



Evaluating Contracting Companies According to Quality Management System Requirements in Construction Projects

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ABSTRACT: Quality management (QM) plays a crucial role in managing companies to improve the performance of organizational work and develop the quality of services and products. In view of the same, project management emerges as a viable tool for implementing the overall strategy of companies. Therefore, investigating the general framework of the strategy in tandem with the management system in the company is just as important as analysing the objectives of the project. For this reason, this paper aims to investigate the requirements of the quality management system (QMS) in accordance with ISO 9001:2015 which affect the performance of construction projects from the perspective of contracting companies. A questionnaire is first developed based on the requirements of QMS and ISO 9001:2015. Then, it is reviewed to ensure compatibility with construction projects. As per ISO 9001:2015, the QMS is mainly based on seven requirements i.e., context of the organization, leadership, planning, support, operations, performance evaluation, and improvement. The questionnaire is sent to 66 employees in contracting companies to indicate the effect level of 37 requirements on construction projects. The collected data are finally analysed using SPSS through descriptive statistics in order to rank the requirements of QMS. It is observed from the obtained results that the leadership requirements have the highest impact on construction projects. On the other hand, the lowest impact was related to the support requirements. These findings may help the construction companies to assess their work according to the requirements of quality management results. Moreover, donors may benefit from these results to evaluate the ability of the organization to meet the requirements of both legislative and regulatory authorities as well as customer requirements.

KEYWORDS: Quality management, construction project, ISO 9001:2015, SPSS.

I. INTRODUCTION

In order to accomplish the objectives of a particular project, it is necessary to manage the project processes within a Quality Management System (QMS). In fact, the adoption of a QMS can be considered as a strategic decision for an organization that contributes to the improvement of the overall performance and provides a great basis for sustainable development initiatives (ISO 9001:2015). However, the relationship between the requirements of QMS and construction projects is still not clear, which is indeed challenging. Recently, contracting companies strive to obtain an ISO 9001 certification in order to improve their reputation and quality of construction processes. However, as the reliable application of QMS does not occur, the situation becomes more complicated. Consequently, the obstacles to the appropriate application of QMS are increased. In light of the same, it is worth mentioning that very few studies have addressed the relation between construction projects and the requirements of the quality management system.

Based on the aforementioned discussion, this paper aims to investigate the impact of QMS requirements on the construction projects based on ISO 9001:2015 in order to appropriately determine the most effective requirements in the construction industry. For this purpose, the construction companies have been asked to assess the effects of QMS on construction projects based on their experience and perspective. The contributions of the paper are highlighted as follows. A literature review related to both construction projects and QMS is first conducted to identify the requirements of QMS, which would be adopted in this study. Then, these



requirements are used to develop the research method for data collection from the construction companies. This is detailed in the research methodology with the employed statistical analysis. The findings of the study play an important role in guiding the construction companies to assess their

projects according to the most effective requirements of QMS. Besides, the study introduces some recommendations for the construction practitioners that could be followed in order to improve the system quality in the construction industry.

II. LITERATURE REVIEW

Quality management is the act of overseeing all activities and tasks that must be accomplished to maintain the desired level of excellence (Nnorom & Olagbaju, 2020). On the other hand, project management includes the planning, organizing, monitoring, controlling, and reporting of all processes of a project. This involves performing the appropriate corrective and improvement actions which are required to achieve the project objectives on a continual basis (ISO 10006: 2017). It is crucial to manage project processes within the QMS in order to achieve project objectives. In the organization where the project organization is operated, the project QMS should be aligned as far as possible with the QMS of the originating organization. As part or all of the project organization are external to the performing organization, QMS requirements might need to be specified to ensure that the project processes are capable of interfacing effectively (ISO 10006:2017). Adopting a QMS is a strategic decision that can assist an organization to improve its overall performance and provide a solid foundation for sustainable development initiatives (ISO 9001:2015). As important as cost and time, quality management is also one of the crucial elements of any construction project and it cannot be considered as an isolated activity. In fact, the role of quality management for any construction company intertwined with all the operational and managerial processes of the company as it attracts customer satisfaction. This would bring long-term competitiveness and business survival for the companies (Abdel Khalek et al., 2016). It is known that modern project quality management is mainly based on quality standards ISO wherein the quality management complements the project management. According to Prathapchandran & Palson (2019), the construction industry suffers from several problems. The challenge of resolving the issue of construction quality and its management lies in seeking long-lasting solutions to the problems facing the construction industry. Many construction industries around the world practice total quality management and it is proved to be an efficient method for implementing a quality-conscious culture across all the vertical and horizontal layers of the company (Prathapchandran & Palson, 2019). The potential benefits of implementing a QMS in an organization

