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IDENTIFICATION OF FACTORS AFFECTING THE QUALITY OF LUXURY RESIDENTIAL BUILDINGS IN IRAN USING A MIXED METHOD

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Abstract

Building construction is an essential part of the construction activities and investments made in this industry of Iran in the last three decades. The construction industry includes important economic, social, cultural, and environmental perspectives due to the wide range of fields. The challenges of poor construction quality in luxury residential building projects are uncountable and require the stakeholders to this issue. This mixed qualitative-quantitative study aimed to identify the factors affecting the quality of luxury residential buildings in Iran. A total of 18 experts were selected by purposive sampling after reviewing previous studies. A semi-structured interview was conducted to collect the necessary data based on theoretical saturation. Then three stages of open, central, and selective coding were performed using ATLAS.ti software. Then, a 21-item researcher-made questionnaire was prepared based on the five-choice Likert scale, which had the necessary validity and reliability. The conceptual research model was evaluated among 250 distribution experts using LISREL software and confirmatory factor analysis. According to the results, all the factors and characteristics identified regarding the quality of luxury residential buildings in Iran were confirmed. The factors of visual and aesthetic proportions and welfare and health were the highest priority, and lowest priority, respectively.

Keywords: Quality, Luxury residential buildings, Qualitative analysis, Confirmatory factor analysis

1- Introduction

The construction industry is an important key player in the economy of every country [1]. The success rate of the construction industry depends largely on quality performance. Therefore, the need to achieve the quality of the final product in building construction is very important. Quality is playing a pivotal role during the construction phase of the project. There is a need to develop a specified method

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to measure quality due to the lack of quality measurement methods. On the other hand, there are a number of problems in the construction industry caused by poor quality control, and the situation seems to get worse. Projects are often late, over budget, and suffer from poor workmanship and materials. Conflict is increasing, resulting in litigation and arbitration with disappointing regularity. The failure of many companies happened due to these problems. Understanding the quality criteria for building construction projects and their impacting factors will make it possible to handle quality problems much better.

Efforts to improve quality in developing countries should be based on methods that stem from their own economic and technological backgrounds. The characteristics of these backgrounds should be turned into advantages to give a competitive edge instead of being regarded as constraints and limitations on the application of the methods and techniques expounded in the modern imported philosophies on quality [2].

Quality may mean different things to different people. For some, it may be defined represent customer satisfaction and others interpret it as compliance with contractual requirements. Quality in terms of construction is even more difficult to define [3]. Hence, quality is defined as “conformance with requirements”, construction project quality is the implementation of the owners' needs per the defined scope of works within a specified budget and schedule to satisfy the owner's requirements per defined scope of works [4, 5]. In the case of the construction industry, the requirements are the specifications and drawings of the contract. It is used in the construction phase of the mentioned documents to the achievement of quality on the project. Hence, it is important not to confuse quality with luxury [6].

The luxury residential buildings construction in Iran is characterized by poor quality. There is no current published work that addresses any of these aspects of quality in a way that relates to or is adapted to suit, the economic, political, social, and technological environment of Iran. Nor is there any published work, which is written from the standpoint of Iran's human resources, and the structure of its construction industry and organization. Therefore, determining the construction industry's viewpoint on the factors which would improve luxury residential building's construction quality in Iran, and the relative importance of each factor, is an essential first step towards establishing methods for a real improvement of these buildings' qualities in Iran and most other developing countries.

Therefore, Identifying the factors that affect the quality of the building construction projects during the construction phase serves as the basis and reference point for implementing a quality model and quality improvement.

2- Literature Review

Quality as a concept has a deep root in history, however, the quality profession greatly evolved after World War II when abruptly people's lives could be destroyed by poor-quality products. Edwards Deming one of the famed quality scholars emphasized that the keys to quality are in management's hands. According to him 85 percent of the quality problems are due to the system, and only 15 percent are due to the employees. In other words, with a reliable system, average people can achieve good results while in the absence of the system it is difficult to achieve the quality target. Joseph Juran is another quality expert, and he is like Deming built his quality reputation in America and then took his

expertise to Japan Juran introduced his point of view into (Juran Trilogy) which can be described as follows:

- 1- Quality control: monitoring techniques to resolve sporadic problems
- 2- Quality improvement: a breakthrough sequence to solve acute problems
- 3- Quality planning: an annual quality program to formalize managerial review and control.

