



## Factors Affecting Quality in the Design Phase: An Evidence from the Construction Industry in United Arab Emirates

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### Abstract

The objective of this research is to identify the factors affecting quality in the design phase of building construction projects in the United Arab Emirates. Based on the intensive and extensive literature search, the researcher developed the questionnaire addressing the key quality parameters while interviewing several project managers handling prestigious projects in UAE. Sets of data were collected from the Project managers handling construction projects in the UAE in context to the quality in the design phase and relevant contributing factors, such as cooperation level of design professionals, educational level, organizational practices, understanding of quality standards and compliance to local and international standards. By analyzing the response, the researchers have summarized that selected companies in the UAE region are committed towards continuous improvement in quality in the design phase by implementing quality as the corporate policy, senior management commitment towards continuous improvement towards excellence in the quality, best communication channels among team members and designers of different domains, focus on developing skills, providing training to the design team with the latest design techniques, accessibility of project related technical documents and project specifications to all team members and system of archiving and circulating past project, s best practices and lessons learned at current projects.

**Keywords:** Quality, Design Phase, Construction Industry of UAE

### 1. Introduction

The project success is defined by its meeting or exceeding stakeholder's expectation. The project derivable acceptance is the key aspect in the successful project delivery, Quality the is the main driving factor. It defines whether or not project has meet its objectives in context to meeting with the project specified standards and local and regulatory requirements and client requirements. The quality of any project cannot be compromised regardless of the project or product grade, the quality is built-in. Many quality guru and scholars has their own definition of quality but their focal point is the same. The quality reflects the project/product or service integrity, durability, reliability, safety, fitness for use, ease of use and esthetics. As per Snadelands (1994), the quality has become the integral part of organizations strategy as result of reduced cost and increase profit.

Subastianelli and Tamimi (2002) defined quality framework on eight dimensions, i.e. performance, reliability, features, durability, conformance, esthetics, serviceability and perceived quality.

The construction market comprises of architects, builders, contractors, suppliers and works who are directly or indirectly influenced by political, economic, social, technological, and local and central legislation.

#### 1.1. Significance of Construction in UAE

In the past, UAE relied on its oil and gas resources, while UAE has diversified its economy to non-oil industry by focusing on other active resources. Today the UAE is one of the rapidly growing economy country. The vital economic growth factor is the real estate and global tourism industry which is the driving force in its growth and creates needs for increased infrastructure, high rise commercial and residential buildings, hotels, roads, bridges, airports, state of the art transportation system and various green projects initiatives.

#### 1.2. Significance of Design Phase in Construction

The design phase is the foundation for any project which defines the project boundaries, structure, finishes, fit out, electromechanical frameworks and esthetics, elevations looks 2D s, 3Ds. The design phase develops the project concept considering the multiple parameters of client / stakeholder's requirements, regulatory compliance, esthetical appearances, technical functionality and economic feasibility.

In the design phase, the architect or designer reflects the client/ stakeholder's vision of the project in digital shaped blue prints, which reflects all the requirements and serves as guide for the builder to execute.

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### 1.3. Significance of Quality in the Design

The quality parameter is the key factor which directly defines the project success. At the designing phase, the designer, while working on the design of any project, by considering quality in the design as in-built approach, pre-certifies the project's success. The quality in the design phase promotes functionality, performance, durability, sustainability, cost and competitive advantage in the market. Nonconformance to the quality in the design may increase the project failure risks, cost overruns due to deficiencies, reworks during construction phase, post-construction defects, warranties and claims.

### 1.4. Problem Statement

Keeping the discussion in view, the researcher plans to analyze the factors affecting quality in the design phase in the UAE construction projects.

### 1.5. Research Questions

How the cooperation level of design professionals, their background experience, education level, organizational practices, understanding of quality standards, regulatory quality requirements and management commitments affect the quality in the design stage of projects in the UAE.

### 1.6. Study Objectives

The main objective of this study is to analyze various factors affecting quality in the design phase of construction projects in the United Arab Emirates (UAE).

### 1.7. Significance of Study

The study provides valuable insight knowledge for the project management professionals, architects, designers to enhance their professional development, decision making skills, help organize compliance to the regulatory compliance, knowledge advancement, competitive advantage, cost and time efficiency and improved project outcome.

## 2. Literature Review

Wuni, Shen and Darko (2022) conducted research to study the construction best practices in the construction projects domain while using qualitative research techniques in Hong Kong, Singapore and some other countries in the region. The researchers studied the regional leading construction companies using construction best practices and has developed a comprehensive quality framework for the construction projects domain. Since the present study addresses the quality perspective in the design phase of construction process, the entire framework could be an addition to the efforts of managing quality in the booming construction industry worldwide.

Similar study was carried out by Sospeter (2023) on projects in Tanzania to analyze various factors affecting the quality of design documents that may have the consequences on the project objectives, and concluded various contributing factors are; size of projects, professional fees, lack of junior design team supervision, weaknesses in the procurement system and over allocation of assignment to the staff. Since the present study address the quality perspective in design phase of construction project, the data could be an addition to the efforts and guidance to the quality management in construction industry.