based on the ISO 9001:2015 include: a) the ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements; b) facilitating opportunities to enhance customer satisfaction; c) addressing risks and opportunities associated with its context and objectives; d) the ability to demonstrate conformity to specified QMS requirements (ISO 9001:2015). In Erbil- Iraq, Wali & Hamadameen (2019) found that the most significant motivation factors for obtaining ISO 9001 certification were to improve the image of the company and its reputation. This satisfies the customer requirements and expectation, and improves the quality of construction processes. They stated that the benefits of implementing ISO 9001 were reflected in improving the awareness of objectives and policies of the company, improving the image and reputation of the company, and documentation and standardization of process and procedure of the projects (Wali & Hamadameen, 2019).

In fact, seven requirements for a QMS have been specified by ISO 9001:2015. These are generic and applicable to any organization, regardless of its type or size, or the products and provided services. These requirements include the context of the organization, leadership, planning, support, operations, performance evaluation, and improvement (ISO 9001:2015). In the following sections, these seven requirements are briefly explained.

Context of the organization

Both the project organization and the originating organization should consider the context in which their project QMS operate. Some internal and external issues can affect the ability to achieve the intended project results (ISO 10006, 2017). Sickinger-Nagorni & Schwanke (2016) investigated the importance of context of organization that has been recently added to ISO 9001:2015. Many participants have found it to be a necessary and indispensable approach for understanding the interrelations and anticipating the risks in time. Moreover, it plays a major role in addressing the opportunities through observation of political and societal contexts. This will decrease risky cases and improve the commitment of top management due to



deeper understanding of their own organization (Sickinger-Nagorni & Schwanke, 2016).

ISO 9001:2015 demonstrated that achieving the requirements of QMS related to the context of the organization are needed for the following reasons.

1. Understanding the organization and its context: The organization shall determine external and internal issues that are relevant to its purpose and its strategic direction.
2. Understanding the needs and expectations of interested parties: The organization shall determine the interested parties that are relevant to the QMS.
3. Determining the scope of the QMS: The external and internal issues, requirements of relevant interested parties, and the products and services of the organization shall be considered by organization when the scope of the QMS is determined.
4. Determining the QMS and its processes.

As per ISO 9001:2015, a company is more successful when the products and enterprise management system of the company better meets the requirements of all stakeholders. Mapping the organizational context and stakeholder identification are reported as main benefits from ISO 9001 certificate (Fonseca & Domingues, 2018). Therefore, many organizations think that the requirement of the context of organization is helpful in order to get an idea which context shall be considered (Sickinger-Nagorni & Schwanke, 2016).

Leadership

Management area of leadership and commitment in the QMS is necessary to promote successful functions, especially in the construction industry (Madyaningarum et al., 2018). ISO 9001:2015 stated various aspects related to leadership to incorporate the QMS in the organizations. These aspects include:

1. Leadership and commitment: This required commitments from the top management of the organization and demonstrate the leadership with respect to customer focus.
2. Policy: Organization should establish, implement and maintain a quality policy, and communicate it within the organization.
3. Organizational roles, responsibilities and authorities: Top management shall ensure that the responsibilities and authorities for relevant roles are assigned, communicated and understood within the organization

The absence of top management support and commitment, according to Wali & Hamadameen (2019), was one of the primary hurdles to ISO 9001

implementation in Erbil, Iraq. As a result, Madyaningarum et al. (2018) proposed that project managers or organisational management identify the leadership style, leadership conduct, and especially leadership policy in strategic decision-making to offer quality performance while reducing project rework levels. Furthermore, the commitment must be maintained to underline that all stakeholders must respect and fulfil the agreed-upon requirements linked to construction quality.

