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TOTAL QUALITY MANAGEMENT IN CONSTRUCTION PROJECTS: ROLE OF CLIENTS PROJECT MANAGERS

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Abstract. The decision to implement Total Quality Management (TQM) in the construction industry should involve both the Client and Contractor. It is a complex and interactive process requires all participants to work jointly with a common objective. The participants should ensure that they are ready to change their traditional management culture and invest the required time, cost and skills for successful implementation. Primarily, the Client should assess these requirements before embracing this concept. TQM in construction often starts with Client's commitment, and it is then extended to all participants of the process by requiring them to adopt the philosophy. This requires the Client to plan, organise and co-ordinate the process in a 23"win-win" solution. The Client's Project Managers are often responsible for initiation and conduct an effective quality programme on behalf of the Client. After highlighting some important characteristics of TQM, this paper highlights twelve important responsibilities of the Client's Project Managers, and suggests best practices to be adopted by the Client's Project Managers when implementing TQM. These responsibilities are considered essential for the successful implementation of TQM, and include: preparing and organising: developing project definition; procurement; organising a joint co-ordination team; design management; safety management; measuring and reviewing performance; communication; motivation; co-ordination; documentation and project postmortem.

1 INTRODUCTION

Total Quality Management (TQM) is a systematic management process aimed at achieving the Client's requirements by doing the job right at the first time. It is not a separate management process to be followed. In the words of Burati [5] "it is a culture and philosophy that must permeate an organisation as the method of management". It should not be confused with Quality Control (QC) and Quality Assurance (QA). Quality Control is based on the inspection of service and work products. Quality Assurance is the means by which an organisation can assure that they have quality system that follows a recognised standard. TQM results from the continuous input of creative ideas, innovative activities and team approaches into the process of implementation. The Client's Representative's main role is to maintain a positive climate and provide the necessary resources and equipment to the participants for continuously improving the process. Both Client and Contractor organisations often rely on their representatives to develop innovations and improvements in their projects.

This paper focuses on the changing role of Client's Project Managers when moving away from traditional approaches and implementing TQM. The tasks and practices for Client's Project Manager presented in this paper are the initial findings of the current research.

2 RESEARCH OBJECTIVES AND METHODOLOGY

The objectives of the present research were: to identify the most appropriate contractual arrangement for implementing TQM on construction projects; and to establish the best practices for the Client's Project Manager when implementing TQM.

In order to meet this objectives this research comprises in two stages. The first stage involved detailed review of current literature followed by preliminary interviews with the construction industry were performed. This resulted in the identification of: 'partnering arrangements' as one solution for improving contractual arrangement between projects participants; and the responsibility of Client's Project Manager as being: preparing an organising; developing project definition; procurement; organising a joint co-ordination team; design management; safety management; measuring and reviewing performance; communications, motivation; co-ordination; documentation; and project post-mortem. In order to successfully perform these tasks, the action points for the Client's Project Manager have also been established during this initial stage. These initial findings are discussed within this paper.

In the second stage, the detailed questionnaire survey will be conducted within the construction industry. The intention being to obtain industry opinion on the initial findings obtained in the first stage. Based on results emerge from this survey, the best practices for implementing TQM will be recommended for the Client's Project Managers.

3 BACKGROUND

During the past decades, a number of management alternatives for quality have been developed and practiced in the construction industry. New management approaches for construction projects have mostly been concerned with liabilities and contractual claims between parties, and few have entered into developing systems that enhance open communications and total involvement of the participants in a project.

Despite considerable time and effort being invested in devising various strategies, conflicts and disputes between various parties is still inherent in the construction industry. Duffy [12] commented this as:

> "*everyone in the construction industry is fighting among themselves instead of serving the needs of the client*".

According to the Building Research Establishment [3], two-thirds of the 501 examples of poor quality observed on site were caused by design faults. Of these, 130 were caused by unclear or missing project information. Other causes were, lack of co-ordination of design, too difficult to build, and design not working. This demonstrates that the lack of sufficient information flow and poor co-ordination between participants seriously affects quality in terms of design and construction faults. In recent years, the concept of Total Quality Management (TQM) has been accepted by some as rationale to solve many of these quality problems in the construction industry. Despite the transient, nature of construction industry, the following question is often used:

> "*why should the construction industry not follow the lead of the manufacturing industry and increase profit by reducing the cost of quality problems through the TQM concept*?"

