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Investigating the Factors Affecting the Design Change In Construction Industry In UAE

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Abstract: The construction industry in Dubai is fundamental and influential to the economy of this emirate. In order to execute projects successfully, it is necessary to deploy and integrate a wide variety of resources, skills, and competencies. Because of this demand, the building industry in Dubai has developed into a prestigious but fragmented one. This is due to a large number of stakeholders in the construction industry in Dubai. This research is designed to investigate the factors that contribute to design change in the construction industry in Dubai, UAE. A construction project is usually processed with a set of interrelated activities happening with the aim of ensuring the client's requirements are met. These activities are usually classified in a set of stages and phases; one very critical and important phase is the design stage. The findings of the study will provide insight into the factors that cause delays in project completion in Dubai. Owner's factors, mainly poor coordination among the involved parties appear to be the main factor from the 'owners' This finding will assist in identifying the areas, which may need more attention. Similarly, the findings will also help in gaining awareness of other important factors, which cause delays, thus helping decision-makers in effective planning and implementation.

Keywords: Design, Construction Industry in the UAE, Design Change

Introduction: Dubai, one of the seven UAE nations, is a trading center (Abu El-Ella, Bessant, & Pinkwart, 2015). Dubai is the second-largest UAE emirate, with 3,885 km2 (Benedict, 2008). It's on the Arbian Gulf south of Abu Dhabi. Dubai is the Middle East's commercial hub (Al-Nuaimi, Taha, & Mohsin, 2010). Dubai's population in 2017 was estimated at 2.98 million (UAE Ministry of Economy, 2017). Dubai city is split by Al-Khor creek into Bur Dubai and Diera (Al-Nuaimi, Taha, & Mohsin, 2010). Dubai's economy "booms." This has increased demand for public services like transportation and utilities. Dubai's government has responded to rising demand with a number of big projects, including the Dubai Metro and Al Maktoum International Airport (Creasy, 2015).

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The construction industry in Dubai is fundamental and influential to the economy of this emirate. Dubai has the tallest buildings all over the world, the biggest mall in the global, and the most expensive one-kilometer square in the world (Business bay). According to Gardezi, Manarvi, and Gardezi (2013), the construction sector is a complicated one. In order to execute projects successfully, it is necessary to deploy and integrate a wide variety of resources, skills, and competencies. Because of this demand, the building industry in Dubai has developed into a prestigious but fragmented one. This is due to a large number of stakeholders in the construction industry in Dubai.

Developers like "EMAR, NAKHEEL, DAMAC, etc." Engineering Consultants, Contractors, Subcontractors, Suppliers, Real estate, Authorizes like "Dubai Municipalities, Trakhees, DCCA, TECOM, DEWA, RTA, DCD, CA, DU, ETISALAT, LPG, EMP" And Civil society, each has different interests and thus with different values.

This research is designed to investigate the factors that contribute to design change in the construction industry in Dubai, UAE.

2 Design Changes

The construction project is usually processed with a set of interrelated activities happening with the aim of ensuring the client's requirements are met. These activities are usually classified into a set of stages and phases; one very critical and important phase is the design stage. During the design phase, the requirements of the client are determined, and the aspects of the product, as well as the quality standards, are specified through the use of methods, drawings, and technical specifications. At the moment, the work that needs to be done during the design stage is broken up into a number of different temporary sequences and then given to various specialists so that they can carry it out. When it comes to construction projects, the owner chooses the architects who will create the architectural design and specifications first, followed by the development of the structural design and any other specialized designs. The structural and specialist design is then given back to the architect who will develop the final working drawing after incorporating all the ideas of the other consultants. The contractor will then use the working drawing at the construction-implementing phase. Generally, the construction stage is the responsibility of a contractor, who is selected through a competitive process by

the owner or project manager appointed by the client, the other project team i.e. the architect, structural engineer, and other specialists would be doing the supervisory role at the stage.

The main problem with this kind of sequence is the little or no involvement of the contractor or the construction team at the design stage, this means that they will be required to construct based on the working drawings which sometimes might be unattainable. The interaction between the construction team and design team results in the delay of projects, as the designing terms are not communicated properly. The results of this are solutions that are less than optimal, a lack of constructability, and a significant increase in the number of design modifications and construction reworks.

