

# A STUDY ON EVALUATION OF QUALITY MANAGEMENT SYSTEMS IN CONSTRUCTION PROJECTS

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**ABSTRACT:** Since the last two decades, quality management systems (QMS) have provided generic guidance and requirements for establishing an appropriate quality management procedure, with the goal of lowering costs, increasing productivity, increasing customer satisfaction, and increasing market share in the organisations involved. Construction industry: It may aid organisations in achieving their objectives and ensuring that all phases of a construction project consistently fulfil the needs of the client are two of the benefits of using a construction management system (need). Total quality management (TQM) is widely used in manufacturing and other industries, and it has been shown to significantly enhance the quality of products and services in these fields. The involvement of stakeholders is the primary focus of Total Quality Management. It increases customer happiness, increases the efficiency of an organisation, and promotes superior management of employees within the organisation. This enlightenment comes from the adaptation of new ideas, technologies, and procedures that can be applied in the building business as well. The purpose of this research is to examine the most recent studies that have focused on improving quality through the implementation of Total Quality Management (TQM) in the construction industry, as well as the suitable uses of TQM in the various phases of building projects. The building industry is a significant source of revenue for emerging countries like India. The construction industry in India is second only to the agricultural sector in terms of employment. The construction industry is confronted with numerous management and quality issues. This standard, which is part of the ISO 9000 standard series, contains a collection of instructions on how to build up a quality management system for processes that have an impact on their products or services. The most significant benefit of system deployment is improved management and work efficiency for the company, whereas the most significant drawback is a lack of awareness of the system among the personnel. For these implementation obstacles to be overcome, it is necessary to increase preparation and auditing (both internal and external).

**KEYWORDS:** Construction, Quality, Quality Management System, Quality Assurance, Quality Control, Total Quality Management, QMS; construction; integrated systems; project management; ISO 9000; quality practices; total quality management; TQM; maintenance; technical; non-technical.

## INTRODUCTION

Construction sector quality management systems (QMS) have been widely deployed and used, particularly by organisations capable of handling large-scale projects. Despite the fact that numerous studies have been conducted to investigate the role of quality management systems in various industries (e.g., manufacturing, food, service, and so on), there has been a dearth of relevant studies into the role of quality management systems in the construction industry. This is due to the fact that researchers are more interested in project quality and costs than they are in quality management systems. While completing their projects around the world, the majority of construction companies confront numerous hurdles and problems, such as "workmanship flaws", "delay," and "cost overrun." Since the 1980s, globalisation and competitiveness have grown in importance (Neyestani and Juanzon, 2016)[1]. The most important component in the success of construction projects is the level of quality. Many reports have criticised the construction industry, particularly in terms of productivity, quality and the implementation of a quality system (Ali and Rahmat, 2010)[2], and the majority of project managers place greater emphasis on cost and time than on quality when managing construction projects, but the scholars argue that greater emphasis should be placed on quality (Mane and Patil, 2015) [3]. Nowadays, quality is not only associated with products and services in organisations; it may also be associated with processes, systems, and management. (Alberto, 2011)[4] "Quality of construction project is a basic concept through which processes are carried out in a comprehensive quality infrastructure." The whole quality infrastructure is made up of a number of critical components. The first and most significant is the quality system (Juran and Godfrey, 1999)[5] as a corporate management tool (Juran and Godfrey, 1999). The International Organization for Standardization (ISO) introduced the first version of the quality system in 1987 with the goal of improving quality and customer satisfaction.

A quality management system is more manufacturing oriented in the early phases of its development, with the goal of improving quality through increased process control and documentation, increased commitment and engagement of management, and more extensive improvement initiatives. Following its successful deployment in the manufacturing industry, quality management systems (QMS) are becoming increasingly popular in the construction business. Following its successful deployment in the manufacturing industry, quality management systems (QMS) are becoming increasingly popular in the construction business[6].

According to [7], quality management is defined as the measurement of output to meet and maintain high-quality standards while achieving and maintaining customer satisfaction. The quality system, on the other hand, is defined by ISO 8402 as "the organisational structures, responsibilities, processes, and resources required to accomplish quality management." Meanwhile, quality management encompasses the overall management functions that determine the quality policy, objectives, and responsibilities, as well as the implementation of those policies, objectives, and responsibilities, such as quality planning, quality assurance, quality control, and quality improvement, all of which are performed within a quality system. As a result, it is possible to conclude that QMS is the interaction of people, procedures, and documentation with the goal of meeting requirements and achieving customer satisfaction[8] in a quality system.