Some research findings [5] and [19] prove that TQM has been effectively applied by both owners and contractors in the construction industry. TQM usually starts in construction with the Client's commitment. In the first workshop conducted by Iowa State University on use of TQM in design and construction, a participants recommended that owners lead the way by first adopting TQM, then requiring other members of the design, construct team [8]. The quality of the service that the Client receives by implementing the concept depends partly on Client's own involvement in, and contact with, the supplier of the services. TQM requires an interdependency between the companies and that the parties adopt a long term - strategies of co-operation, therefore, participation by the Client is

essential. Graves [23] thus pointed out that:

> *"the standard of service given by the building industry relates closely to the amount of effort expended by the Client in establishing a good brief, and satisfaction at the construction stage is closely linked to the degree of control and supervision by the Client".*

Relating to Client's participation, Baden [2], stated:

> *"many of the technical failures steamed from the failure to recognise to extent to which the building Client should participate, not only in fully exploring and analysing with the designer his/her requirements in the early stages of the project, but also, then and subsequently, in making a full case study of the ability and suitability of the resources of those organisations through which his/her requirements will be fulfilled".*

Both of these statements stress the importance of demonstrable participation by the Client when reducing failures and improving quality in construction. However, whether the Client is naive or sophisticated, the presence of an individual or team representing the Client is inevitable. It is apparent that, on behalf of the Client, the participation of the Client's Representative is an essential ingredient for any successful TQM programme. The Client's Project Manager has a key role to play in acting as a communication channel and co-ordination tool between external professionals, contractors and other members of the Client organisation. However, current literature indicates little focus on direct investigation of the role of the Client's Project Manager within the TQM framework. Hensey [17] states that about 95 per cent of current literature on TQM focuses on: 1. necessities, benefits, and advantages; 2. philosophies, concepts, and principles; 3. cultural and operating changes; 4. successful strategies and firms. To emphasis this, Barrett [2] calls for research on the role of individuals during the various phases of implementation of TQM.

4 CONTRACTUAL ARRANGEMENT FOR TQM

Contractual arrangement in the construction industry define the functional and contractual relationships between the various participants. There are a number of procurement methods (such as traditional, management contracting, design and build etc.) currently being practiced in construction industry. These methods have produced different contractual arrangements which are often criticised for their inability to take account of changing technology, and in many cases different organisational requirements.

Chase and Manning [8], at a national workshop on TQM in the design and building process, held in Iowa State University, identified three major causes for a lack of teamwork, poor communications, and inadequate planning and scheduling. These were: 1. no team-building exercises at the inception of the project; 2. lack of understanding of team members' expectations; 3. little or no team-oriented planning and scheduling. These three causes stress the importance of 'teamwork' from the inception stage onwards. However, this practice (teamwork) is often neglected in the traditional procurement methods. Traditional procurement methods encourage the participants to plan and define their project mission separately, which leads them to function with different objectives. This approach encourages the participants to concentrate more on administering the contract than on managing the process.

TQM requires a contractual arrangement that provides interrelated sub-systems, facilitates cross-functional co-operation, and removes barriers between the participants that impede the progress. It should involve everyone in the process and make them feel that quality is everyone's business.

The contractual structure for implementing TQM in construction can be characterised by attributes: open communications, barrier removal, and Client/Contractor relationship. These attributes are interrelated with each other. The first two attributes characterise the functional relationship, and the last one characterises the contractual relationship between the participants.

4.1 Open Communications

Gameson [14], quoted from a company document that:

> *"it is essential that communication lines between different groups and persons of the project team are clearly identified and understood. Good communication and information flow of the right quality at the right time are essential to the success of the project".*

Everyone in the TQM process needs to communicate with everyone else to explain what is going on, get their views on the proposed solution, and determine how the best solution is to be implemented. Chase [7] revealed that improved communications is the key element in achieving customer satisfaction, supplier improvement and process improvement. The construction process generally comprises a number of participants such as client, contractor, sub-contractor, and vendors. The organisation structure should bridge these participants so that information flows freely and effectively between them. Improved communications between the participants also: provides a good influx of ideas to resolve project-related problems, enhances teamwork to complete project in an effective manner: enables faster processing and resolution of disputes/claims; and improves field cooperation on requests for information [9].