Quality can have different definitions in a different situation, in The Certified Quality Engineer Handbook (1) published by the American Society of Quality different definitions can be found. The below list contains some of these informal definitions:

- Quality is not a program; Rather it is an approach to business.
- Quality is a collection of concepts and powerful tools that are proven to work.
- Quality is defined as satisfaction by the customer.
- Quality includes breakthrough events and continual improvement.

Besides the above definitions, there are many other definitions for quality. Juran defined quality as “fitness for use” while, Philip Crosby a well-known quality expert defined quality as “Conformance to specifications”[7].

The ISO 8402 Standard has a formal definition for quality which is “Quality: the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs [4]. Of course, Not to be mistaken for “degree of excellence” or “fitness for use” which meet only part of the definition [8].

A famous researcher named Collins (1996) describes quality as the world’s oldest documented profession. Quality professionals use a number of definitions to define project quality[9]. The definition of quality depends on the people defining it; some view it as conformity to specification. Others view it as performance to standards or value paid for the price[10]. While it can be recognized, that definitions of quality vary, it is necessarily opposite or contradictory. Instead, the diversity of definitions recognizes that quality is being assessed in different ways. This diversity of viewpoints and definitions cannot be problematic, although it can be understandably confusing. But no matter what definition we follow for quality, it becomes very complex when we try to put it into actual practice. For a user, quality is nothing but satisfaction with the performance, appearance, and reliability of the project for a given price range.

Arditi and Gunaydin (1998), conducted a study to identify the factors that affect process quality. The general factors that affect process quality are: Commitment to continuous quality improvement, quality training of all personnel, management, management leadership in promoting high process quality, effective cooperation between parties taking part in the project, efficient teamwork to promote quality issues at the corporate level, and Industry-specific factors are: communication practices between the parties that are effective and Inspection of quality on the construction site, drawings, and specifications that are consistent, designers and contractors that are selected on merit [11].

Chua et al. (1999) in their research have developed a hierarchical model for construction project success for different project objectives. For quality objectives, they find that it is influenced by four main project aspects, namely, project characteristics, contractual arrangements, project participants, and interactive processes [12].

Bubshait & Al-Atiq (1999) observe that a contractor's quality assurance system, which ensures consistent quality, is essential in preventing problems and the reoccurrence of problems [13].

Ashworth (2004) stressed that defects in construction projects are a persistently worrying problem despite continually improving technology and education [14].

The findings of Albert et.al (2000) show that continuous improvement, building an effective project team, effective communication, and training of employees, are the factors affecting quality. The quality problems are due to management, inappropriate planning, carelessness, lack of training, and improper use of materials [15, 16].

Abdel -Razek et al (2001) discussed the factors that can improve the quality of construction projects. These factors are suitable planning and improving quality control system, accurate estimation of cost, implementation of ISO 9000, effective utilization of resources, and implementing new technologies [2].

S.Alwi (2003) Showed that Many construction industrial sectors have been experiencing critical problems such as insufficient quality, poor safety, and inferior working conditions. These problems have been identified as factors that affect construction productivity and will affect companies' performance [17].

Jha & Iyer (2006) investigated the factors affecting quality performance in construction projects and suggested some possible remedial measures for improving the quality. A questionnaire survey was carried out and the data are collected from the large construction industry. From the study the critical success factors obtained were: the project manager's competence, monitoring and feedback by project participants, top management's support, owners' competence, and interaction among project participants. The factors that adversely affected the quality performances of projects were: faulty project conceptualization, conflict among project participants, harsh climatic conditions, PM's ignorance & lack of knowledge, hostile socio-economic environment, and aggressive competition during tendering [3].

Adnan et al. (2009), research the factors affecting the performance of local construction projects; and their relative importance. The most important factors agreed by the owners, consultants, and contractors as the main factors affecting the performance of construction projects were: Leadership skills for project managers, availability of personnel with high experience and qualifications, quality of equipment, material prices, availability of resources as planned through project duration, average delay because of closures leading to materials shortage, and raw materials in a project [18].

Adze (2009) observed that price is no longer the determinant factor, building clients are becoming more conscious and are insisting on quality construction from the contractors [19]. Isidoro (2009) stressed that project quality was the most important yardstick for patronage by clients, and it is an indication that delays in project delivery and increases in project final costs are not as important as project quality to clients [20].

According to Adbdulkareem and Adeoti (2011), the main problems identified in their research are; non-conformance to quality control clauses by authorized agencies, inadequate budgetary allocation for quality control, and insufficient quality control laboratory and personnel [21].

