Delay in High-rise Building Construction Projects of Dubai: A Review

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Abstract: Construction industry plays dynamic role to the socio-economic progress of country. It is extremely vibrant industry which generate 11% to 13% of GDP annually all around the world. Construction industry is affected by various unpredictable factors like lack of quality work, lack of labour production, incapability of contractor to manage the site, lack of finance and extreme weather conditions are the key factors leading projects to delay. Delay is chief concern faced by construction industry. It's affecting the projects by means of time, cost and quality. The causative factor of delay varies for every region of the world. Level of impact also varies from every project, extending from a few days to months or even years. After reviewing the 64 number of research papers 56 number of factors causing delay were identified & top most common factors in different parts of the world causing delay in construction projects are recognized keeping in mind the environment of Dubai, United Arab Emirates. The ratio of delay in construction projects is different for developed and developing countries has been also identified. This delay can lead to many negative effects in which it has an adverse influence to the project's stakeholders particularly clients and contractors such as cost overrun, arbitration, litigation, time overrun, disputes, and fully abandonment of project. Thus, it is always suggested that all team members of construction projects should be capable and educated on factors and effects of delay in order to minimize it.

Keywords: *Construction Delay; Unpredictable factors; Causative factors; Effects of delay; Stakeholders*

1. Introduction

Globally Construction sector is the key sector and has great impact on economy. This industry generates about 11% to 13% of gross domestic product (GDP) worldwide [1]. Construction industry of United Kingdom generates 6.5% of annual GDP [2]. Construction industry of Canada generates 11.3% of GDP annually as reported in economy report of Canadian [3]. Qatar construction industry generates 9.8% of GDP annually [4]. United Arab Emirates construction industry shares 11.1% of GDP annually as reported by Dubai Chamber of commerce (2017). It also improves the excellence in living standards and enhances the life quality by providing basic facilities like roads, schools, hospitals, hotels and other. This industry is considered as the backbone for the development and prosperity of any country. It is renowned fact that United Arab Emirates has diversified culture with different traditional backgrounds, Organizational and administrative trends. At present UAE's construction market is booming to meet the requirements of upcoming Expo 2020 meanwhile many challenges and barriers are faced by this industry. According to [5] the total value of building project across the UAE is USD 294.365 billion for ongoing mega projects like) Sadiyat Island (Figure-1) Masdar city (Figure-2) are Projects of Abu Dhabi Mohammed Bin Rashid Al Maktoum city (Figure-3) and Palm Jumeirah (Figure-4) are the major examples of ongoing developments in UAE.

Figure 1: Sadiyat Island Development Project (Saadiyat)

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Figure 2: Masdar CityDevelopement Project (google)

Figure 3: Mohammed Bin Rashid Al Maktoum city(google)

Figure 4: Palm Jumeirah Development Project (Palm Island)

As stated by report of AECOM [6], UAE has current ongoing projects of worth US $ 427 billion and it is also estimated by building management institute (BMI) that construction market of middle east and North Africa (MENA) will increase at average percentage of 6% between 2017 and 2020 beforehand dropping down at a rate of 4.6% between 2021 and 2026. Therefore, the maximum quota of budget is assigned to Dubai construction projects of worth USD 364.79 billion out of 427 billion. Hence the larger portion of budget is allotted for the development of Dubai. Besides that, increasing construction market of Dubai is facing various challenges like, cost overrun, quality of work, construction waste low labour production, extreme environmental conditions challenged by this industry but severe concern among them is timely achievement of projects which is key issue faced by this industry. However, this key issue is substantially more in developing countries that resulted in negative impact to the industry image. This negative impact has encouraged many researchers,

Assaf et al., 1999, Assaf & Al- Hejji, 2006, Skitmore, 2009, Al- Kharashi 2009, Allogamy et al., 2012, Mahamid, 2013, Alotaibi et al., 2014, Elawi, 2015, Hamid 2016, Serdar Durdyev et al., 2017, I.A Bhatti (2018), to explore more about delay factors. According to findings of [7],he identified that projects of Saudi Arabia are delayed 70%. In Abu Dhabi capital of UAE 90% projects are delayed, so delay proportion is higher in United Arab Emirates as compared to other middle east countries. However maximum number of Building construction projects of Dubai, UAE are in progress. Thus, it is very necessary to find out rate of delay in countries and their effects on the stakeholders of the project. So that the construction industry of UAE, especially Dubai becomes aware about the severe effects of delay.