4.2 Barrier Removal

In traditional management systems, the tendency of the parties is to work in closed environment, within individual organisations, as well as between companies in the project chain. This attitude motivates the participants to undertake non-productive activities can, however be eliminated through improved teamwork. To remove barriers that interfere with process improvement, BS 7850 emphasises teamwork between the participants as:

> *"open communication and teamwork remove organisational and personal barriers that interfere with effectiveness, efficiency, and continuos improvement of work processes; they should be extended throughout the whole supply chain including suppliers and customers".*

Another obstacle is the old paradigm "controlling one over the other". This results in everyone undertaking checks and inspections of the same items of work. It was believed that the targets set by the Client's personnel could be achieved through inspection, punishments and penalties. In order to achieve quality, Deming [11] advised as:

> *"Cease dependence of inspection to achieve quality. Build quality into products and services in the first place".*

The aim of this philosophy is that quality should not be inspected, but can be achieved through participation. This again stresses the importance of teamwork. Thus, an effective contractual arrangement should eliminate all these barriers and enable the participants to work with a common goal.

4.3 Client/Contractor Relationship

The quality of the final product largely depends on the relationship between the parties involved in the project (i.e. the Client, Contractor, and Sub-contractors). The participants within the project organisation need to satisfy the needs of the next participates in the line who use their output. Both the supplier and the customer need to share their objectives, resources, and techniques if a quality product is to be produced. Thus, they are in need to work jointly towards a common goal. However, there are obstacles that may impede this approach. According to Juran [18], two obstacles that impede establishing joint teams are the state of legal independence between the companies, and their traditional methods of working together. These obstacles can be overcome by adopting a partnering arrangement. Partnering will greatly improve the interface between the Client and the Contractor, and the execution of projects. It also provides an ideal environment to implement TQM. Chase [7] interrelated TQM and partnering as follows.

> *"On individual construction projects, the parties may establish a team environment in which the general contractor, sub-contractor, suppliers, owner's representative and designers all work together. Sometimes, this is the result of TQM; other times it is the result of partnering arrangement. Sometimes it is both."*

5 PARTNERING-AN IDEAL RELATIONSHIP FOR TQM

The Construction Industry Institute [9] defines 'partnering' as a long-term commitment between tow or more organisations for the purpose of achieving specific project objectives by maximizing the effectiveness of each participant 's resources. According to CII, the three key elements necessary for partnering are trust , long - term commitment, and a shared vision. Trust helps eliminate the traditional adversarial relationship between the parties. Long-term commitment helps reduce the learning curve in knowing each other's principles and expectations. Shared vision is the mutual exchange of ideas between the participants, which helps the parties to accomplish the common goal successfully.

Discussion of 'partnering' is beyond the scope of this paper, however, the way the participants working together under 'partnering arrangement' is briefly described through the graphical diagram illustrated in Figure 1. This diagram has been established based on the partnering relationships of many companies (such as DuPont/FLUOR Daniel, Union Carbide/Bechtel, Procter & Gamble/Kellogg, Anglianwater/Biwater, Shell Oil/Parsons etc.) investigated by the NEDC [22] and CII [9].

The underlying features of this type of are structure is trust, long-term commitment, and shared vision. This includes several sub-elements, all of which must be developed to optimise the benefits of the relationship: improved profit; increased competitive advantage; and continuos improvement of product and services.

Figure 1 depicts the boundaries which define and separate the two major participants involved in a project -the Client and Contractor. In this structure the individual participants with unshaded area and the partnering team (Joint Co- ordination Team) with shaded area are shown. Within this shaded boundary the participants work together with common objectives. This illustrates the project-specific work, where both the Client and Contractor establish a joint co-ordination team and work jointly within the limit provided by the joint team for a particular project. The membership of the JMT are well balanced by representatives of both the Client and Contractor. The plain area represents the parent organisation, where the participants function separately on businesses related to their own parent organisations. This means in partnering each participant has a matrix form of two overlaying organisation, one dealing with the project and the other with the parent organisation.

