

Environmental awareness and total quality management in the construction industry

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Abstract. In today's construction industry, being environmentally conscious and maintaining high quality are more important than ever. This study looks at how integrating environmental awareness with Total Quality Management (TQM) can improve construction projects. By reviewing various literature, effective strategies can be identified for making construction more eco-friendly while still meeting high-quality standards. The findings show that combining environmental sustainability practices with TQM can lead to better project results, such as less environmental damage, higher efficiency, and more satisfied stakeholders. It has been concluded that a combined approach of environmental awareness and TQM is crucial for sustainable construction and long-term industry success. This research was done using narrative review method. The related keywords have been used to narrow down the results to twenty-nine literature which was carefully reviewed and discussed.

1 Introduction

In previous years, customers' needs started to grow rapidly, they are looking for more quality and environmentally friendly products. Industries need to come up with good process planning to create a valuable product or service for their customers. Industries started to use different types of management systems to gain more customer satisfaction. The management systems evolved throughout the years and several approaches are being developed. Total quality management (TQM) is one of these management systems that have been used in different industries around the world. TQM focuses on the customer needs and involves all the organization to achieve this target [1].

TQM implementation improves companies' performance and increasingly affects customer overall satisfaction [2]. The construction industry is considered as one of the lowest acceptable quality levels and customer satisfaction [3]. Redoing the work, unqualified laborers, absence of effective quality policies, delays in the projects, cost exceeds the planned budget, low quality project output, environmental unsustainability, and

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lack of quality management systems are the main issues that faces the construction industry, especially in the developing countries. many laborers are not qualified, and the company does not have a periodic assessment for their skills and experience [4]. It has been found that there is a relationship between TQM and environmental sustainability [5], [6]. Customers recently are focusing on using high quality materials and at the same time are friendly to the environment.

According to [7] TQM focuses on the use of materials that are required by customers to achieve their wanted level of quality. These materials must be sustainable building materials, and they must be consumed in a way that ensures reducing construction waste. TQM focuses on making the whole organization work together to achieve the required strategic objectives in all different aspects [8]. One of these aspects is environmental sustainability. TQM practices can be used to impact the environment performance for any organization [6]. TQM plays an important role in increasing the environmental performance in Pakistan [5].

There is lack of awareness towards TQM in the construction industry [3], [9]. This lack of awareness will lead to low quality works which will impact the environment. Unskilful workers are one of the main reasons for redoing the construction works and lowering the quality of work. Redoing of the construction works will cause in increasing the waste and increasing the cost which can be avoided using TQM [3]. It can lead to the excessive use of water which negatively impacts the environment. Using of quality management systems such as TQM is not common in the developing countries [10], [11]. This research was done to highlight the relationship between total quality management and the environmental sustainability in the construction industry and how to increase the awareness about them. This research was unique because it covers the lack of awareness of using TQM towards achieving higher environmental sustainability. It has been found that there are less literature related to TQM and environmental sustainability.

2 Methodology

In this research the review was based on studies which were gathered from Scopus and the web of science using the phrase total quality management and construction industry. The narrative review method was used in this research as in Figure 1. A result of 3047 literature was found. Most of the results were limited to the previous five years studies to get a clear understanding of TQM and its relationship to environmental sustainability in the current time. The keywords which have been used in this research helped to highlight the relevant study to this research. Using keywords such as TQM, environmental sustainability, and construction industry narrowed the results into 188 studies. The 188 studies have been reviewed by reading the abstract, checking the keywords, reviewing how many times these 188 studies have been cited to decide the number of studies that need to be focused on. Out of 188 studies a few twenty-nine studies have been used as references in this study.

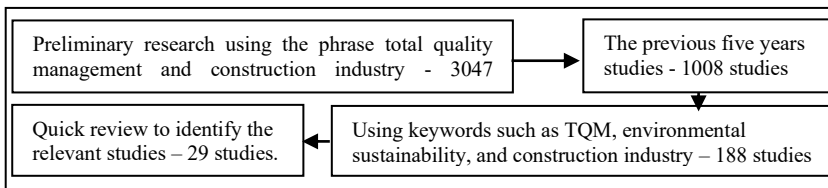


Fig. 1. Methodology flowchart

3 Literature Review

3.1 Total Quality Management

The first time Total quality management has been used was in the manufacturing industry and after the success of this industry by using this management system, TQM started to be used in most of the industries around the world because of the notably customer satisfaction. TQM focus is the customer satisfaction, and it can be achieved by engaging everyone inside the organization toward that goal [12].