A design change is an alteration to a construction project's design, building work, project program, or other features induced by a modification to pre-existing conditions, assumptions, or needs. This type of change is referred to as a "design change" (Ghosh, Liang, Meng, & Chan, 2001). In terms of costs, quality, and schedules, the repercussions of modifications are not fully understood and are only sometimes acknowledged. Rework or revision of work is one of the undesirable outcomes that might result from changes in design (Lauer, 2014). It has been estimated that between 40 and 50 percent of a project's total work hours were spent on making adjustments. The designers were responsible for many of these changes (Lauer, 2014). Lehner (2015) found that 63% of site instructions resulted in additional work, and he then suggested that more attention should be devoted to the design stage so that issues of variation order can be minimized. Lehner's findings showed that it is important to pay more attention to the design stage in order to reduce the likelihood of variation orders. In addition, a study that looked at the effects of redesigning institutional building projects revealed that it led to a sizeable increase in money that was planned for the construction works (Noé, 2014). In addition, an increase in the total cost of the project as well as a lengthening of the time required to finish it are the two primary repercussions seen for change orders (Poeschl, 2013).

While changes are inevitable, if not properly analyzed and controlled, they may lead to changes in contract price (cost) or the construction schedule (time), and project specifications (Quality and they may also increase the possibility of a contractual dispute. A critical change may cost in consecutive delays in the project schedule, re-estimation of works statement,

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and extra demands of equipment, materials, labor, and overtime (Rees, & French, 2013) In general present problems to all parties involved in the construction process and hence it's important to identify its impact on the control of the construction project. In order to provide a clear knowledge of the phrases that are used, this part provides a discussion on the meanings of design alterations that are implemented in construction projects in Dubai. In order to provide a deduction on the overall overview of definitions that are available, some keywords from previous studies are highlighted and synthesized.

Any modification made to the MEP and architectural designs of a building after the contract has been granted or while it is being built is considered to be a design change. These modifications are not only connected to issues that are in line with the provisions of the contract but also modifications to the working circumstances (Rizvi, 2019). Similarly, Sha, Shahi, Pandit, and Pandey (2017) highlighted that these alterations are any additions, omissions, or adjustments made to the initial scope of work after the contract has been awarded. It is common in construction projects and might result in a change to the contract's price or the time frame (Ibbs, 2012). Table 5 provides a list of the keywords that have been utilized in the definition of "design change" by previous studies.

Table 5: Keywords for design changes

Main course	Park (2003)	Okada et al. (2017)	Ibbs (2012)	Burati et al,(1992)
Changes in design / construction (addition / omission)	✓	✓		✓
After award of contract and signed				✓
Affect contract provision (affect on scope)	✓		✓	✓
Affects work conditions	✓			
Adjustment to contract price / contract time		✓	✓	✓
Occurs regularly			✓	
Make construction dynamic and unstable	✓	✓		

This study provides a synthesis of the definition of design changes, which is that regular additions, omissions, and adjustments to design in a construction project occur after the awarding of the contract and affect the contract provisions and work conditions that make construction dynamic and unstable. This definition was derived from a previous study that defined design changes as "regular additions, omissions, and adjustments to the design

Rework was described as the superfluous effort of redoing a process or activity because the initial implementation of said process or activity was carried out in an erroneous manner (Love, 2002). According to the findings of Hwang et al. (2009), phrases like "non-conformances," "quality deviation," "quality failures," and "defects"

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have been considered to be synonyms for "rework." In recent years, rework has emerged as one of the most common concerns regarding building projects. The majority of situations that require rework are those in which there were alterations, damages, flaws, errors, omissions, or other types of non-conformances. The keywords that were utilized in the definition of rework by previous studies are displayed in Table 1.