Dandan et.al (2020) carried out study to identify the various contributing factors that affects the accuracy of the cost estimates during the design stage of the construction projects in Jordan, and concluded the most driving factors are; the experience of the client, project team, project managers, quantity surveyors and architects are the significant factors that affects the accuracy of cost estimates. This research enhances the current study perspective as design stages in constructions projects. The study was based upon another research conducted by Tan and Lu (1995) who analyzed the factors affecting quality in the design of construction projects in Taiwan. The key factors impacting the quality in the design process were identified as; conformance to the codes and standards, client, s requirements, design process and procedures, capabilities of project managers, design team, completeness of engineering design manuals, utilization of standard material and construction methods. These analyses are relative importance of impacting factors and a contribution to the present study of quality perspective in construction projects in design phase.

Jraisat, Jreisat, and Hattar (2016), Conducted a study in Jordan on quality in construction management to identify the factors affecting quality as it is as important to minimize waste in terms of time, cost and resource due to insufficient nonexistent of quality. Elaborating the highest important factors affecting quality (human resource management, customer satisfaction, and construction specific factors) and the lowest important factors (strategic planning, continuous improvement, resources). The study outcomes are an important input and contribution to the quality perspective in construction and benefited the current study.

Willar et. al (2023) has conducted study on evaluating quality management for road construction project in Indonesia, it has highlighted substantial factors that hinder the implementation of quality management processes as well as indicated the countermeasures to address the quality obstacles encountered by the stakeholders affecting quality. Since the present study addressed the quality prospective in the design phase of construction projects, the entire framework can be value added in the construction projects worldwide.

Zeng, Tian and Tam (2005) conducted a research on quality implementation in design organizations at China. They have found out that by implementing ISO 9001 and improving the management and organizational culture has improved internal operations, increased confidence from the client and customer, and reduce the design deviation for effectiveness improvement. The content and area of reteach has some common goals of quality in design perspective and the entire framework is beneficial to the construction industry. Gosmo and Debs (2023) conducted the study to identify the core principles for implementation of strategic changes in design and construction and proposed the recommendations; as to develop the product oriented business model, promote leadership, engage in partnerships, shift towards digital transformation, training of management, adopt lean construction practices, integrate logistic and supply chain management with architects, engineers and builders. Since the current research is focused in quality perspective in design stage of construction projects, the above research provides guideline and formwork for key principles for implementing in strategic changes in design in construction and the framework is beneficial to the construction practitioners in the designers worldwide.

Sim and Putuhena (2015) conducted a study to identify the mechanism and approach in the Malaysian construction industry to importance the environmental concerns and to enhance the construction quality aspects and concluded that outcome of the environmental sustainability in the construction projects is of great benefit to all the stakeholders and whole construction sector. The focus of the current research in quality perspective in design phase in construction projects, however the sustainability factors are also driving factors towards quality in the construction projects.

Alencastro, Fuertes and Wilde (2023) conducted study to investigate the influence of quality management on building thermal performance. The paper investigated the limitations and challenges to the implementation of project quality plans (PQPs) and their impact on the achievement of expected thermal performance in the UK social housing projects by using qualitative approach and concluded that the adoption of statutory approval as the main quality compliance procedure led to the dilution of the responsibility for prevention and appraisal of defects that compromised the effectiveness of PQP devised by housing associations (HA) and contractors. The current study is addresses the quality perspective in the design phase of construction projects, hence the above study addressed the thermal performance perspective of quality outcome and benefits.

Koutsikouri, Austin and Dainty (2008), conducted research to identify the critical success contributing factors in collaborative multi-disciplinary design projects from the project members point of view and concluded that by adopting socio-political dynamics practices among inter-disciplinary teams, passion and enthusiasm, shared values, creativity and innovation can contribute to the positive project outcomes. Since the current study focus on quality perspective in design phase, however the above research is also providing us the key success factor in multidisciplinary design projects.

Savolainen et. al (2018), conducted research highlighting the importance of collaborative indicators for design management in the construction projects and how the design management affects the quality of construction projects. The research provides a novel way to gain a holistic view with analytical indicator tools and contributes to lean design management literature by providing insight to the underlying mechanism of beneficial collaboration. The current research has the similar framework emphasizing the quality in design phase for construction projects.

Sutrisna and Goulding (2019) conducted the study to highlight the importance of quality information systems, channels among the project team, stakeholders can affect the project design during construction of off shore projects. And concluded that by establishing the proper information transmission channels for client requirements, project requirements, regulatory and social aspects, significantly improve the project outcome. The current study is based on quality aspects in design phase which has similar context with respect the design perspective.

Gharaibeh et. al (2021), conducted study in Jordan on various construction projects to highlight the various factors affecting the changes in the design and its overall impact on the projects outcome are; the client requirement in the design changes, errors in the design affects the project schedule, cost and quality. The above all mentioned studies are more or less relevant to the current research and is helpful in the conceptual context.