3.2 TQM Relationship with Environmental Sustainability and Awareness

Environmental sustainability and awareness are becoming increasingly important. It is becoming a social responsibility for all countries. Countries are focusing on putting policies and regulations to guide and direct companies in different sectors to ensure environmental sustainability in all their projects and products. one of the main sectors that affects environmental sustainability is construction sector. This Sector is affecting the environment by using excessive amount of water, increasing waste, and increase in emission of greenhouse gases. The building itself or the final product of the construction projects can be either harmful or friendly to the environment. A relationship has been identified between TQM and environmental sustainability [5], [6]. TQM plays an important role in increasing the environmental performance in Pakistan [5]. According to [6] TQM practices can be used to impact the environment performance for any organization. It can be directly impacting the environment with its practices alone or it can be used alongside just in time approach and green supply chain management for more enhanced approach.

TQM is mainly focused on customers' satisfaction and in this century, customers are looking for more environmentally friendly construction projects which can be achieved when aligning the strategy of the company with the principles of TQM for more enhanced experience for customers. The long-term strategy for the companies must be aligned with both TQM principles and environmental sustainability. TQM focuses on making the whole organization work together to achieve the required strategic objectives in all different aspects [8]. Environmental sustainability is considered one of these. It can be used to make the organization work toward using environmentally friendly materials for the construction projects so the building will not affect the current and the coming generation by being environment friendly. TQM focuses on the use of materials that are required by customers to achieve their wanted level of quality [7]. Customers are focusing on using high quality materials and at the same time are environment friendly.

3.3 TQM Benefits

According to [13], [14] satisfying the customer is the most important benefit for applying any quality program within any construction company. One of the demands of the customers in the meantime is to have an environmentally friendly project. using TQM can prevent any potential issues that might arise in the construction project and will make sure that the project will be finished within the previously planned schedule [14]. TQM implementation in the construction industry improved the performance of the construction projects and achieved required quality [15]. TQM is good for maintaining the cost of the project, finishing the project within the schedule, increasing customer satisfaction, and increasing profitability [16]. TQM positively impact the performance of the construction projects in Mombasa in Kenya [17]. It can also guarantee the sustainability of the

environment by making the whole organization work together towards protecting the environment.

3.4 TQM Critical Success Factors (CSFs)

3.4.1 Training and Development

If enough training is given to employees, it will enhance the overall quality and environmental sustainability of the construction project [18]. Training the employees with a way that makes them work efficiently before any problem happens and try to anticipate the potential problems will improve the quality. Companies must change the way of thinking of its employees, so they understand the importance of the environmental sustainability. The proper training on quality provided by the company and educational initiatives programs are important enablers to implement TQM [19]. Labourers must have the training that give them the ability to use the exact number of materials needed to finish the construction work without increasing the construction waste. The training must highlight the importance of water and how it should be used with a wise way. Construction companies should provide an adequate quality training for its management, site supervisors, and labourers to increase their awareness of TQM and strive to apply TQM practices [20]. This quality training must increase the awareness of the employees or the staff about environmental sustainability. Construction workers in Iraq do not get enough training which should make them capable of doing the work with high quality and most of them learn how to do the work by seeing how the experienced workers do it whether they do it with the right or wrong way [21].

3.4.2 Employee Involvement

Employee's involvement and satisfaction is one of the CSFs of applying TQM practices in the construction industry [14]. According to [21] if the employee did not get incentive or fair appreciation for his effort in the organization, it would lead to the loss of motivation in work which will cause low productivity and less quality. This reduction in the quality caused by non-recognition can lead also the employees or workers to do the activities or construction works in a harmful way for environment and it can also lead to increase in construction waste. Giving the labours and the non-supervisors staff the ability to take the decision about the quality in their work will increase their knowledge about quality and will make the staff and the labours feel more freedom in decision making [20]. companies must put a recognition system that emphasizes on environmental sustainability.

3.4.3 Continues Improvement

Continues improvement is one of the CSFs for implementation of TQM in Malaysia [22]. One of the important factors for implementing TQM is the continues improvement of everything in the organization which means they should have new core competencies or sharing innovative ideas [23]. This process of continues improvement includes the improvement in the environmental aspect. The construction activities or work must be optimized in a way that ensures development in the long term for both quality and environmental performance. According to [18] the company and its management should do continuous and periodic reviews of the construction works to identify the potential issues and try to reduce these issues or avoid them in the future. It has been found that one of the ways of achieving continuous improvement is good process management by having smart systems that can be used for planning everything for the construction project. These

systems can also be used to do monitoring and analysing for the work in the construction site to improve any process or activity that will lead to less quality or negatively impact the environment. Construction companies should pay attention to all the processes and try to analyse them to avoid any potential problems that may arise in the future and to develop the way that work is done [24]. By doing process analysis, companies can enhance their process so they can reduce construction waste, avoid excessive use of water, and reduce the emission of greenhouse gases.