Planning

This represents the third requirement among of QMS based on ISO 9001:2015. The project planning in the organization according to ISO 9001:2015 should incorporate the following aspects:

1. Actions to address risks and opportunities: The organization shall consider the risks and opportunities need to be addressed and actions to address these risks and opportunities.
2. Quality objectives and planning to achieve them: The organization shall establish quality objectives at relevant functions, levels and processes needed for the QMS and plan how to achieve these objectives.
3. Planning of changes: When the organization determines the need for changes to the QMS, the changes shall be carried out in a planned manner considering the purpose of change, integrity of QMS, the availability of resources and the allocation/reallocation of responsibilities and authorities.

The process approach utilized in ISO 9001, which includes the cycle "Plan - Do - Check - Act" (PDCA) and risk-based thinking, allows the organization to plan its processes and interactions. Additionally, risk-based thinking enables an organization to identify the factors that may lead to a deviation from the planned results and the processes of the quality management system of the organization. Moreover, this type of thinking enables the use of preventive controls (Nikolay, 2016). Fonseca & Domingues (2018) reported that the risk-based thinking is an advantage achieved by organizations that have ISO 9001:2015 certificates. Further, risk-based thinking is essential for achieving an effective quality management system (ISO 9001:2015).

Support

In light of support requirement, QMS required various concepts to be achieved according to ISO 9001. These concepts include:

1. The resource organization shall determine and provide the required resources for the



establishment and implementation of the QMS as well as the maintenance and continual improvement of the system. These include the people, infrastructure, and environments. In addition, organization shall determine and provide resources needed to ensure valid and reliable monitoring and measuring to verify the conformity of products and services to requirements.

2. Competence: The organization shall determine the necessary competence of person to perform the QMS with the basis of appropriate education, training or experiences.
3. Awareness: The organization shall ensure that persons work under the organization are aware of the quality policy, relevant quality objective, contributions to the effectiveness of QMS, and the implication of non-conforming with the QMS.
4. Communication: The organization shall determine the internal and external communications relevant to the QMS.
5. Documented information: The organization shall create, update and control the documented information determined by the organization for the effectiveness of the QMS.

Resource optimization in construction projects, either large or small scale, ensures the most efficient use of available resources, and it should be done as part of the management process. (Kurhadel & Patel, 2019). Nikolay (2016) stated that implementation of PDCA cycle allows the organization to guarantee that its processes will receive the necessary resources, manage the resources, identify and implement opportunities for the improvement of overall system. In fact, labor is one of the fundamental requirements in the construction industry (Kavithra et al., 2017). Besides, ISO 9001 assured the importance of awareness and knowledge of quality in QMS (ISO 9001:2015). It is worth mentioning that, Wali and Hamadameen (2019) reported that the inadequate culture of employee toward quality was a major obstacle facing the implementation of ISO 9001 QMS in Erbil- Iraq.

Operations

Based on ISO 9001:2015, the operation requirement has various aspects which are listed in the following.

1. Operational planning and control: The organization shall plan, implement and control the processes to meet the requirements for the provision of products and services.
2. Requirements for products and services: The organization shall determine, review the

requirements for products and services to be offered to the customers.

3. Design and development of products and services: The organization shall establish, implement and maintain a design and development process that is appropriate to ensure the subsequent provision of products and services.
4. Control of externally provided processes, products and services: The organization shall ensure that externally provided processes, products and services conform to requirements.
5. Production and service provision: The organization shall implement production and service provision under controlled conditions.
6. Release of products and services: The organization shall implement planned arrangements at appropriate stages to verify the commitments of products and services.
7. Control of nonconforming outputs: The organization shall identify the control and document the outputs, either products or services, which do not conform to requirements.