### 3. Research Methodology

The researcher carried out an extensive and intensive literature review and identified a questionnaire addressing the research question (Khalid Mehmood Sadar Din and Hummayoun Naeem, 2023). The researcher approached 8 project managers working for the construction projects in the emirates of Dubai. After assuring the issues pertaining to data confidentiality, the researcher interviewed the above project managers to analysis the issue of the factors affecting quality in the design phase; an evidence from the building construction projects in UAE. The collected sets of data were arranged in a thematic order and interpreted leading to logical findings and conclusions and recommendations for future researchers.

### 4. Study Findings

The questionnaire developed by Arditi and Gunaydin (1999) was adopted for data collection for data collection. The project managers working for eight different construction projects were interviewed. Based on the detailed interviews of the respondents, following findings have been derived:

**Table 1: Design Factors**

Design Factors Indicated by Arditi and Gunaydin (1999)	Findings
Level of cooperation among design professionals	Majority of the project managers has confirmed the satisfactory level of cooperation among the design professionals.
Communication among design professionals	Majority of the project managers has confirmed that the design teams are ensuring the cooperation system practicable by communicating through emails and weekly design meetings while some has endorsed the communication channels among the design professionals.
Integrated design	Majority of the project managers has confirmed that the design team is playing valuable role in preparation of integrated design by coordinating among structural, architectural and MEP drawings into single coordination drawings.
Design professionals team work	Half of the project managers has emphasized that it is our team works effort that we have got quality in our design.
Coordination among design professionals	Majority of the project managers has highlighted that the coordination among the design professionals is the key towards project success.
Coordinated design	Majority of the project managers has confirmed that the coordinated design has resulted in less rework, hence improved the construction project quality.
Project team input in design	One third of the project managers has endorsed that the project team is involved in providing feedback of their works experience as an input to designers of relevant trades which they have encountered during execution.
Senior management, s commitment towards quality	Almost all project managers have confirmed that the quality is the first priority of senior management and organizational leadership.
Senior management commitment towards continuous quality improvement	Almost all project managers have confirmed the senior management commitment towards continuous quality improvement, while half of the project managers has confirmed that the corporate leadership is most focused on compliance to quality standards in order to achieve quality project deliverables.
Quality assurance and quality control team reporting to:	Half of the project managers have confirmed that their quality assurance and quality control department are directly reporting to the corporate senior leadership to ensure its independent operating body and to avoid any influence from the construction team.
Statistical method in quality compliance	Almost all project managers are using check list and control charts as statistical tool for collecting information about errors in the quality compliance, in addition to that some project managers are using customized forms as per requirements.
Lessons learned as baseline for future projects.	All project managers have confirmed that during construction phase and at the end of each project, they compile lesson learned, archive and

	transmit to ensure benefits of these lessons for future projects while half of the project managers has confirmed that we use lesson learned as baseline for future project success.
Design team skills development system.	Half of the project managers have confirmed that their designers are updating themselves with latest design tools, while half of the project managers have confirmed that the company is providing trainings for the design teams.
Design firm selection criteria.	Majority of the of the project managers has confirmed that while selecting the design firms, we look for the company having similar projects experience, and half of them have confirmed that they are considering expertise and capabilities approach.
Project documents accessibility for the team.	Majority of the project managers have confirmed that the project specifications and technical documents are available and accessible to the project team for their application and compliance in the specific work packages, while half of the project managers has confirmed that they are providing relevant set of project documents and specifications to the concerned team members for their efficient use in their work related domain.
Project specification and design compliance local and international standards.	Majority of project managers have confirmed that their project specifications and design complies to the local, international and applicable industry standards while some most of the project managers have confirmed that the local and federal government quality standards and codes are incorporated in the project quality standards.
Design tools	All project managers have confirmed that they are using AutoCAD as traditional drafting practice, two third of the project managers has confirmed that they are using AutoCAD with 2D and 3D features for enhanced design while some are using extra drafting software like 3D Max and Autodesk Rivet.

## 5. Conclusions

In the research study, various key quality factors have been analyzed that leads the project towards successful outcome and concluded that focusing on quality in the design phase has significant effects on the overall project success.

Based on the research findings, it has been concluded that by focusing on quality in the design phase has significant effect on the project success. It is evident that effective communication and collaboration among project team members, enhancing the qualification and expertise of the design professionals through training and certification programs, compliance to the regulatory authority and international standards, access and knowledge of project technical details by team members, and archiving and circulation of project lesson learned are the driving factors towards project success.

It has been observed that structural, architectural, electrical, mechanical and IT designs are prepared by the individual specialist and are integrated into a single set of coordinated design; that single set of coordinated design reflects all the construction domains and minimizes errors, omissions, mistakes and reworks during the construction phase which is the true indicator of quality in the design phase at building construction projects.

### 5.1. Recommendations

Based on the conclusions, it is recommended quality management practices as presented in the findings part must be kept in view during the design phase of the construction projects. Such findings may be forwarded to the concerned authorities in the developing countries too for the quality construction.

Another study may be planned in while selecting construction projects from African and South Asia to develop a deeper understanding of the quality management practices during design phase in their respective regions. Subsequently, a comparison may be drawn based on the findings of the present study and the one from developing countries.

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