Table 1: Keywords for rework

Keyword	Love & Li (2000)	Love (2002)	Palaneeswaran (2006)
Unnecessary effort of redoing a process of work		✓	✓
Unneeded effort of redoing an activity	✓		✓
Incorrectly implemented at the first time		✓	✓
Wrong way from the beginning	✓		✓
Arising from changes			✓

The rework that occurs as a result of non-conformances to quality or specification will not be discussed in this paper because the focus of this study is solely on the rework that results from modifications to the design. Therefore, rework due to design changes can be summed up as the superfluous efforts of restarting a process of work or activity due to poor implementation at the beginning that comes from design modifications. This definition may be found in the following sentence.

As a result, PWC (2014) emphasized the importance of the literature review by defining it as the process of developing connections between related research works with the goal of recognizing recent achievements in a particular field and highlighting significant questions that still need to be answered. As a result of the vast amount of information that is currently available, delimitation to determine the scope of the study is very necessary (Burnes, 2014).

Design modifications, rework, change management, construction industry, delay, cost overrun, and project performance are some of the keywords that have been identified for use in the literature search. As a direct consequence of this, the author included the two-stage filtering approach that was adopted (Desai & Bhatt, 2013) in their literature review that was submitted to one of the most prestigious journals in the field of project management. To begin, all of the research were excluded from further consideration right away. Second, the contents of each document that was discovered were quickly sifted through to determine which ones were relevant, while excluding any papers that were deemed to be irrelevant. A literature map was then used to finalize the process of organizing the available material (Dievernich, Gong, & Tokarski, 2015).

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2.1 Factors of Design Change

These factors are derived from the previous literature and presented a research gap that helps the researcher to design a conceptual diagram of the current study.

2.1.1 Owner's Factors

According to the research done by (Dispan, & Schwarz-Kocher, 2014), the owner of the organization is basically the main stakeholder and has the maximum stake in the business. Any profits or losses earned will directly be affecting the owner of the organization. The study suggests that having an owner who is experienced in the field puts a competitive advantage for business performance. This implies that a person who has already worked in some capacity in the construction sector would be able to make better decisions looking at the economic and prevailing conditions.

The capital that the owner is investing also makes a difference on the business performance. More capital would not only lead to higher investment but would also lead to easier cash flows. Even if the organization has good business and sales but is not able to receive the money for the sales then the cash flows would be hindered. Cash flows are extremely imperative when it comes to paying the bills of the business. Hence an owner who has the advantage of having easier cash flows would tend to be in an easier situation given the circumstances of Dubai as it will not hinder their business capability and the ability to survive in the market even in tough conditions. Another important factor when it comes to checking the impact of the owner on the business performance in this sector is the connections of the owners.

According to the research of (Edmonds, 2011), the better connected the owner is, the easier it is for the business to generate sales. This makes sense as UAE is composed of many different nationalities. In such times, it is easier to do business with a known entity. This instills a factor of trust in the buyer. Hence, an owner with more contacts in the industry is more likely to survive even if the conditions are tough and not as economically easy. The connections also have a ripple effect on business performance. Because of these connections, there will be the positive word of mouth will be generated. This will help in getting more business from the industry.

In the construction industry specifically, the people in the UAE rely a lot on word of mouth. So the more positive the word of mouth is, the more likely it is that the business generates more sales.

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Apart from that, the temperament of the owner also affects the way that the business is run. If the temperament is positive and motivated then the business would be able to survive even the tough economic conditions.

This obviously comes with experience and exposure in the industry. The higher the experience, the better and easier it is for the owner to navigate the business in any economic condition.

2.1.2 Design Consultant's Factors

Design consultant, according to the research that was conducted by (Felden, & Hack, 2014), are basically the people who design or do the architecture of the business. This involves not only designing for the first time but improvising on the design over and over again. Design consultant has an important role to play when it comes to the success of a project. This is because of the fact that the project variables keep on changing. They are not permanent and according to the changes the design has to be changed.

If the consultant is understanding and compassionate enough then they will be able to easily put forth changes and redesign for the project. Redesigning is a hectic task as it involves going over changes and then making them even more suitable. Another main task for the design consultant in the UAE, which might affect the success of the project, is how well the consultant is handling the stress.