3.4.4 Quality Control and Quality Assurance

It was found that the one of the CSFs for implementing TQM within any construction company is the continues supervision for all works in the construction site and making sure that all works have been done according to the requirements of the quality and with this strategy they can avoid the redoing of the work which can lead also to reducing waste and using only the required amount of water [23]. construction companies should make their workers learn how to do the self-inspection for the work that they done and then the supervisor or the inspection team should check the work whether if it is done according to the requirements or needs to be redone again [20]. It was found that management should change their culture and make it related to quality and they should have their own values of quality so that they can make their employees follow this culture.

3.4.5 Leadership and Top Management Commitment

Top management commitment is one of the most CSF to implement TQM in any industry especially the construction industry [19]. It is one of the main enablers for TQM. Top management must put a clear plan or strategy for how to implement TQM within their construction projects and they should put their quality policies which will help them to increase the awareness of quality for employees and how they should implement it [18]. This commitment of the management can be also used toward the sustainability of the environment and the management should strive and push the staff toward that direction. The most CSFs for implementing TQM is leadership and management of the company [22]. It was found that giving the employees periodic training and doing seminars at least once a month are effective leadership style for any company to increase their employee's awareness towards quality and environment. Leadership must have the commitment towards quality and implementing TQM and they must be able to demonstrate their quality policies for their employees. According to [20] top management must have full commitment to implement TQM. The management is responsible for finishing the construction work with the required quality with positive impact on environment.

3.4.6 Teamwork and Communication

It was found that one of the CSF for implementing TQM is teamwork and communication [18]. When employees are working as one unit with effective communication, they can achieve the best quality and positively impact the environment. It was found that communication get employees to clearly know the quality policies and procedures, also sharing the knowledge among the organization which will lead to enhancing quality and environmental awareness. Effective teamwork between all the staff in the company including the full cooperation and coordination between all departments is one of the essential practices to implement TQM within the construction companies [14]. Good communication between management and employees will ensure that all construction

works will be done according to the demands of the customers which can include quality and environmental demands.

3.4.7 Customer Focus and Satisfaction

TQM can be used to achieve higher customers' satisfaction and deliver the construction projects the same way that the customers want [1]. Customer satisfaction is one of the factors affecting the implementation of TQM [20]. Construction companies must have a clear policies and regulations that ensure that satisfaction of customers towards quality and environmental sustainability. Fulfilling customer needs should be the main target for any company, which will improve the reputation of the company and give it a competitive advantage in the market. Fulfilling customer needs can be done by good coordinating with customers to know exactly what their requirements for the construction project [22].

3.5 TQM and environmental sustainability Barriers

3.5.1 Lack of Awareness

If there are not adequate initiatives regarding TQM and environmental awareness, it will lead to low quality works with bad impact on environment [25]. It will also negatively affect the satisfaction of the customers. Some companies provide training but still the employee is not aware of how to implement the construction work with high quality and good environmental performance. Unqualified and unskilled workforce is affecting negatively on applying TQM in the Turkish construction industry [3]. It has been found that lack of awareness and knowledge of employee towards quality and environment is one of the barriers of implementing TQM. Lack of awareness of TQM is one of the obstacles to implementing TQM within the organization [9]. It can lead to bad behaviour towards environment.

3.5.2 Lack of Management Commitment

Lack of top management commitment by not focusing on applying customer's needs and choosing bad management system is one of the barriers for implementing TQM [26]. Management is considered as important barrier if their practices are bad like not being serious about the quality, not have enough commitment to apply it within the company, and do not care about environment [14]. Lack of quality leadership who will strive for implementation of TQM and motivate all the employees is one of the barriers that will cause low quality works and not ensure environmental sustainability [27]. According to [3] lack of top management commitment and support to implement TQM and the top management bad leadership will lead to not successfully implementing TQM which will affect quality and environmental sustainability.

3.5.3 Resistance to Change

One of the factors that affect implementing of TQM in the construction industry are the resistance of employee to change [26]. This might be because employees are afraid from new initiatives, or they think that they will have to work for more hours and do more effort. Resistance to change may arise from individuals or groups of individuals inside the organization when the organization wants to adopt new ideas or new initiatives [9]. It has been found changing in the culture of the organization towards quality and environmental

sustainability will face a lot of resistance which require the full commitment of the management and increasing the awareness of the employees about this new quality program or culture to successfully implement it. One of the TQM barriers is the resistance that may arise when the top management is trying to implement TQM, so the company needs to start changing the culture of the employees to reduce this resistance [14].

3.5.4 Other Factors

Motivation is one of the barriers to implement TQM in the construction companies [25]. Loss of motivation can lead to low quality works and cause negative impact to environment. The management need to encourage employee to implement TQM either by recognition or incentives to ensure employee motivation. Bad communication between the top management and the team that supervises the construction site which will lead to potential mistakes and the unsatisfactory of the client or the owner and the same apply for sharing the information in time [23]. Ignoring the inspection process at every stage to make sure that the work has been done with the required quality is one of the factors that affect the implementation of quality management [13]. Inspections will ensure that all construction works are being done with the required quality and the work or the final product is friendly to environment.