The materials used in construction (including raw materials, finished products, semi-finished products, components, and parts) are essential. Furthermore, one of the key elements for ensuring building quality is material quality. Moreover, construction machinery and equipment are essential facilities for the modern construction as they reflect the construction power of the enterprise and have a direct impact on the project progress and quality (Abdel Khalek and others, 2016). Furthermore, engineering equipment is essential part in the construction project and usually manufactured with long lead times, large costs and special engineering requirements. In fact, construction manager targets that equipment to be delivered in the site on time, with the right quantity, appropriate cost and required quality, which means that an efficient supplier must be able to meet these goals. Thus, selection of engineering equipment supplier is a crucial managerial process. It requires evaluation of multiple suppliers according to multiple criteria (Erzajj and Bidan, 2016). However, Zeng et al. (2018) found that improving the capacity of suppliers is one of the potential challenges in infrastructure mega-projects in China.

Deviations in desired quality or specific client requirements in a construction process are referred as nonconformities. The most important tasks of nonconformities management are identification of possible causes of nonconformities and development of necessary corrective actions to prevent errors (Nikolay, 2016).



Performance evaluation

In view of the performance evaluation requirement, the organization needs to:

1. Monitor, measure, analyse and evaluate the performance and effectiveness of the QMS.
2. Monitor the customers' perceptions to which degree their needs and expectations have been fulfilled.
3. Analyse and evaluate appropriate data and information from monitoring and measurement.
4. Conduct internal audits at planned intervals to provide information whether the QMS conforms to organizations own requirements for its QMS and ISO 9001.
5. Plan, establish, implement and maintain an audit program, with audit criteria and auditors.
6. Review the organization's QMS, at planned interval to ensure its continuity suitability, adequacy, effectiveness and alignment with the strategic direction of the organization (ISO 9001: 2015).

The organization shall analyze and evaluate appropriate data and information arising from monitoring and measurement to evaluate: a) conformity of products and services; b) the degree of customer satisfaction; c) the performance and effectiveness of the quality management system; d) if planning has been implemented effectively; e) the effectiveness of actions taken to address risks and opportunities; f) the performance of external

III. RESEARCH METHODOLOGY

This paper provides an investigation of the effect of QMS requirements on construction projects. For this, an extensive literature review is first conducted. Then, a quantitative research approach using a questionnaire survey is adopted to collect the required data. It is worth mentioning that the questionnaire is built based on the QMS ISO 9001:2015 requirements, and it is reviewed to ensure its compatibility with construction projects. As per the ISO 9001:2015, the QMS based on seven requirements is presented. These requirements include the context of the organization, leadership, planning, support, operations, performance evaluation, and improvement. The questionnaire lists 37 items categorized into seven requirements. It targets the employees in the contracting companies using non-probability sampling due to the limited knowledge about the population number. The respondents are selected conveniently, as the convenient samples are easy, cheap, and quick to obtain (Alvi, 2016). The questionnaire was filled by

providers; g) the need for improvements to the QMS (ISO 10006: 2017, ISO 9001: 2015).

Study of Prathapchandran & Palson (2019) presents recommendation for quality control and quality assurance in building construction. Quality control emphasizes testing of products to uncover defects and reporting to management who make the decision to allow or deny product release, whereas quality assurance attempts to improve and stabilize production (and associated processes) to avoid, or at least minimize, issues which led to the defect(s) in the first place (Abdel Khalek et al., 2016).

Improvement

Construction companies has adopted a kind of scientific management procedure and method to do quality control of construction, named PDCA Cycle, which is composed of 4 stages of P (plan), D (do), C (check), A (action). The quality goals can be realized and some problems can be solved in each cycle, so that the quality can be improved (Abdel Khalek et al., 2016). Depending on ISO 9001: 2015, the organization shall commit to these tasks while adopting the QMS:

1. Determine and select opportunities for improvement and implement necessary actions to meet customer requirements and enhance customer satisfaction
2. Correct, prevent or reduce undesired effects.
3. Improve the performance and effectiveness of the QMS.