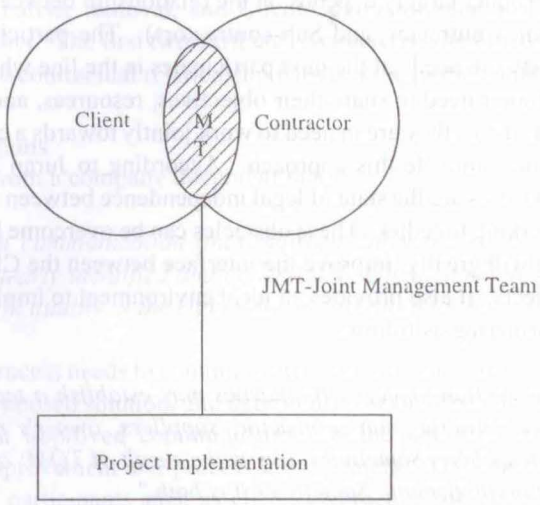

Figure 1 Partnering arrangement for project implementation

6 TQM-ROLE OF CLIENTS' PROJECT MANAGERS

In traditional management systems, the role of the Client's Project Managers are often based on a policy of 'management by control' to achieve or complete the project by the required date, with in budget, and to the required quality. This approach may be some what successful, simple, logical and consistent, but problems such as delay and low quality may arise when the work gets distorted. In this system, all participants are motivated to achieve the target with different goals, which can lead to adversarial relationships, reduced communications and accusations when goals are not met.

In TQM, quality is everyone's business, it can be achieved only through mutual trust, co-ordination, and teamwork. It needs the Client's Project Manager to participate in the process, instead of inspecting it. The Client's Project Manager should focus on operational goals, and co-ordinate the team of all kinds to provide support for the process of operation. Based on the current literature [5], [22], [9] [16], [5], [10], [13], [21], [7], [15], [25], [24], [20] and preliminary interviews within the construction industry, the responsibilities of Clients' Representatives and the best practices to successfully perform each responsibility were established.

The main responsibilities of Client's Project Manager: preparing and organising; developing project definition; procurement; organising a joint co-ordination team; design management; safety management; measuring and reviewing performance; communication; motivation; co-ordination; documentation; and project port-mortem. Many of these responsibilities are performed by the Clients' Project Managers jointly with the other members of the project organisation. In the following sections, the relevant issues and tasks to be considered for each responsibility are briefly defined and the best practices to accomplish these responsibilities are suggested.

6.1 Preparing and organising

Pre-Planning and organising principally includes the development of Client's quality programme and organising the Client's organisation for TQM. Before a quality programme can be finalised, the Client's readiness for the programme and objectives have to be evaluated. The main objectives of this task are to set objectives; establish policies to meet objectives; develop organisational structures;

and delegate authority and responsibility. The following practices are suggested for the improvement of the preparing and organising task.

Practices for the improvement of preparing and organising

- Determine the focus, concerns and the ability levels of Client's organisation for planned improvement, by conducting first party audit.
- Visit companies who had successfully implemented TQM, and consider their accomplishments before preparing a quality plan.
- Appoint Quality Consultant for advice, if necessary.
- Prepare a Quality policy for the Client's organisation.
- Establish organisational structures and responsibilities.
- Prepare education and training requirements for all levels of staff.
- Delegate the in-house quality champion or external quality consultant to train the Client's organisation on professional, quality, technology, and team building skills.
- Delegate appropriate responsibilities and authority to the respective personnel, for conducting quality programme.

6.2 Developing project definition

Project definition involves defining the Client's requirements through careful planning and forethought. It includes the feasibility study of the project. The following practices for the improvement of 'Developing project definition' task have been identified.

- Practices for the improvement of developing project definition
- Analysis the Client's brief, and highlight any omissions.
- Establish programme and staffing requirements for producing project definition.
- Apply Quality Function Deployment (QFD) and other TQM tools to develop Clients' requirements, and identify quality characteristics for accomplishing Client's requirements.
- Involve construction professionals to achieve constructability in project definition.
- In project definition, define project specific quality plan to implement TQM.

6.3 Procurement

The procurement task involves the selection of suitable contractors, professions and other participants to the project. The main objective is to ensure that the participants for the project are acquired in the most effective way. The following practices are suggested for the improvement of the procurement task.