2 Background of Study

2.1 Delay in Construction

Many researchers are exploring about the delay in construction projects for many years [8]. The term delay is described by numerous researchers in numerous ways. As it's an extra time taken to complete the specific task or project, rather than specified in agreement or contract on which both parties were agreed to deliver a project [9],Delay in construction industry is common concern all around the world It's very costly, challenging and risky to handle [10]. [11] defined delay as incident that can lead to extension of time within agreed contract to complete a project, according to definition of Oxford dictionary it is late or postponed period of time to deliver a task or project So the proper description of delay for this study is failure to complete project or milestone of activities as planned schedule because of various causative factors

2.2 Types of delays in Construction

A. Non- Excusable delay

Non-excusable delay is usually arisen by contractor or Sub contractor due to any reason, may be due to lack of labour production or may be due to financial difficulties. Hence, no time extension is granted for such delays but contractor has to compensate to client if it is mentioned in agreement. The factors which can be the reason for this type of delay are enlisted below.

i. Extreme weather conditions
ii. Due lack of sub contractor's performance
iii. Incapability of Main contractor to manage the project site.
iv. Financial problems faced by contractor
v. Work is not executed as per specifications
vi. Rework at the site, Quality of work is not maintained at the site
vii. Unable to manage the site progress as per Planned Scheduled

B. Excusable non-compensable delay

Excusable non- compensable delay is neither caused by contractor nor by client, usually this type of delay caused due to natural reasons like rain, earthquake, cyclones and Snow fall. Usually time extension is granted for such delays but however no monetary loss is compensated. The factors that include this type delay are

C. Protest or strike of workers
D. Environmental factor like rain, snow, earthquake or high temperature.
E. Unanticipated delay in delivery of machines or equipment
F. Unanticipated delay in delivery of material from contractor side
G. Unanticipated delay in delivery of material from client side which in their scope of work.

C. Excusable compensable delay

Excusable compensation delays are purely raised from owner or client side. This type of delay is caused due to change in scope of work or delaying in payment schedule. But most of the time change in scope of work is required by client side, for that client always produces in written regarding variation in scope of work. For this type of delay, usually contractor is compensated with time extension as well as cost is also paid against change in scope of work.

D. Concurrent delay

Concurrent delay can be defined as when more than one type of delay happens at the same time and both either together or independently impact the projects progress [11]& [12] Concurrent delays occur when both owner and contractor are responsible for the occurrence of the delay

2.3 Dubai's Construction Industry

United Arab Emirates has seven numbers of states; Dubai is also one of them, this state is considered as the largest and most populous state of UAE. In last few years Dubai has fascinated the attention of the globe through many advanced and enormous construction projects and sports activities. According to the data base of [13] they compared the one-decade building construction progress of Dubai's and Abu Dhabi's building construction of on basis of two factors.

i. According to number and function of buildings
ii. According to height of building (meters)

Where they found that Dubai was top with respect to number of buildings projects constructed as well as with respect to height as compared to Abu Dhabi and rest of other states as shown in Figure 5 & 6 below

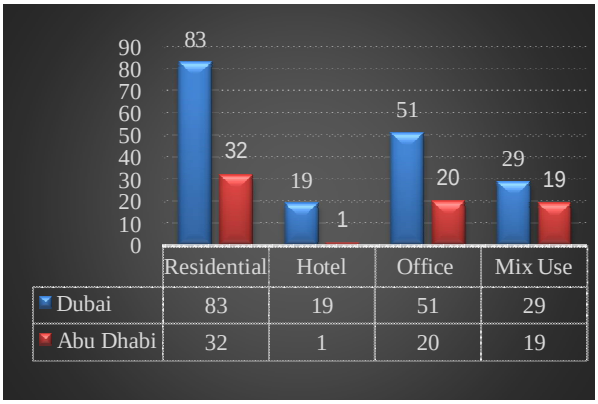

Figure: 5 No of Buildings projects Progress (2008-2018)

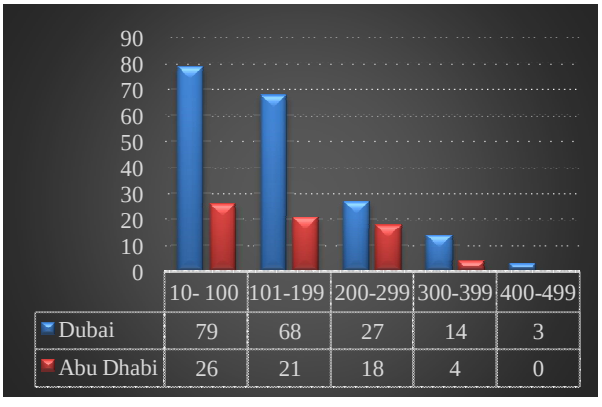

Figure: 6 Height of Buildings Progress (2008-2018)