3.6 TQM Implementation in the Construction Industry

A framework has been proposed by [28] for implementing TQM in the construction companies. 1st phase include that companies should have the full commitment of the management, and orientation for all employees on TQM. The 2nd phase is to plan organization restructuring that help emphasize the implementation of TQM. In this phase the environmental sustainability can be included in the planning process. The 3rd phase is to make all departments improve the process so the overall quality of construction can be improved along with environment performance. The 4th phase includes carefully choose the contractor, give more attention to the pre-design stage, recognition for any quality work, and having periodic meeting to improve all construction works. The 5th phase is to provide the required training for the employees to increase their awareness about the TQM and the environment sustainability. The 6th phase is to measure the outputs to see if the chosen management system is efficient or not. A study [29] investigated the CSF of TQM to propose a framework for implementing TQM which consists of five stages. The 1st stage is to provide the training programme that ensure increasing the awareness of employee towards TQM or any quality management system that can also ensure environmental sustainability. The 2nd stage is to carefully choose the supplier because if the materials is not good, it will affect the quality by reducing it and it can be very harmful for environment. The 3rd phase is that companies need to enhance their teamwork and communication, and they need to ensure the involvement of employees so the whole organization can work towards achieving customer need. The 4th stage is that companies need to carefully analyse their processes to identify the reason behind any issue. The 5th phase is that companies need to be proactive and identify any potential issue regarding the quality and build a positive relationship with suppliers for the short and long term.

3.7 Framework

Based on the relationship investigated in the literature, all CSF of TQM, and the proposed frameworks by researchers, a suggested framework has been developed to align the use of TQM with increasing the environmental performance and awareness. First step, the

continues improvement can be used to highlight any activity that causing the bad quality and affect the environment. The companies then need to improve these kinds of activities to have a full set of process that ensure both quality and environmental sustainability. For example, when there is a process that consumes a lot of water then this process needs to be analysed so that the reason behind consuming a lot of water can be identified and avoided in the future. For 2nd step, Companies should provide adequate training to improve the skills of their workers and supervisors to ensure that every construction activity is being done according to the required quality and at the same time will be friendly to the environment. They can use different ways of training and provide both practical and theoretical training to increase the awareness of TQM and environmental sustainability. This training should highlight the importance of environmental sustainability for the current and future generations. The training must emphasize on carefully using the water, reducing construction waste, and prevent any process that increases the greenhouse gases. For 3rd step, the leadership should have the capability to strive for quality and environmental sustainability. Top management should show the full commitment towards protecting the environment and not just achieving quality even if the quality is harmful to the environment. For 4th step, Construction companies should make sure that all employees are being recognized and have different kinds of initiatives that encourage them to do a friendly work environment with high quality. companies should build a recognition system that emphasizes on the environment sustainability. For 5th step, companies should use smart ways of communicating to ensure the full cooperation between all departments. All employees must work together as one unit and have the same goal which is achieving high quality and sustainability of environment Fig 2. These steps will ensure that the awareness of TQM and environmental sustainability will be increased which will lead to a successful construction project and eventually the customer satisfaction will be higher.

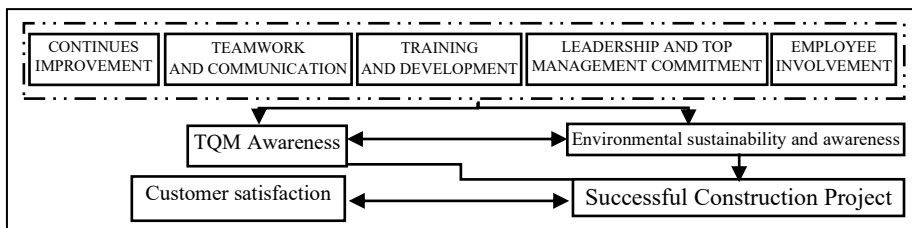


Fig. 2. Suggested Framework

4 Conclusion

Combining environmental awareness with TQM in construction projects is crucial for achieving both sustainability and high-quality results. This study shows that this integrated approach can significantly reduce environmental impact, improve efficiency, and boost stakeholder satisfaction. By embracing environmental sustainability practices alongside TQM principles, construction companies can not only meet regulatory standards but also drive innovation and gain a competitive edge. This synergy is vital for promoting long-term success and growth in the construction industry. However, there are a few studies discussing this integrated approach which mean it is not covered well in the current literature. This integrated approach needs to be discussed more in the future literature specifically in the developing countries. The future literature should also provide case studies showing how TQM positively can impact the environment sustainably.

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