66 respondents asking to indicate their perspective regarding the effect of 37 items on the construction projects using a five-point Likert scale from 1 (very low) to 5 (very high). According to Brewerton and Millward (2001), the required survey participants for various statistical tests range from 14 to 50 for large effect size and range from 35 to 133 for medium effect size. Therefore, the number of acquired respondents is suitable. Moreover, Easterby-Smith et al. (2002) presented a rough formula for calculating the sample size (n) in terms of the maximum error required (E) as

$$n = \frac{2500}{E^2} \quad (1)$$

The sample size was 66, which is according to Brewerton and Millward (2001), considered as medium sample size. This results in an error of 6.15% according to equation (1). Then, the collected quantitative data from the questionnaires are analyzed using Statistical Package for the Social



Sciences (SPSS) 21 version software through descriptive statistics using frequency distribution, mean and standard deviation. Cronbach's alpha is also used to assess the reliability of the survey scale by investigating the internal consistency of the responses relating to the 37 items. The normal range of Cronbach's alpha is between 0.0 and +1, with a higher value reflecting a higher degree of internal consistency (Field, 2009). The calculated value of Cronbach's alpha varies from 0.878 to 0.957, which suggests that the seven requirements used in the questionnaire are internally consistent. The research methodology adopted in this research is summarized in Figure (1).

Respondents' profile

The profile of respondents targeted in this research is summarized in Table (1). The respondents of the

questionnaire are employees in the contracting companies. It can be observed from Table (1) that out of 66 respondents, 26 are project managers, 9 are project engineers, 19 are in quality sector distributed between manger, control and engineer, and 12 work in other jobs related to the construction management. On the other hand, 72.7% of the respondents are from Saudi Arabia, 21.2% are from Egypt and 6.1% are from other countries. Regarding the experience of the respondents, the majority of respondents (37.9%) had 'more than 20 years' of working experience, 13.6% have experience from '16 to 20 years', 22.7% have experience from '11 to 15 years', 21.2% have experience from '5 to 10 years', and 4.5% have experience less than 5 years.

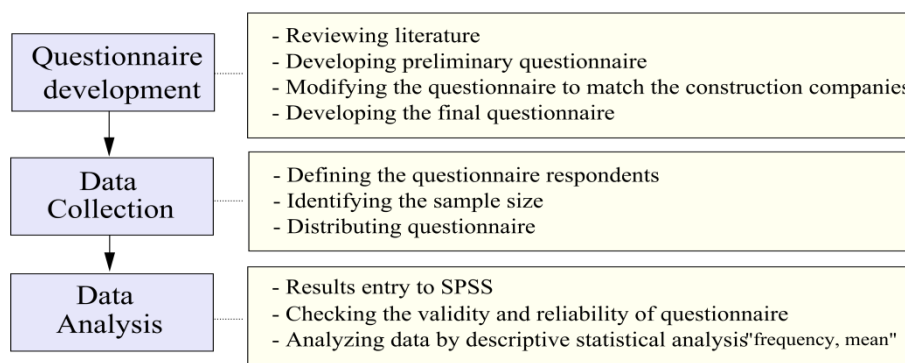


Figure (1): Research methodology

Table (1): Respondents' profile

		Frequency	Percentage
Current job	Project manager	26	39.4
	Project engineer	9	13.6
	Quality manager	8	12.1
	Quality control	8	12.1
	Quality engineer	3	4.5
	Others	12	18.2
Country	Saudi Arabia	48	72.7
	Egypt	14	21.2
	Others	4	6.1
Work experience	Less than 5 years	3	4.5
	From 5 to 10 years	14	21.2
	From 11 to 15 years	15	22.7
	From 16 to 20 years	9	13.6
	More than 20 years	25	37.9
Total		66	100



IV. RESULT AND DISCUSSION

In this section, the research findings that are collected using the questionnaires are presented. The findings fulfil the main objective of this paper in assessing the effect of the requirements of QMS on construction projects. Data are analyzed using descriptive statistics, including mean scores and standard deviation. Requirements are listed in the questionnaire and categorized into seven groups, including the context of the organization, leadership, planning, support, operation, performance evaluation, and improvement. In the following, the obtained results related to the impact of QMS requirements based on ISO 9001:2015 on construction management are presented and categorized into seven groups.