Quality and quality management systems are two research areas that have gotten a lot of attention lately in developing countries, thanks to the government investing a lot of money on bridge construction to keep regional connectivity going. Today's bridge construction projects are complicated in nature, and they are frequently plagued by quality failures or non-conformance to quality standards, which result in an increase in project cost and efficiency, as well as an adverse impact on the overall performance of the construction industry. Despite efforts, quality has not reached a sufficient level of acceptance in emerging countries such as India, where it has encountered numerous difficulties due to the complicated nature of the construction industry.

As a functional term in the industries of industry and engineering, quality refers to something's lack of inferiority or superiority in comparison to another thing; it can also be defined as being suitable for its intended use (fitness for purpose) while also meeting the expectations of the customer. Performance is a perceptual, conditional, & highly subjective trait, and various people will interpret it in a variety of ways depending on their own experiences. Consumers should pay attention to the consistency of a product or service's performance, as well as how it compares to its competitors in the marketplace. The degree to which a product or service was correctly manufactured can be calculated by the manufacturer to determine the quality of the compliance. It is possible for support workers to evaluate the quality of a product based on its effectiveness, feasibility, and long-term viability. Even though there are many levels of quality in business terms, it is vital to remember that the company is creating something, whether it is a real product or a specialised service. Quality products and/or services, as well as the procedures and methods used to create them, involve a wide range of processes, methods, machinery, personnel, and investments, all of which fall under the quality umbrella. The concept of quality management has its roots in the fundamental characteristics of quality and how it is disseminated throughout the industry.

Although quality management as well as its concepts are relatively new trends, the concept of organisational quality has been around for a long time. Pioneers such as Frederick Winslow Taylor and Henry Ford recognised the shortcomings of the techniques used at the time of industrial manufacturing or the resulting varying quality of performance. As a result, they instituted quality control, inspection, and standardisation procedures for their work in the early 1900s. Today, these procedures are still in use. The likes of William Edwards Deming & Joseph M. Juran, who lived later in the twentieth century, contributed to the improvement of quality.

A Quality Management System (QMS) is a method of continuous improvement that involves all elements of a company's operations. The overall goal of a Quality Management System is to prevent problems from occurring before they do. Quality Management Systems are divided into three phases: Quality Planning, Quality Control, and Quality Assurance. Workplace error reduction is a process that must be followed. The keys to continued progress are dedication and cooperation among team members. This dedication must begin with the chief executive officer and permeate across the entire organisation as a result of their leadership. The implementation of a quality management system will be impossible without the full support and participation of top management. Managers in all sectors of the organisation are responsible for ensuring that

employees have the necessary training, tools, and equipment, as well as an appropriate work environment, in order to complete the tasks allocated to them.

### **QMS guideline series**

- ISO 9000 Quality Management Systems-Principles and Vocabulary, applied in all ISO 9000 Standards.
- ISO 9001 Quality Management Systems – Provides criteria that and company must meet in order to be accredited as ISO 9001.
- ISO 9002-Instructions for ISO 9001:2015 use.
- ISO 9004 – Managing an organization's consistent success, offers guidance for maintaining QMS progress through assessment and enhancement of results.
- The latest edition of ISO 9001:2015 is an ISO 9001 standard.

### **QUALITY MANAGEMENT SYSTEM IN CONSTRUCTION PROJECT**

The International Organization for Standardization (ISO) 9000 quality management system was adopted by the construction industry around the world during the end of the 1990s (Moatazed-Keivani et al., 1999; Barad & Raz, 2000; Chan & Tam, 2000; Hiyassat, 2000; Landin, 2000; Choi & Chin, 2001)[9]. As a result, ISO 9000 has progressively risen to become the most well-known quality management system in the construction sector in recent years, when compared to other forms of quality practises for improving the quality performance of an organisation.