Practices for the improvement of procurement

- Depending on the size of Client's organisation and nature of the project appoint a selection team to select project participants.
- Ensure that the selection team is represented by all sections of the organisation (i.e. marketing, operations, engineering, purchasing, construction, etc.).
- Set criteria for the Contractor selection process and ensure that this include technical skills, quality and safety systems.
- Identify the potential Contractors through questionnaire requests or preliminary interviews or by checking British Standards registration.
- Conduct an audit against identified firms, and assess that their equipment and systems satisfy the quality plan.
- Request tenderers to notify any of the aspects for quality improvement not included in the quality plan.
- Select the Contractor, who meets the pre-determined selection criteria, and seek Client's approval.
- Conduct interviews with the Contractor, share project objectives and management policy, and agree the formation of a joint co-ordination team.
- When preparing contract document, minimise unnecessary contract terms which impose more risks and liabilities on contractor.
- Ensure that the co-ordination agreement and safety plans are included in the contract.
- To pre-qualify Designers and Consultants consider the principles used in the Contractor selection process.
- Ensure that the Main Contractor adopts qualitative approaches in the selection process of Sub-contractors and vendors.
- Ensure that the selected Sub-contractors have got enough equipment to satisfy the quality plan.
- Advice the Main Contractor the principles of selection of Sub-contractors and vendors.

6.4 Organising a joint co-ordination team

Under most partnering arrangements, a joint co-ordination team should be established at the earlier stage of the project. This team should be represented by members of both the Client and Contractor. Plans and objectives specific to the project should be shared between the parties. An action plan for co-ordination, problem solving, performance measurement, communications, etc. should be prepared jointly. The plan should address the involvement of appropriate parties form both organisations. In accordance with the action plan, responsibility and authority are delegated to the respective personnel. To improve the efficiency of this tasks, the following practices have been identified.

Practices for the improvement of organising a joint co-ordination team

- Conduct meetings of top level representatives from all parties, and share project plan and objectives.
- Assist the members to jointly develop action plans for problem solving, resolving disputes, performance measurement, communications, and corrective actions.
- Assist the members to establish the joint team and delegate responsibilities and authority to the appropriate personnel.
- Ensure that the membership of the joint team is well balanced by the representatives of the Client and the Contractor.
- Depending on the nature of project and problem, assist the joint team in appointing quality improvement team and corrective action teams.
- Record the agreed action plans, and communicate it to the entire organisation.
- Delegate the quality champion or quality consultants to train the members of the co-ordination team on quality tools and technology and team building skills.

6.5 Design management

Design management for Client's Representatives includes co-ordinating the design team for continuos improvement and checking that the design confirms and satisfies the Clients' requirements. The following practices have been identified for the improvement of the design management task.

Practices for the improvement of design management

- If design responsibility is left to the Contractor, during the pre-bid assessment. assess the design capabilities of Contractor's professionals and ensure that they have enough design expertise.
- If separate design professionals are to be appointed, pre-qualify them by auditing their expertise.
- Consult the Contractor and construction professionals for advice during the preliminary design, and achieve constructability in the earlier phase of the design.
- Provide the Designer with necessary design input data as and when required, and without delay.
- Before issuing design inputs, ensure that they are completely checked and reviewed right at the first time.
- Ensure that the detailed design satisfy fire and means of escape regulations, building regulations, health and safety regulations. and traffic and noise control regulations, etc.,
- Ensure that training on health and safety at work is given by the Contractors to the workers, including those who are actually carrying out construction work.
- Conduct regular meetings at all levels to discuss health and safety issue.

6.6 Measuring and reviewing performance

Measurement of performance is the means of quantifying performance made against pre-specified targets. Measures established at the planning stage should be carefully monitored and their conformity to pre-determined standards ensured. Any deviation from the established plan should be investigated and removed through the P-D-C-A (Plan-Do-Check-Act) problem solving process. Performance of quality programme should be measured jointly by the co-ordination team.

Practices for the improvement of measuring and reviewing performance

- Measure the effects of training given to the Client's organisation for example by measuring skills of workforce before and after the training.
- Through the joint team conduct a regular measurement of performance and progress.
- Identify, problem areas, deficiencies and deviations.
- Use the TQM tools, such as fish-bone diagram and statistical methods to identify the causes of and solutions to various problems.
- Discuss with team members causes of deficiencies and deviations, and suggest corrective actions.
- Check, through the joint team, that the corrective action has been implemented.
- Continuously review the results of any performance measurement and identify areas where performance standards are absent or inadequate.
- Ensure that the measurement results comply with the pre-determined health and safety plan and quality plan where appropriate.
- Define a system to measure the performance improvements in terms of cost/benefit.
- Assess Clients' satisfaction with performance.