Quality requirement related to the context of the organization

The requirements related to the context of the organization on construction projects consist of five items, and their effects are summarized in Table 2. It can be observed that the requirements related to the context of the organization ranged between 3.77 and 4.14 with an average mean equals to 3.92. This reflects that the respondents confirmed that the requirements of quality related to the context of the organization have a high effect on construction management. It is also observed from Table 2 that, "Determining the scope of the QMS" has the highest rank in this group with mean and std equal to 4.14 and 1.051, respectively. However, the lowest effect is related to the requirement of "Understanding the organization and its context" with mean and Std equal to 3.77 and 1.035, respectively.

Quality requirements related to leadership

In this section, four requirements related to the leadership are investigated to assess their effects on the construction projects. It is observed from Table 3 that the mean for these requirements are ranged from 4.09 to 4.41 with an average equals to 4.23. Besides, the standard deviation equals to 1.113. It can be observed from the obtained results that the respondents think that the highest effect from leadership requirements on the construction projects is related to the "Commitment of management to the customer Focus" (Mean= 4.41 and Std= 1.037). On the other hand, "Organizational roles, responsibilities and Authorities" has the lowest effect in this group with mean and Std equal to 4.09 and 1.147, respectively.

Quality requirements related to planning

The quality requirements related to planning contain four requirements and are summarized in Table 4. The means of these requirements vary from 3.67 to 4.20 with an average mean of 3.93. The targeted respondents found that "Quality objectives and planning to achieve them" has the highest effect on construction projects with mean= 4.20 and Std= 1.041. Besides, the lowest effect is related to the requirement of "Planning of changes to the QMS" with M=3.67 and Std= 1.232.

Quality requirements related to support

The requirements related to the support effects on construction project consist of nine items and their means vary between 3.55 and 3.97 with an average mean of 3.83. It can be observed from Table 5 that, "Determining the necessary competence of persons and taking actions to acquire the necessary competence" has the highest rank in this group with mean and Std equal to 3.97 and 1.109, respectively. Moreover, the respondents believed that the lowest effect in this group on the construction management is related to the requirement of "Determining, providing and maintaining the environment necessary for the operation" with mean and Std equal to 3.55 and 1.126, respectively.

Quality requirements related to operations

The quality requirements related to operations contains seven requirements which are summarized in Table 6. From the perspective of targeted group, the means of these requirements vary from 3.88 to 4.33 with an average mean of 4.07. The targeted respondents found that "Verifying the requirements of projects before releasing to the customer" has the highest effect on construction projects with mean= 4.33 and std= 0.982. However, the lowest effect is related to the requirement of "Establishing, implementing, and maintaining a design and development projects" with mean=3.88 and std= 1.157.

Quality requirements related to performance evaluation

In this section, five requirements related to performance evaluation are investigated in order to assess their effects on the construction projects. It is observed from Table 7 that the mean for these requirements vary from 3.82 to 4.05 with an average equals to 3.90. Besides, the standard deviation was found as 1.172. It can be also observed that the respondents think that the highest effect is related to the "Monitoring the customers' perception of the degree to which their needs and requirements have



been fulfilled” with mean and Std equal to 4.05 and 1.156, respectively. On the other hand, “Analysing and evaluating appropriate data and information arising from monitoring and measurement” has the lowest effect in this group with mean= 3.82 and std= 1.136.

Quality requirements related to improvement

The quality requirements related to improvement contain three requirements summarized in Table 8. The means of these requirements vary from 3.85 to 3.97 with an average mean of 3.91. The targeted respondents found that “Take actions to control the nonconformity and corrective actions” has the highest effect on construction projects with mean= 3.97 and Std= 1.202. However, the lowest effect is related to the requirement of “Determining and selecting opportunities for improvement and implementing any necessary actions to meet

customer requirements and enhance customer satisfaction” with mean=3.85 and Std= 1.056.

Ranking the main requirements of quality management system

In this section, the average mean of the seven requirements of QMS are calculated as shown in Figure (2). According to respondents’ perspective, they are also ordered in Table 9. It can be observed that, the target respondents think that the highest effect from the seven requirements of QMS “ISO 9001:2015” on construction projects are related to the leadership with an average mean of 4.23 and standard deviation of 1.113. On the other hand, they believe that the requirements related to support have the lowest effect on construction projects with mean=3.83 and Std= 1.151.