When it comes to the manufacturing industry, quality performance is being measured in order to improve the quality control of products and services, among other things. Nevertheless, the scope of quality management has been broadened to encompass all levels of corporate activity, and this is referred to as total quality management (TQM) (Lee et al., 2011) [10]. However, according to a study conducted by Lau and Tang (2009), contractors in the Hong Kong construction industry are less familiar with total quality management (TQM) (Lau and Tang, 2009). According to Sharma and Gadenne (2002), only three criteria out of eleven factors in total quality management (TQM) are significantly connected with a firm's performance (Sharma and Gadenne, 2002). Furthermore, Curkovic et al. (2000) asserted in another study that total quality management (TQM) can have either no effect and negative consequences on the performance of the organisation (Curkovic et al., 2000) [12].

The quality of a project is sometimes taken for granted, and it receives insufficient attention as a result of this. Because of this, every year, a significant amount of time & resources are wasted due to a lack of adequate quality management methods. Due to the high amount of uncertainty around the concept of quality or the subjectivity associated with its assessment, as well as the enormous number of variables involved in its assessment, this is the case.

It includes a systematic approach, documentation, advice, and audit that can be incorporated into any project management process, from the beginning of a project through the final steps in the project closure phase, and it can be used in any organisation (Aized, 2012) [13]. ISO 9001 can help firms enhance the efficiency of their operations through generic advice and documentation, as well as continuous improvement through the "Plan-Do-Check-Act" (PDCA) approach, in order to achieve successful customer satisfaction and quality objectives. Unfortunately, most construction companies in developing countries believe that establishing a quality management system (QMS) is a waste of time and money because it involves consulting, training, periodic internal and external audits, and certification fees that provide no benefit, and that having a QMS certification is only useful as a market tool. As a result, project managers frequently prioritise certification as the major goal and need rather than the overall value of the project, and this kind of thinking can result in inefficient operations and a lack of an effective quality management system. As a result, most project managers do not typically have a broad enough view of what quality means in terms of QMS, and they do not measure how the project might offer value to the customer in both the short and long terms (Madsen, 2013) [14]. According to several studies, the absence of support from top management is the most significant impediment to the implementation of quality management systems in the construction industry (Khattak and Arshad, 2015)[15]. Additionally, the lack of sufficient evidence regarding how quality management systems (QMS) actually affect organisational practises and performance (as well as a lack of awareness of the benefits of QMS) is a significant obstacle to motivating managers and owners of construction companies to implement QMS. This study was carried out in order to evaluate the impact of quality management system installation on the main factors of a construction project (cost, time, quality/scope) in a sample of construction enterprises in the Philippines' capital of Metro Manila.

### **Integration of ISO 9000 with other management system**

In addition, the construction industry is attempting to incorporate additional principles into quality management systems in order to improve efficiency & quality standards in construction projects. The case study of a private condominium project demonstrates that buildability concepts can be integrated into ISO 9000's quality management system (QMS), despite the fact that they are typically considered separately by many consulting & construction organisations (Low and Abeyegoonasekera, 2001)[16]. In addition, a study (Low and Tan, 2005) investigated the compatibility of integration between the ISO 9001: 2000 quality management system and the ISO 14001: 1996 environmental management system. Although there would be some implementation & potential challenges, according to the study, the integration is still technically feasible in the construction business.

The study also reveals the possibility of merging these two systems in order to improve project performance by enhancing coordination & utilisation of restricted resources, both of which are currently lacking (Low and Shiua, 2000). A computer-based system for construction quality management has been developed as a result of ongoing research and is integrated with the aspects of the ISO 9001 quality management standard. It is intended to be used in conjunction with other computer-aided project management features where possible. The goal of integration is to increase

overall quality performance in construction projects (Battikha, 2002), regardless of whether the project is being carried out by a contractor or a consulting business. [18]

### **QMS in ECC(Engineering Consultancy Companies)**

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### **Quality Planning and Quality Control in construction**

Quality planning (QP) for the project is being designed and developed as a programme by the contractor throughout the design stage, in accordance with the specifications provided by the customer (Rumane, 2011). The goal of quality planning is to ensure that the organization's management and technical obligations are met in order to produce a high-quality product efficiently. Quality Control (QC) is the specific practise of the quality assurance technique and the diversity of actions that are associated with this procedure. Effective quality control has the power to lower the chance of alternatives, errors, and neglect, and it also has the potential to resolve fewer discussions and controversies than ineffective quality control (Rumane, 2011). Quality Assurance (QA) of a project, on the other hand, is a sequence of activities that encompass the intentions that are necessary to generate quality in the job in order to meet the project criteria (Rumane, 2011). It entails developing the project-related rules, work procedures, quality standards, workmanship training, quality guidelines, & quality system that will be required to emerge from the project. The determination of the construction project's focus on the elements will improve the overall quality of the construction project in Malaysia. Identifying the essential elements impacting quality in the construction industry is a fundamental or initial step toward developing strategies for improving the overall quality of a construction project[21].