This factor was given by the research was conducted by (Friedrich, & Behrend, 2007). If the consultant is able to cope up with the pressure, then their tasks and designing become easier. This has an overall positive effect on the project performance.it makes sense as the consultant would be able to work with all the demands of the stakeholders and produce a result that is efficient and effective and makes the work easier. This would lead to positivity in the business performance and an overall improvement in the benefits and cost-saving purposes of the businesses.

Another important factor that affects the performance of the business in the construction industry of UAE and is related to the design consultant is the experience and exposure of the design consultant. The market of UAE us unique and dynamic and poses various challenges in order to survive. If a consultant has previously worked on projects within Dubai then many dynamics will already be clear to him. He would be able to understand how the stress has to be handled. All this would give the

consultant a competitive advantage so that they would be able to work better and perform better in the industry and have a positive business performance.

Experience is not the only important factor in order to be able to survive the many demands of the stakeholders. Experience also helps the design consultant to get more business. Some design consultants are in the house whereas some are freelanced. Because of the economic conditions of the market if the UAE, free-lance design consultants are preferred by organizations as they pose much less of a cost.

Hence, it would be much easier for the consultant who has experience and connections to find even better projects and be able to thrive. This would all add up to his experience and eventually total to the success of the project that the consultant is performing at that time.

2.1.3 Contractor's factors

The contractor is the person in the business who is basically the middle party, according to the research conducted by (Albach, Meffert, Pinkwart, & Reichwald, 2015), and takes up a project for a buyer who basically buy the services of the contractor. So the contractor builds the project in their behalf.

This is important because a contractor has all the specialized tools and is equipped with the techniques that are required to architecturally build a project that all the stakeholders would later on appreciate.

Contractors are the backbone of any project. The market of Dubai, especially , according to the research conducted by (Albach, Meffert, Pinkwart, & Reichwald, 2015), shows that contractors tend to be more laid back and usually do not let the designers or the owners have a lot of say in the project matters.

This could lead to potential problems for both the owners and the designers as co-tractors ate the main people who are going to execute the project. Based on their execution only the work is going to be completed.

Contractors in Dubai find cheap labor in the UAE and hence their profit margins are also high. This would also affect the success of any project as the firm, which is bigger, might have more projects at hand and would not be able to dedicate time to each project as well.

There are many smaller contractors also functioning in the UAE. These are smaller

businesses that are operational on a small scale and help the builders in small construction works. Some project owners might prefer using smaller co-tractors as opposed to the bigger ones as they would be more disciplined in listening to the requirements of the owner and the designers.

Contractors have a huge impact on the success of the project. According to the study by (Albogamy, Scott, & Dawood, 2013), the contractors here in UAE have a complete hold or autonomy of the project that they are looking after. They make all the decisions in their entirety. If the contractor is understanding and lets the designers of the project decide and be helpful about it then it leads to easier completion of the project.

Contractors have complete autonomy over the project in a sense that they deploy the main workforce. The entire scope of the project, which is based on cost, time, and quality, revolves around the contractors. If they are able to complete the project on time then the scope of the project would be achieved. Similarly, if the project is completed within the cost then also the scope is fulfilled. Lastly, if the quality of the project is achieved then also the scope is completed. All these three factors are the main indicators of the variable of performance in the construction industry in Dubai and a contractor can influence all three of these factors.

The contractors also help in the improvising process. As it has been already mentioned that improvising is a main aspect of the project and happens very often. When it dies happens, it is actually the co-tractor that helps in implementing the change. If the contractor is adamant about non-improvisation, then the progress of the project could be easily compromised.

Hence, it is imperative to select a contractor based on the past performance of the projects so that the best contractor could be picked that would be able to deliver the progress of the project.

2.1.4 Project Management

Project management, according to the study conducted by (Anderson Ackermann, & Anderson, 2010), is the science and art of being able to handle all the aspects of a particular project. These aspects include when the project is being completed if the quality of the project is being compromised and how much time is it taking to complete the project. Usually, managers practice project management. They help direct all the employees in such a strategic way that productivity is maximized.

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Various tools are used by project managers in order to complete the tasks of project management. Specifically talking in this study, the construction industry is extremely elaborate. There are many tasks involved in the completion if an architectural based project in the UAE.