Except the progress of building projects constructed, Dubai is also known as city of iconic for high-rise buildings and a skyscraper particularly for world's tallest building Burj Khalifa. As reported by [14], the population of Dubai is

increasing faster than rest of other states of UAE, in 2013 population of Dubai was recorded 2,213,845 and total area of Dubai is 4114 km^2which is becoming inadequate day by day. In 2016 Dubai has secured the title of best designation for tourists (Faeez, 2016). This statement was further ensured by the report of [14] that passenger traffic was recorded 5.5% more than the passenger traffic of 2016. As reported in [15], Dubai's high-rise building construction industry has made a significant position on the map of world.

Worldwide Ranking

Dubai has got world's ranking because of having tallest building Burj Khalifa which is 828 meters high.

Figure :7 Burj Khalifa world's tallest Building (Google)

Global Ranking

Dubai is on third number in the global ranking because of completing maximum of building higher than 150 meters.

Figure 5: Buildings heights 150m+ (Dubai Marina)

Regional Ranking

Dubai is on top number on regional ranking in the Middle East for constructing maximum number of highest buildings.

Figure 6: Max No Highest Buildings in region(DWTC)

2.4. High-rise Buildings and Why needed in Dubai

To define the particular category of building with respect to height or story, [16] the Council on tall buildings and Urban Habitat has developed an International standard for measuring and defining the particular category of Building as shown in figure 7. So, in this regard CTBUH has categorized the buildings into three categories.

High-rise Building

It is defined as if the height of building is more than 50 meters or any building having stories more 14 is categorized in high rise buildings

Super high-rise Building

It is defined as if the height of building lies between 300 meters and 600 meters, that building is categorized in super high-rise buildings.

Mega high-rise Building

It is defined as if the height of building is more than 600 meters is categorized in mega high-rise buildings.

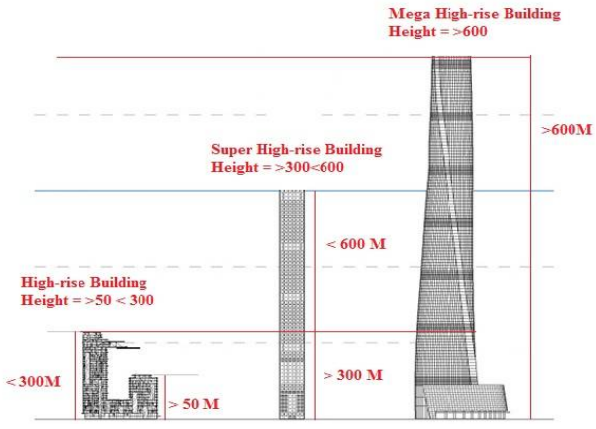

Figure 7: International Measuring standard for Buildings (Own)

As per above defined categories of buildings, all the above-mentioned building of skyscraper center of UAE lies in the category of high-rise buildings and few of them lies in category of super high-rise buildings. There are various reasons behind the construction of high-rise building projects which is enlisted below

(1) First, the increasing population Creates demand for High-rise Buildings
(2) Land prices are very expensive
(3) Restriction of random expansion adjacent to agricultural land or oil fields
(4) The high budget required for setting up infrastructure for new cities.
(5) The shortage of land area like the Dubai, and this dominant number of high-rise building projects in Dubai is increasing day by day

2.4 Literature Reviewed Previously

There are many causative factors which the key reasons for Delay in construction projects are. It is very necessary to recognize those factors which are causing delay in construction projects. Since numerous researcher works had been carried out in determining these factors. Thus, a wide-ranging literature review was carried out to expose these factors causing construction delay.

[17] accompanied a qualitative and quantitative survey in Bahrain; analysis of the survey concluded that major factors for delay in construction projects of Bahrain are improper planning, lack of qualified team and operatives and incapability of client to make decision in time

[18] emphasized that first of all factor of delay has to be investigated and later on it will be easy to alleviate and avoid them within construction projects, because knowing the influence of factors which are causing delay are somehow usual as they have directly and indirectly impact on the project.

[19] has recognized 42 reasons for delay in construction projects they identified that major reasons for delay are change in scope of work, financial issues from client, commercial market fluctuations and delay in making decisions from client or client representative side.

[20] conducted a survey in Zentan city of Libya and he found that the major reason for delay in construction projects is due to incorrect preparation, lack of proper and efficient communication and correspondence, design errors they all results in delay in construction projects

[21] found that major reasons for delay are unrealistic time duration of project and very hard and strict contractual obligations.