6.7 Communications

Receiving and dispersing information on behalf of Client's organisation. This includes exchanging information by open communication with all participants. The following practices are suggested for the Client's Representative to improve communication between parties.

Practices for the improvement of communications.

- Convey management's commitment to TQM to the Client's organisation.
- Establish a good communication system that keeps all participants aware of the objectives, progress and successful stories of the programme.
- Communicate the standards, procedures and systems relating to implementation and performance measurement to relevant participants.

- Prompt actions of client to feedback from contractor, supplier, and other professionals.
- Communicate the suggestions and required corrective actions to respective parties.
- Welcome comments and suggestions from participants for process improvement.
- Publish successful results and recognise employees, using newsletters/posters.
- Communicate the Client's views and suggestions on process improvement.
- Adopt 'walk and talk' policy for effective communication.
- Follow 'on the job briefings' to discuss problems and issues relevant to the job.

6.8 Motivation

Establishing a good environment which encourages people to work successfully in the interest of the Client and other participants. The following practices have been identified for the improvement of motivation.

Practices for the improvement of motivation

- Encourage the Client to implement TQM in the project.
- Identify the need of each participant.
- Encourage co-ordination team members to aim for continuos improvement, and assist them to maintain a positive climate.
- Empower people to act quality for improvement.
- Recognise high-performing people.
- If possible introduce incentive schemes to enable parties to work towards a common goal.

6.9 Co-ordination

Keeping all participants to function together efficiently for a common goal. It include preventing and resolving conflicts. The following practices for the improvement of co-ordination tasks have been identified.

Practices for the improvement of co-ordination

- Initiate action in both the Clients' team and co-ordination, and keep them focused on the target.
- Provide a common ground for both the Client and Contractor by maintaining openness and avoiding defensiveness.
- Identify and resolve differences constructively and positively.
- Solved disputes immediately with the assistance of team members.
- Conduct meeting at regular intervals and ensure that all parties attend the meetings continuously.

6.10 Documentation

Recording act, condition, or event which bears an effect on the objective of the relevant process. It includes recording both the success and failure of efforts spent on the process. The following best practices for project documentation have been identified.

Practices for the improvement of documentation

- Document the Client's quality plan containing policy, objectives, and structure of organisation.
- Maintain a safety file, containing safety policy, performance standards, rules and procedures.
- Document the quality plan specific to the project.
- Record the degree of achievement of the quality objectives at each stage of the project.
- Record the level of Client satisfaction wits the service.
- Record decisions made on corrective actions and effectiveness during performance.
- From the result of measurement, recording the performance of Contractors and suppliers against the quality procedures.
- Maintain these documents as readily retrievable and retain for a designated period.

6.11 Project post-mortem

Project post-mortem is conducted at the end of the project to review, discussed and check all aspects of the project to uncover opportunities for improvement on future project. The following practices for the improvement of project post-mortem task have been identified.

Practices for the improvement of project post-mortem

- Conduct post-mortem meetings involving all jobsite quality planners.
- Use brainstorming and other TQM tools to review the success and failures of the project and lessons learned.
- Access achievement of Clients' requirement.
- Access Client's satisfaction on overall performance of the project.
- Widely distribute the minutes of the post-mortem meetings.

7 CONCLUSION

TQM works well when all parties involved in the project impart greater participation to the process. It is not just the responsibility of the Contractor render total quality in construction. It is the responsibility of everyone involved in the project. The TQM-approach requires Client's Project Managers to adopt a `teamwork' philosophy in controlling the project. This helps to achieve total quality in construction. The tasks of Client's Project Managers which considered essential for the succesful implementation of TQM-based construction project are: preparing and organising; developing project

definition: procurement; organising a Joint Management Team; design management; safety management; measuring and reviewing performance; communication; motivation; co-ordination; documentation and project post-mortem. Finally, practices for all of the twelve tasks which considered as "best practices" for Client's Project Managers to achieve total quality in construction projects were identified.

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