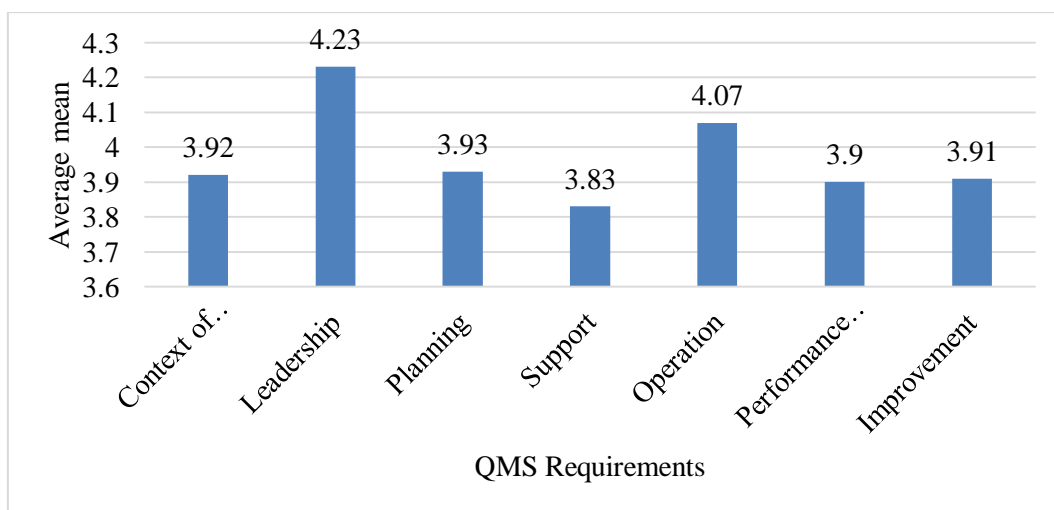


Figure (2): Average mean of QMS requirements

Table (2): Ranks of effect of quality requirements related to the context of organization on construction management

#	Requirements related to the context of organization	Mean	Std	Rank
1.	Understanding the organization and its context	3.77	1.035	5
2.	Understanding the needs and expectations of interested parties	3.92	1.100	3
3.	Determining the scope of the QMS	4.14	1.051	1
4.	Determining the process needed for the QMS with the inputs and outputs from the process	3.92	1.057	2
5.	Determining the sequence and interactions of process of QMS	3.86	1.080	4
Average		3.92	1.065	



Table (3): Ranks of effect of quality requirements related to leadership on construction projects

#	Requirements related to leadership	Mean	Std	Rank
1.	Leadership and commitment to the QMS	4.17	1.184	3
2.	Commitment of management to the customer Focus	4.41	1.037	1
3.	Establishing the quality Policy	4.24	1.082	2
4.	Organizational roles, responsibilities and Authorities	4.09	1.147	4
Average		4.23	1.113	

Table (4): Ranks of effect of quality requirements related to planning on construction projects

#	Requirements related to planning	Mean	Std	Rank
1.	Addressing risks and opportunities	3.95	1.182	2
2.	Establishing plans to address risks and opportunities	3.89	1.191	3
3.	Quality objectives and planning to achieve them	4.20	1.041	1
4.	Planning of changes to the QMS	3.67	1.232	4
Average		3.93	1.162	

Table (5): Ranks of effect of quality requirements related to support on construction projects

#	Requirements related to support	Mean	Std	Rank
1.	Determining and providing the people necessary for the effective implementation of QMS	3.95	1.014	2
2.	Determining, providing and maintaining the infrastructure necessary for the operation	3.82	1.006	6
3.	Determining, providing and maintaining the environment necessary for the operation	3.55	1.126	9
4.	Monitoring and Measuring Resources	3.65	1.143	8
5.	Determining the organizational knowledge necessary for the operation	3.82	1.239	7
6.	Determining the necessary competence of persons and taking actions to acquire the necessary competence	3.97	1.109	1
7.	Ensuring that the persons doing work are aware of the quality policy and relevant quality objectives	3.92	1.328	4
8.	Determining the internal and external communications relevant to the QMS (what, when, with whom, how?)	3.89	1.191	5
9.	Creating, updating and controlling the documented information to ensure that the operations of QMS are as planned	3.94	1.201	3
Average		3.83	1.151	