Software like GANTT charts could be used. These charts not only help to visualize the entire process but also help to identify how the sources of the project could be maximized in the best possible way.

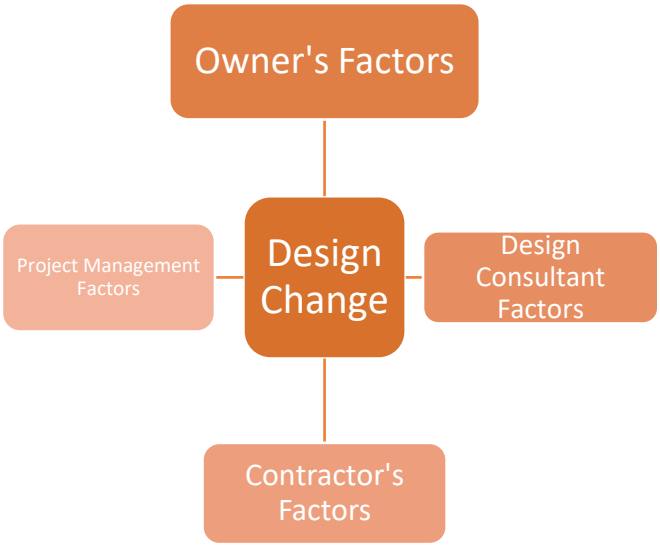
Project management has a huge role to play when it comes to the success of the project. Only a project that is being properly managed would be able to be successful. Since the project of architectural nature in the UAE range from simple to extremely complicated, it is imperative that the project managers handle the project strategically.

A project that has been managed well would be able to deliver all the requirements on time and within the cost. Project management includes all the aspects that have been described above. They include managing the contractors.

3. Conclusion

Various studies have been conducted that show the impact of various internal and external factors on the success of the project. The study that was conducted by (Aziz, 2013) found empirical evidence from the literature that project success is dependent on various factors that range from bringing internal and external in nature. These factors tend to be a controlling milestone when it comes to architecture bare projects. The researcher is of the view that as compared to the normal functioning of the organization, a project has a completely different nature. The project is a unique entity, which is creating a unique product. Hence, a project of any nature is more likely to be affected by internal and external factors.

The study that was conducted by Aziz (2013), found that projects organized by stakeholders that are repeatedly successful mean that the organization is controlling the internal and external factors well. Because of that, the planning and the scope of the project could be implemented and used.



Another study was conducted by (Bammens, Notelaers, & Van Gils, 2013) and found that internal factors that have been described above play a huge role in assessing the success of the project because they all require proper time and planning in order to be understood and their risks mitigated. This particular study aims to identify the success factors that lead to the completion of a particular project in the UAE in the architecture sector. The past researches of Yap and Abdul-Rahman (2011) and have been mentioned but these particular factors sun up in entirety in terms of internal and external factors that how UAE market enables the success of a particular project.

The internal and external factors have been taken from the study of Al-Nuaimi, et al., (2010). They had a similar framework but this study is more UAE-centric. The findings of this study would enable organizations working in the UAE on a project basis to understand the critical factors and then evaluate them in accordance with their own business. This study would also open further arenas of study for not just architecture but various other industries. The dependent factors are time and cost which are the two most important factors of the project success triangle, the third one being quality. Hence, there was a gap in identifying the impact of these internal and external factors on the time and cost of the project, which essentially lead to project success.

Based on the above discussion, the researcher conceptualizes the following diagram that becomes the basis of future study.

Researcher recommends to test the above mentioned factors using quantitative and qualitative techniques. Changes are inevitable in construction projects and during a construction project, many decisions have to be made, often based on incomplete information, assumptions and personal experience of the construction professionals. Change is a common denominator in all construction projects, though the size, scope, and complexity of projects may vary significantly from case to case. Change management is a critical problem faced by the construction industry. The effort of managing change orders has imposed a huge burden on project management. The findings of the study will provide insight into the factors that cause delays in project completion in Dubai. Owner's factors, mainly poor coordination among the involved parties appear to be the main factor from the 'owners' This finding will assist in identifying the areas, which may need more attention. Similarly, the

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