According to study of Alaghbari et al (2007), that commercial problem is major concern which initiates many other reasons for delay in construction projects of Malaysia

[22] Had detail research in Saudi Arabia on time performance factor of construction projects, they found 73 numbers of different causes of delay because that study was conducted in detail from the prospective of client, contractor and consultant, these three stakeholders of the project acknowledged that the most usual reason for delay is “change in scope of work” and research was concluded that nearly 70% of the projects were overdue in Saudi Arabia.

2.5 Factor of Delay in construction

The factors which cause delay in construction projects were identified from previous studies. The list those factors of delay were listed through reviewing the past literature. A total 46 factor were identified as shown in Table 1 below

Table: Factors of delay in construction

No	Factor	Reference
1	Project duration is impractical	Emam et al (2015)
2	Poor contract Management	Ejaz et al (2013)
3	Improper planning for project	Albogamy et al (2013)
4	Construction contract type	Assaf et al., (1995)
5	Project scope is not defined properly	Assaf et al., (1995)
6	Lack of cooperation among team members	Assaf & Al Hejji (2006)
7	Contractors selection goes wrong	Islam et al (2015)
8	Lowest tender cost dependency	Ejaz et al (2013)
9	Improper early planning of project	Albogamy et al (2012)
10	Owner’s Interference in construction operation	Al Kharash & Skitmore (2009)
11	Lack of decision power from client side	Al Kharash & Skitmore (2009)
12	Lack of decision power from contractor team side	Mahamid (2013)
13	Lack of decision power from	Al Kharash &

	consultant team side	Skitmore (2009)
14	Suspension of work	Hasan et al., (2014)
15	Late in approving shop drawings	Al Kharashi & Skitmore (2009)
16	Late in approving material samples	Al Kharashi & Skitmore (2009)
17	Change in materials	Mahamid (2014)
18	Material Shortage	Toor &Ogunlana (2008)
19	Delay in material delivery	Koushki et al., (2005)
20	Delay in approving variation orders	Alotaibi et al., (2014)
21	Change orders are issued late	Assaf et al., (1995)
22	Clients lack of experience in construction	Emam et al., (2015)
23	Payment schedule is delayed by client	Massood et al (2015)
24	Communication gap between client other parties	Ismail (2014) &Gajare et al (2015)
25	Coordination gap between client and other parties	Ismail 2014 & Masood et al l (2015)
26	Failure in coordination with government authorities by client.	Al Khalil & Al Ghafly (1999)
27	Poor quality of work done by contractor	Masood et al, (2015)
28	Delay in handing over of site by client	Megha& Rajiv (2013)
29	Lack of technical knowledge by Client	Faridi& El Sayegh (2006)
30	Insufficient technical experience of consultant	Ren et al., (2008)
31	Deficiencies in drawing details	Motaleb & Kishk (2010)
32	Engineering designs are generated complex	Chan & Kumar swamy (2013)
33	Resistant attitude of consultant	Megha & Ragiv (2013)
34	Incompetent management team of contractor	Ren et al., (2008)
35	Reworks due to mistakes at construction site	Ren et al., (2008)
36	Frequent replacement of sub-contractor	Assaf et al., (2005)
37	Dispute between main contractor and sub-contractor	Megha&Ragiv (2013)
38	Bureaucracy of government authorities	Kikwasi (2012)
39	Delaying in issuing the permits by government departments	Masood et al, (2015)
40	Short working hours and many holidays by authorities	Ren et al., (2008)
41	Changes in requirements and regulations	Wu et al., (2004)
42	Criminal activities by workers	Assaf et al., (2005)
43	Conflicts among workers	Assaf et al., (2005)
44	Cultural and traditional conflicts	Ren et al., (2008)
45	Abrupt change in prices	Faridi& El-Sayegh (2006)
46	Geological environment of construction site	Assaf and Al Hejji (2006)
47	Shortage of equipment	Davis *et al. 2014).*
48	Shortage of labour production	Faridi& El-Sayegh (2006)
49	Shortage of skillful workers	Ismail 2014 & Masood et al l (2015)
50	Logistic access to site	Islam et al.,

		(2015)
51	Political insecurity	Ejaz et al., (2013)
52	Effects of subsurface conditions	Assaf and Al Hejji (2006)
53	Labour Absenteeism	Assaf and Al Hejji (2006)
54	Delay in procurement of material	Akogbe et al., (2013)
55	Late in producing design drawings	Enshassi et al., (2009)
56	Frauds practices by contractor	Skitmore (2009)