Table (6): Ranks of effect of quality requirements related to operations on construction projects

#	Requirements related to operations	Mean	Std	Rank
1.	Operational planning and control	4.03	1.095	5
2.	Identifying, reviewing, and changing to requirements of projects through communication with customers	3.94	1.036	6
3.	Establishing, implementing, and maintaining a design and development projects	3.88	1.157	7
4.	Control of externally provided processes, products and services	4.12	1.103	2
5.	Implementing projects under controlled conditions	4.08	0.982	4
6.	Verifying the requirements of projects before releasing to the customer	4.33	0.982	1
7.	Control of Nonconforming Outputs to the requirements	4.11	1.069	3
Average		4.07	1.061	

Table (7): Ranks of effect of quality requirements related to performance evaluation on construction projects

#	Requirements related to performance evaluation	Mean	Std	Rank
1.	Identifying the needed methods for monitoring and measurement and when shall be performed	3.89	1.083	2



Table (7): Ranks of effect of quality requirements related to performance evaluation on construction projects

#	Requirements related to performance evaluation	Mean	Std	Rank
2.	Monitoring the customers' perception of the degree to which their needs and requirements have been fulfilled	4.05	1.156	1
3.	Analysing and evaluating appropriate data and information arising from monitoring and measurement	3.82	1.136	5
4.	Conducting internal audits at planned intervals to investigate the performance of the QMS and its effectiveness	3.86	1.175	3
5.	Reviewing the top management to the organization's QMS to ensure its continuity suitability, adequacy, effectiveness and alignment with the strategic direction of the organization	3.86	1.311	4
Average		3.90	1.172	

Table (8): Ranks of effect of quality requirements related to improvement on construction projects

#	Requirements related to improvement	Mean	Std	Rank
1.	Determining and selecting opportunities for improvement and implementing any necessary actions to meet customer requirements and enhance customer satisfaction	3.85	1.056	3
2.	Take actions to control the nonconformity and corrective actions	3.97	1.202	1
3.	Continual Improvement the suitability, adequacy and effectiveness of the QMS	3.92	1.281	2
Average		3.91	1.180	

Table (9): Ranks of requirements of QMS

#	Requirements of QMS	Mean	Std	Rank
1.	Requirements related to the context of organization	3.92	1.065	4
2.	Requirements related to leadership	4.23	1.113	1
3.	Requirements related to planning	3.93	1.162	3
4.	Requirements related to support	3.83	1.151	7
5.	Requirements related to operation	4.07	1.061	2
6.	Requirements related to performance evaluation	3.90	1.172	6
7.	Requirements related to improvement	3.91	1.180	5

V. CONCLUSION

The adoption of a QMS is a strategic decision for an organization that can help in improving the overall performance and provide a great basis for sustainable development initiatives. In light of that, this paper aims to investigate the effect of the requirements of QMS according to ISO 9001:2015 on the construction projects from the perspective of contracting companies. The study adopted the quantitative approach using a questionnaire to collect the study data from 66 employees in contracting companies. It is observed from the obtained results that the requirements related to leadership have the highest effect on construction projects. Moreover, the requirements related to support has the lowest effect on construction projects. These findings may guide the construction companies to assess their work according to the requirements of quality

management results. Besides, donors may benefit from these results to evaluate the company ability to meet the requirements of both legislative and regulatory authorities in tandem with customer requirements. In view of the research findings, this study recommends the contracting companies to draw their attention towards the highest impact requirements of QMS on the construction projects in order to improve the image of construction companies. Moreover, this study also recommends contracting companies to continue developing a QMS in companies and appoint a particular team for quality management in projects for periodic follow-up and monitoring.

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