Zidan (2013) in his study, he concluded that Poor design is the main factor that reduces the overall performance of the construction project. The main factors are changes in client requirements, method of selecting the designer, lowest price offer, insufficient overall design time, and lack of documentation [22].

Adenuga (2013) studied Factors Affecting Quality in the Delivery of Public Housing Projects in Lagos State, Nigeria to show for good performance in the quality of construction projects following factors are essential, utilization of quality assurance methods, joint working, the effective management team of contractors, mutual objective, no enforcement of bureaucracy and politics, no blame culture [23].

Alqahtani et.al (2015) studied factors affecting the performance of projects and developed a conceptual framework to show different aspects and factors that affect the project outcome and performance. The model showed that the project's outcomes are influenced by three aspects, namely project manager, organizational culture, and project management culture [24].

Oke, Aigbavboa, & Aigbavboa (2017) in a study evaluated the factors that affect the quality of the project performance.

The study adopted standardized questionnaires to identify the most important factors and Mean item score (MIS) to calculate the total weighted responses and further used to rank the order of significance of highlighted variables in conjunction with Standard Deviation. The study discovered that major factors affecting the performance quality of construction projects in the study area were related to the use of unskilled and incompetent trade contractors, poor on-site supervision, and lack of commitment by supervising a team shouldered with the responsibilities of ensuring compliance to an approved standard, poor planning, and scheduling as well as inadequate knowledge, training, and skills of construction workmen. The study identified and ranked both factors influencing project performance and performance quality improvement factors using MIS and SD methods [25].

According to the surveys, no study has been conducted on the factors affecting the quality of luxury residential buildings. Since stakeholders may have different views on this issue, it is not easy to comprehensively list those factors.

3- Material and Methods

This applied study was conducted by a mixed method (qualitative-quantitative) using a model, and the data were collected descriptively-survey. First, other articles and experts' opinions were reviewed to identify primary variables and provide a conceptual model of the research and questionnaire design. Then, the data were collected by a researcher-made questionnaire.

The qualitative population consisted of experts, (including senior managers in consulting and design companies, construction, and university professors) who are active in the city of Tehran in district 1 to identify the factors affecting the quality of luxury residential buildings. The quantitative population consisted of customers and investors of luxury residential buildings to answer the questionnaire and determine the impact of each factor.

The sample examined in the qualitative phase was selected by the purposive method until the information saturation and included 18 experts along with ATLAS.ti software to structure the collected data. For this purpose, the interview text, documents, and notes were imported into the

software and coded at the beginning. This process stage is called open coding to form the main concepts. In the second coding stage, the first-level categories were created using axial coding by removing and integrating the existing concepts. Finally, the final theory was obtained from the categories by coding the third stage (selective coding).

In the quantitative stage, the recommended sample size for confirmatory factor analysis and the use of LISREL software was about 280 people. Hence, 250 people were included in the study; along with the dropout rate. In this step, the questionnaire tool was made by the researcher, and the five-point Likert scale was used.

The questionnaire's validity was confirmed based on the opinion of a group of experts, and Cronbach's alpha test, which is one of the internal consistency methods, was used to determine the reliability of the questionnaire. The reliability of the whole questionnaire and individual components were also calculated.

4- Data analysis

In this section, the research data were analyzed in two qualitative and quantitative sections, respectively.

4-1- Qualitative section

First, 186 codes related to the topic were identified from the primary data using the ATLAS.ti software, a concept was extracted from several codes through continuous comparison. The other codes were also converted into concepts until 21 concepts were obtained. In the next stage, the concepts were unified and finally reached five main concepts. Figure 1 shows the conceptual model of the research. Factors affecting the quality of luxury residential buildings are placed in five categories of strength and stability, physical comfort and mental peace, safety, security, and environment, visual and aesthetic proportions, and welfare and health.

