to find innovative methods of material quality maintenance can be identified. So far National Building Research Organisation (NBRO) has done a good job with regard to research and development of this area. Educating

suppliers and recommending quality procedures to maintain material quality also can be applied to maintain the required quality of materials. Proper means of storage and transport can enhance the quality of the materials. Government reducing tax on construction materials can encourage contractors to use high quality materials for the construction.

Maintaining and retaining ideal human resource is one of the sensitive facts to be addressed in the industry. The workmanship quality highly influences the quality of the product. Therefore, concerning more on job satisfaction of the labours is very important. To reduce working stress shift hours method can be implemented. Through work studies more practical norms can be derived which helps in identifying the scope of a labour. Workers can be categorized and with proper training they can be developed in to specialized labour gang. Using specialized subcontractors to specific work section can be identified as a good solution to uplift the labour quality in construction. Corporate Social Responsibility (CSR) is a good solution to uplift the labour quality of labour force in the industry. At present some companies practice CSR which is highly beneficial to both company and society. In addition to that proper supervision and motivation of labours is highly essential to carry out the work. Whether the labours are skill or not proper supervision is essential to make sure that the workmanship has meet the required quality and specifications. Proper means of labour satisfying payment methods also should be implemented to keep the skilled labours in the company. With aforementioned recommendations problem of shortage of skilled labour can be successfully eliminated.

Imposing proper quality practices also can enhance the quality of construction. Encouraging contractors to follow-up quality procedures Like ISO certification, considering more on quality factor when giving CIDA certifications and award scheme for following quality procedures can increase the contractors indent to complete a project with high quality. Through enforcing contractor to employ qualified staff with QA/ QC knowledge and following up standard documents, consultants and clients can encourage contractors to follow-up more quality procedures. Contactors top management commitment is must if they are to implement quality procedures thus the minor staff can implement them. Use of lean construction methods can identify as a good methodology to implement to enhance the quality of the project as well in the process. These lean construction methods won't compensate the quality of the product or the client's requirement. Relevant authorities should make sure that construction professionals are well educated and aware about the Quality procedures. To bring out the advanced construction professionals to the construction arena the educational bodies who provide construction related courses should include QA/QC engineering as a subject to engineering syllabus and conducting proper training and development programs and workshops to the current employees also create positive consequences in achieving better quality. Associating the developed and advanced technology to maintain proper quality in building materials also paves the way to derive high quality output.

## 4.0 Conclusion

Quality parameter of the building project will directly influence to the construction project successful. Therefore, by studying and improving the factors that affect quality parameter of the project will help to improve the project performance. This research was questionnaire survey concluded that critical factors affect quality of building projects in

Sri Lanka. Hence, this research recommended following strategies to improve the quality parameter of building projects in Sri Lanka.

- Implementing new technology for material production, use of high-quality alternatives to avoid natural resource depletion, conducting more research and work studies to find innovative methods of material quality maintenance process.
- Introduce new tax regulations which is encourage the stakeholders in order to use high quality materials for the construction.
- Introduce and implement new courses relevant to quality of construction field.
- In order to use more knowledgeableprofessionals and work force, the organisations need to conduct training, knowledge enhancement session, and increase the facilities of work force.
- Assistance of the specialised sub-contractors to special works.
- Follow all specifications, guidelines, and rules. In addition to that government institution need to introduce new guidelines along with the new technologies' applications.

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