## **LITERATURE REVIEW**

In the construction sector, quality is the backbone of the company, and maintaining the quality of work is a difficult job to accomplish. The construction industry places a high value on the overall quality of the implementation process. The theoretical knowledge & methodological contributions to the study that were discovered through a review of the literature were documented.

**Abdul Hakim Muhammad and colleagues (2006)** provided a concise overview of the definition of the Quality Management System (QMS) and its application in the construction industry. A disagreement over the definition of the quality management system (QMS) among development players has become a major stumbling block in the implementation of the system. A quality management system (QMS) can be implemented at the corporate or project level. Because of the many different aspects of the project, their work on the company-based quality management

system in manufacturing can be defined as substantial. While various studies on company-based quality management systems (QMS) have been done, the analysis of QMS projects is still in its infancy. While reports that construction businesses benefited from and gained advantages from obtaining ISO 9000 certification are technically true, the primary goal of QMS implementation, namely maximising customer satisfaction in projects, remains a significant goal. A Project Quality Plan is required at the project stage as part of the quality management system (QMS) (PQP). A lot of difficulties are encountered during the deployment of PQP because the market participants are still unfamiliar with the concept. Important information to keep in mind during the design, implementation, and management of the PQP includes the project's strategy and goals, the mechanism, the leadership teams as well as the work methods used to accomplish those goals. PQPs can be written individually for each project team member or as a collaborative document that includes all project team members[22].

**Keng Tan Chin et al. (2016)** were able to determine the significance of implementing ISO 9001 Quality Management System within Malaysian construction companies, as well as the difficulties that construction companies face in adopting ISO 9001 Quality Management System, as well as the approaches that ISO-certified construction firms use to solve or mitigate problems and challenges. They carried out a case study and selected a method for gathering data for this investigation, which they presented to the committee. Five construction organisations were chosen to be interviewed for the goal of conducting a case study. Those involved in the implementation of ISO 9001 QMS are consulted through a single representative form in order to gather additional information about the advantages, problems, and methods of implementing ISO 9001 QMS. Conclusions were reached based on research findings indicating the most significant benefit of implementing the programme is enhanced management and work quality within the business, while the most serious challenge is a lack of understanding about the programme among employees. In order to overcome these implementation difficulties, preparation and auditing (both internal and external) must be improved[23].

**YosepHernawan et al. (2018)** defined the degree to which the implementation of ISO 9001:2015 as a Quality Management System is implemented in a business, what benefits a business can reap from adopting the ISO 9001:2015 Quality Management System, identifying challenges and solutions, and defining the steps organisations must take in order to incorporate the ISO 9001:2015 Quality Management System. The technique employed is a qualitative descriptive tool with a descriptive component. In the form of reinterpretation of the implementation of ISO 9001:2015 in the organisation in the context of constraints and barriers, assessment, & benefits obtained after the application of ISO 9001:2015 Quality Management System, such as the division of authority and obligations in each group that is simpler, faster contact and response to customers, and on-going improvement in the organisation[24]

**AbdulAziz et al. (1999)**, Internal and external parts of quality management systems are intertwined. An internal quality system includes activities that are designed to give assurance to an organization's management that the desired quality is being attained. A "quality management system" is what this is formally referred to as. The successful adoption of a quality management system can result in an improvement in product quality, an improvement in craftsmanship and

efficiency, a reduction in wastage, and an increase in profit for the company. The actions that are part of an external quality system are those that are intended to instil confidence in the customer that the supplier's quality system will deliver a product or service that meets the client's quality criteria. A "quality assurance system" is what is referred to as this[25].