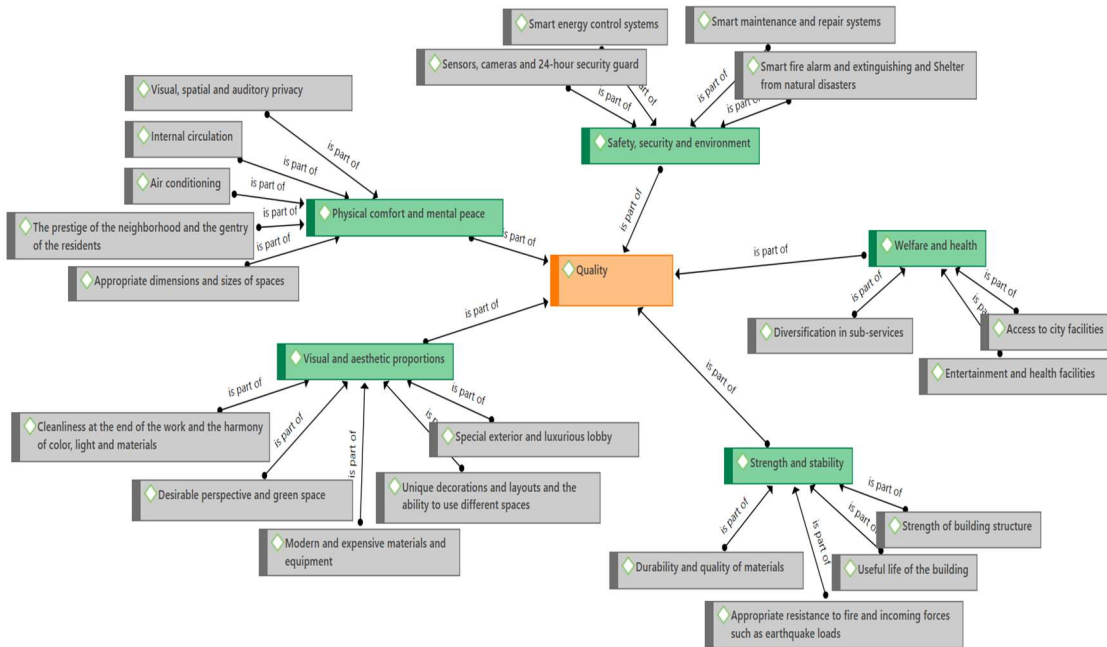


Figure 1 Caption: Conceptual model of factors affecting the quality of luxury residential buildings
 Figure 1 Alt Text: It shows 5 factors affecting quality along with their sub-criteria. Also, the relationship between sub-criteria and main criteria. And the relationship between the main criteria and the quality "is part of" is defined.

4-2- Quantitative section

According to the presented conceptual model, 21 indicators were included as the most effective factors in the quality of luxury residential buildings. Then, the measuring indicators were compiled in a questionnaire, and the questionnaire’s validity was confirmed based on the opinion of a group of experts. A suitable questionnaire was prepared and distributed among 15 people to confirm the identified characteristics. The calculated validity based on the value of Cronbach's alpha was 0.955. In addition, the value of Cronbach's alpha for the questions related to each factor of this questionnaire was above 0.7, and the reliability was acceptable. The questionnaire was randomly placed among 250 qualified experts, including clients and experts in consulting, design, and construction companies. All the criteria and their relationship with the relevant sub-criteria were subjected to confirmatory factor analysis tests based on the extracted votes and then ranked. The analyzes performed and their ranking was conducted with the help of LISREL and SPSS software. Figure 2 presents the graph of criteria and sub-criteria, and table 1 indicates that the presented indicators of the model have a suitable and acceptable fit.

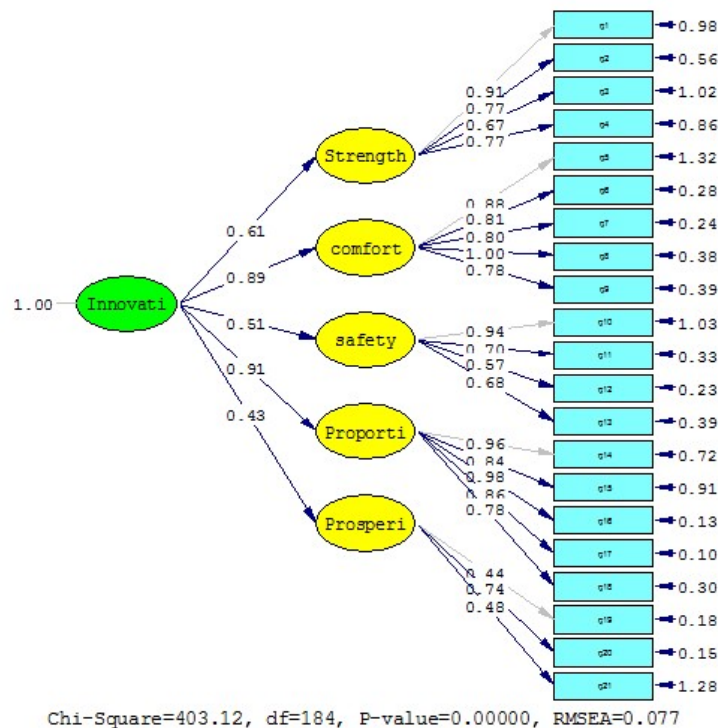


Fig 2: Diagram of Model Estimation Results

Figure 2 Alt Text: This is the output of LISREL software, which shows the factor loading of criteria and sub-criteria