Delay in construction projects is very usual and chronic concern for developed and developing countries however the factors causing delay may vary from country to country and region to region except that the ratio of getting delay in construction projects may also vary from country to country and region to regions. After reviewing all the factors causing delay in different parts of the world, the majority of common factors of delay are enlisted below

1. Difficult for contractor to Finance a Project
2. Lack of Coordination among stakeholders
3. Improper Scheduling and Planning
4. Incapability of Client to take decision
5. Delay in Payment from Client
6. Change in scope of work
7. Low labor productivity
8. Unskilled labor
9. Poor contract management
10. Lack of trained peoples in project team

Hence delay in construction is unavoidable phenomenon all around the globe; the ratio of delay in construction projects also varies from place to place, after reviewing about the delay in different parts of the world, the table below show the ratio of delay in construction projects.

Country	Delay Rate	Reference
Qatar	Over 80%	(Hassan Emam et al.,2015)
Saudi Arabia	Over 70%	Assaf and Al-Hejji's 2006
UAE	90%	Salama et al., 2008
Malaysia	92%	Memon et al., 2012
United Kingdom	Over 60%	Davis *et al. 2014).*
United States	70%	Workman et al., 2008
Germany	63%	Kostak et al., 2015)
Canada	82%	Berechman et al., 2006

3. Effects of Construction Delay

When construction projects are experiencing delay, this delay can lead to many negative effects in which it has an adverse influence to the project's stakeholders particularly clients and contractors such as cost overrun time overrun, arbitration, disputes, litigation and total abandonment of Project. Several researchers highlighted the effects of delay in construction projects as presented in Table 1.

Table 1: Effects of Construction Delay

Effects of construction delay	Country	References
• Cost overrun • Time overrun • Dispute • Arbitration • Litigation • Abandonment	Nigerian	Aibinu & Jabroro, (2002) and Motaleb & Kishk, (2010)
• Time overrun • Cost overrun • Disruption of traffic movement • Delay of other projects related to the main project	Bahrain	Hasan et al., (2014)
• Time overruns • Cost overrun • Arbitration • Loss of interest of stake stakeholders • Black listing	Pakistan	Masood et.al., (2015)
• Time overrun • Cost overrun	Malaysia	Memon et al., (2011) &Gajare et al., (2014)
• Lack of Finance • Delay in progress of payment	Saudi Arabia	Al-Kharashi & Skitmore (2009) Al-Emad (2015)
• Change in work plans	Denmark	Lindhard and

• Work force • External conditions • Material and construction design		Wandahl (2014)
• Time overrun • change orders • slow decision by client • financial difficulties • Late delivery of materials.	UAE	Omayma Motaleb & Mohammed Kishk (2010)

After reviewing all the effects of delay from certain countries, the majority of the common effects of delay are found following as shown in figure 7 below

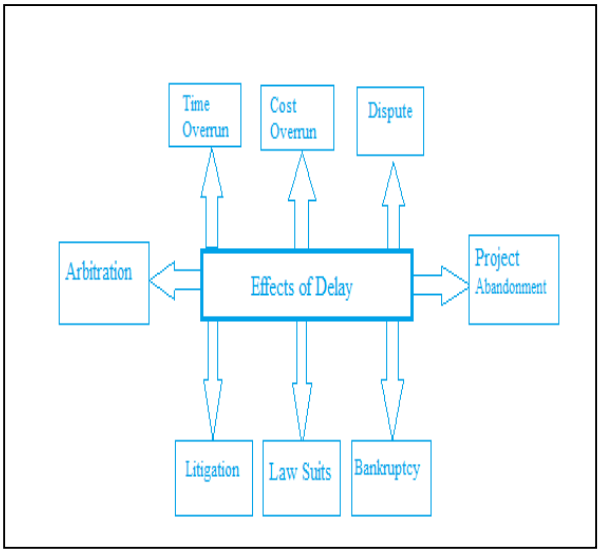

Figure 7: Effects of construction Delay

4. Results, Conclusion and Recommendation

Based on detailed literature review of 64 research papers, the top 10 most common factors causing delay in construction projects are identified from studies carried out in different parts of the world keeping environment of UAE especially Dubai in consideration as enlisted. Any one of the identified factors can be the reason for delay. To conclude, this delay can lead to many negative effects in which it has some adverse influences to the project's stakeholders particularly clients and contractors such as time and cost overrun, disputes, arbitration, total abandonment and litigation as enlisted in table 1. It is therefore recommended that all members of construction teams should be trained and educated on factors and effects of delay in order to minimize it.

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