**Lydia (2010)**, In order to ensure quality in planning, the following guidelines should be followed: (i) Ensure that all relevant parties involved in the project, including consultants, subcontractors, and suppliers, are included in task of quality planning for the project; (ii) Establish & define the purpose of the quality system; (iii) Minimize the effort required to amend copies of documents; (iv) Establish a quality system development team so that the team can produce an effective plan; and (v) Ensure that throughout the project, The organisation must prepare for resources and construction work by giving a work programme, cost programme, project quality plan, labour, material & plant schedules, construction technique statement, and inspection and test plan as part of an effective planning process. Therefore, it will be the primary reference for construction process control, as well as for conformance & performance measurement processes in the construction industry[26].

**Yasamis et al. (2002)** relates to the definition of quality of performance as including the dependability of the original product and/or service, as well as the competence, integrity, and promptness of the staff and support services, as well as the reliability of the original product and/or service. Quality in construction must be redefined to include the performance of the organisation as a whole as well as the level of client satisfaction resulting from that success in order for owners to gain more value for their investment[27].

**Wilson and Pearson, 1995** There is a transition in company thinking from a compliance-oriented to a performance-oriented perspective. While contractors strive to improve their overall performance, the control and monitoring systems that clients use to monitor and regulate contractors and their work should also be reengineered to be more effective. MS could be deployed at the corporate or project level, depending on the circumstances. Quality management in construction projects, from the perspective of a construction company, should mean maintaining the quality of construction works at the required standard in order to achieve customer satisfaction, which would result in long-term competitiveness and business survival for the company involved.

**Kerzner (2010)** Defined a project can be thought as as a collection of activities & tasks that are executed within specific parameters and that consume resources across multiple functional lines in order to achieve specific goals. Project management involves a variety of activities, one of which is analysing information pertaining to the best possible balance between the project's objectives. For a company to thrive in a competitive market while also competing with other businesses, it must set goals that are based on the organization's and business objectives. Project management plays a critical part in achieving these goals[28].

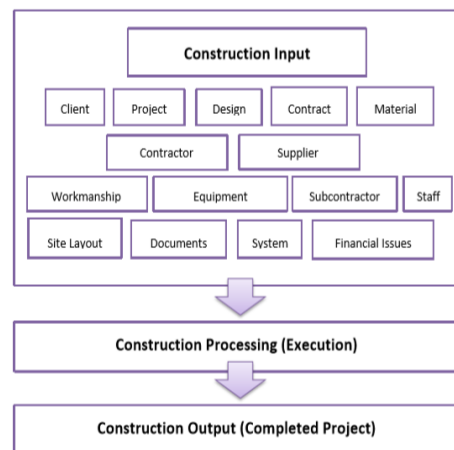
**AnupW S et al. (2015)** It was necessary to do exploratory work in order to gain insight into quality processes, methods, and strategies, as well as the commitment of management to quality implementation in building projects, among other things. They also talked about the difficulties that Quality Control Systems have when they are deployed. They collect data through the use of a



qualitative questionnaire approach, and they conduct a case study to validate the questionnaire utilising a content review tool to validate the questionnaire. They completed by conducting an interview process with the experts based on the findings of the review and also data from the case study, and provided reasonable suggestions on how to resolve any QMS concerns that arose as a result of the process. They have discovered that there is a widespread belief that the deployment of a quality management system increases paper work. The inability of the personnel to follow the QMS and a lack of technological know-how are two of the most major issues encountered during the QMS implementation process. The bulk of the quality issues that have been reported elsewhere are significant in the local environment. Among management variables, the association values are higher for naming members and doing evaluations than they are for any other task. Subcontractors are employed, and there is a greater link between limited professional experience in QMS implementation challenges and the use of subcontractors[29].

**Razek, 1998**The process of a building project is comprised of three stages, namely the input process, the process process, and the output process. Resource and player inputs to a construction project are processed through project execution, and the output of a construction project is a project completed, all of which need the achievement of the anticipated outcome and the production of a high-quality product.

**Pascal Bacoup et al. (2017)**In this case, the approach employed was a synergistic synthesis of both ISO (Quality Management System) principles and the fundamentals of Lean Management concepts and practises. A description of a company's performance is presented at the outset of each article, followed by the presentation of some important conclusions. Obtaining certification in conjunction with a Lean Quality Management System is an option for organisations that meet the following requirements: a one-page Quality Guide, only 10 documents, no substantial non-conformities, and no consumer problems for a period of two years[30].