Fit Criteria	RMSEA	GFI	p-value	NFI	NNFI	IFI	χ^2/df
Acceptable Values	<0.08	>0.9	<0.05	>0.9	>0.9	0-1	<3
Calculated values	0.077	0.92	0.000	0.94	0.96	0.98	2.25

Table 1: Fit Criteria Model for Research

According to Table 2, all factors affecting the quality of luxury residential buildings and their corresponding sub-criteria are greater than 1.96. Therefore, the relationship between criteria and sub-criteria was confirmed.

Based on factor loadings, visual and aesthetic proportions, physical comfort and mental peace, strength and stability, safety, security and environment, and welfare and health were ranked. The sub-criteria related to each of the factors can be ranked.

criteria	Factor loading	sub-criteria	Factor loading	t-statistic
Strength and stability	0.61	Strength of building structure	0.91	-
		Useful life of the building	0.77	11.39
		Durability and quality of materials	0.67	11.81
		Appropriate resistance to fire and incoming forces such as earthquake loads	0.77	14.85
Physical comfort and mental peace	0.89	Air conditioning	0.88	-
		Internal circulation	0.81	9.34
		Appropriate dimensions and sizes of spaces	0.80	13.71
		Visual, spatial and auditory privacy	1.00	15.53
		The prestige of the neighborhood and the gentry of the residents	0.78	12.5
Safety, security and environment	0.51	Sensors, cameras and 24-hour security guard	0.94	-
		Smart energy control systems	0.7	8.10
		Smart maintenance and repair systems	0.57	6.74
		Smart fire alarm and extinguishing and Shelter from natural disasters	0.68	8.14
Visual and aesthetic proportions	0.91	Cleanliness at the end of the work and the harmony of color, light and materials	0.96	-
		Desirable perspective and green space	0.84	14.43
		Special exterior and luxurious lobby	0.98	15.59
		Modern and expensive materials and equipment	0.86	12.88

		Unique decorations and layouts and the ability to use different spaces	0.78	13.P9
Welfare and health	0.43	Access to city facilities	0.44	-
		Entertainment and health facilities	0.74	14.33
		Diversification in sub-services	0.48	6.50

Table 2: Factor loadings of criteria and sub-criteria

5- conclusions

Quality affects construction. Quality is an essential element for customer satisfaction and sustainability. For a customer, quality is nothing but satisfaction with the performance, reliability of the project for a given price range, and appearance and such quality is affected by some factors before, during, and after construction. This study aimed to identify and rank the factors and characteristics affecting the quality of luxury residential buildings based on the literature and research findings. According to the results:

- Five criteria, including strength and stability, physical comfort and mental peace, safety, security and environment, visual and aesthetic proportions, and welfare and health were identified as effective factors in the quality of luxury residential buildings.
- All relevant criteria and sub-criteria were approved, indicating the effect of all factors on the quality of luxury residential buildings, which should be considered during design and construction.
- Visual and aesthetic proportions with a factor load of 1, the first criterion, physical comfort and mental peace with a factor load of 0.91, were evaluated as the second effective criterion. The importance of these two factors can be justified by their ability to eliminate physical needs. The sub-criteria of visual, spatial, and auditory privacy, special exterior and luxurious lobby, Cleanliness at the end of the work and the harmony of color, light and materials were ranked 1st to 3rd with 1.00, 0.98, and 0.96 loadings, respectively.
- Based on Tehran's history and its proneness to earthquakes, and the presence of faults, an earthquake warning is highly likely based on the city's history and faults in district 1. Strength and stability became the third priority, in the choice and mind of the beneficiaries with a factor load of 0.61 psychologically.
- Safe housing has a special place in peace and increases the quality of life because of providing different degrees of security for the residents against natural and unnatural disasters, societal crimes, the effects of human activities damaging to the environment, and other mental dimensions. Therefore, the criterion of safety, security, and environment (0.51) were ranked fourth.
- As a result of this research, a dwelling is not a structure used as a house. Which is an element of improving the quality of life in accordance with human needs (Maslow's pyramid). Therefore, welfare and health should be given the last priority with a factor of 0.43.

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