**Abdel-Razeq(2001)**The elements that are typically thought to have an impact on quality performance can be classified into the following categories: customer, project environment, project team leaders, project procedures, and project management action. The factors that influence building construction projects are design, contract, material, labour, equipment, subcontractors,

site layout, systems, site staff, and execution. Design, contract, material, labour, equipment, and subcontractors are the elements that affect building construction projects. [31].

**Saylor**"both a philosophy or a set of principles" that serve as the foundation for the organization's continuous improvement, which provides an implicit picture of the philosophical component of TQM based on the concept of "continuous improvement" as the core of TQM in all sectors of business[32].

**NurDiyana, [2009]** Poor quality control may result in rework, which may increase the budget & cause the project to be delayed as a result. Worst of all, poor quality management, which includes substandard materials and craftsmanship as well as substandard management and maintenance from start to finish stage, can lead to structural defects as well as building failure and even collapse. In the construction sector, it has been identified as a problem that is characterised by poor quality fulfilment or performance, as well as low productivity in comparison to other industries. [33].

**Nursyamimi, et al., 2014**Employers, such as consultants and contractors, who represent the organization's senior management in the course of a building project should be scrutinised and hired accordingly. At the outset of the project, the client plays an important part in decision-making and establishes the goal, as well as the quality level that players are expected to reach. When it comes to creating a quality management system, the commitment of the customer is critical (QMS). According to the findings of the study, the researcher outlined how top management's commitment to quality management affected practiseQMS[34].

**Low Sui Pheng1 et. al.** As construction projects grow in size and complexity, clients are increasingly expecting greater quality requirements from the companies who carry out the work. It is widely recognised as a successful management concept in the industrial and service industries, and it is abbreviated as TQM! TQM can also be applied in the construction industry to assist enhance the overall quality and productivity of the work. Construction companies in two different case studies demonstrated how Total Quality Management (TQM) may be successfully applied in the construction industry. Reduction in quality costs, improved employee job satisfaction as a result of not having to deal with defects and client complaints, recognition by clients, work completed correctly the first time, subcontractors with proper quality management systems, & closer relationships with subcontractors and suppliers are some of the benefits experienced. Top management commitment, customer involvement & satisfaction, staff involvement and empowerment, customer–supplier connections, process improvement and management, and other TQM performance criteria were all demonstrated. Finally, a framework for implementing Total Quality Management in the construction industry is offered. The construction industry contributes significantly to the overall economic development of a country. Currently, the construction industry is one of the most rapidly expanding businesses in the world. The construction business is seen as a service industry that generates significant employment and serves as a growth engine for other manufacturing industries. Nowadays, the most important goal for the construction industry is to execute the project on time and within the budget and prices that have been established. A continuous improvement process known as DMAIC (define, measure, analyse, improve, and control) tries to increase the efficiency of budgeting by identifying and eliminating inefficiencies[35].

## Conclusion

There are numerous benefits to becoming an ISO 9000 certified organisation. These specifications are also used as the foundation for the ISO 9000 criteria, which are based on them. It is a regulation that occurs frequently in nature and may be tailored to meet the specific demands of every organisation. According to the literature, the general objectives of ISO 9001:2015 are as follows:

- For it to be sufficiently standardised while still being applicable to all types and sizes of companies, independent of their industry or field of operation.
- Considering developments in practise and technology in the field of total quality management. In addition, the implementation of the standard framework, core texts, and definitions as set out in the ISO Directive's annex is required.
- To make operational performance and compliance checks more efficient while reducing costs. According to the literature, the benefits of ISO registration as well as the implementation of a QMS are as follows:
  - Increased management and job efficiency: Both organizations accepted that the introduction of ISO 9001 QMS in their organization would make work management more systematic.
  - Improved communication: As job management has become more formal, companies A, C, D and E have found that contact between workers has improved considerably.
  - Improved documentation control: Companies B, C, D and E submitted that the structured filing system was one of the significant advantages of implementing ISO.
  - Increase customer trust and satisfaction, and thus improve the brand image of the organization. • Heightened number of projects undertaken.
  - Increased efficiency of the on-site jobs.

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DOI: <https://doi.org/10.15379/ijmst.v10i4.2357>

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