

A COMPARATIVE STUDY OF DELAYS FACTORS IN PROJECT COMPLETION IN LIBYA AND UK CONSTRUCTION INDUSTRY

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ABSTRACT: Delays in completing construction projects have significant financial and social impact to all parties involved in the construction process and in particular in developing countries. This is very evident in most construction projects in Libya and in both public and private sectors. The research study was initiated by Libyan Government and the main aim of the project is to develop a new strategy in reducing the impact of delay factors. In order to achieve this, a number of objectives have been set-to conduct a comprehensive literature survey, to conduct a comparative study of the delay factors in project completion in both Libya and UK using semi structured questionnaire and finally, to identify and analyse the causes of delay and ranked them using frequency of occurrence and severity. The critical causes of delay for construction projects were quite different between Libya and UK. For the former, the most critical causes of delay in Libyan construction industry were low skills of manpower, changes in the scope of the project, slowness in giving instruction and poor qualification of consultant, while for the latter they were financial problems, bad weather conditions on the job site and change in the scope of project. Statistical experiments including Paired Samples T-Test, was run to test the significance of the survey data in both countries Libya and UK. The statistical results confirmed the collected data from the survey were significant.

Keywords: Questionnaire survey, Construction delay, Impact on time and cost, Statistical tests.

1. INTRODUCTION

Construction delay is the major problem facing in the construction industry. In every construction projects, there are delays due to several reasons and their impact level varies from project to project ranging from a few days to years. It is generally understood that the construction delay is the most critical factor affecting to deliver the project in time, within budget, and required quality. However, understanding the causes of construction delay may help to find out exactly the various causes and their significance in order to minimize and avoid the impact of delays in any construction projects. According to Mansfield [1], it is found that timely completing of construction project was a signal of project efficiency; however, construction processes depend up on several variables and unpredictable factors that occur from various sources, including performance of involved party, availability of resources, site conditions and contractual conditions. However, it is rarely happen that a project is complete within the specified time. The aim of this paper is to identify and rank the most critical causes of delay in the Libyan construction industry and develop a comparative study of delay factors between Libyan and UK construction industries.

2. LITERATURE REVIEW

There are several research studies were conducted in identifying the delay causes in construction projects and their impact in cost and time in different countries. Wa'el [2] identified that the major causes of delays in construction project in Malaysia and the perceptions of the different parties regarding the causes and the types of delays. They discussed all factors causing the delay in construction projects based on three categories: contractor, consultant, and owner. Additionally they found poor conditional weather, shortage of materials and lack of equipment in local market were found as external factors in construction delay.

Zaneldin investigated the variation and claims in construction projects in Dubai and Abu Dhabi in the United Arab Emirates using 124 claims related to different projects. He concluded that a reasonable time should allow for the design team in producing clear and complete contract documents with no or minimum errors and discrepancies. Efficient quality control techniques and mechanisms need to establish in minimising errors, mismatches, and discrepancies in the contact documents. Special contracting provisions and practices that have been used successfully on past projects need to add in contract document and a strategy needs to introduce on how to deal with tighter scheduling requirements [3].

Alaghbari found several causes of delay in Saudi construction projects that drawing preparation, approval of design, payment delay, changes in design, slow cash flow, design errors, labour shortage. They examined the delay in construction projects in Saudi Arabia and discussed in a field survey that included 23 contractors, 19 consultants, and 15 owners [4].

Al-Moumani conducted a qualitative analysis of construction delays by examining the records of 130 public building projects constructed in Jordan during the period 1990-1997. The frequencies analysis method used to discover the main causes of delay from the survey records. The result of the analysis exposed that the main causes of delay in construction projects were relate to designers user, changes weather, site conditions, late deliveries, economic conditions and increase in quantities [5].

A report published by the National Audit Office, UK 2003 and edited by John Bourn having title “Modernising Construction”, exposed that 70% of the construction projects carried out by public departments and agencies were completed late. Moreover, a recent research by Building Cost Information Service (BCIS, UK) found that nearly 40% of all studied construction projects had overrun the contract period [6].

Chan [7], conducted a industry survey to discover the causes of overruns in Hong Kong construction projects and they found that three major groups of construction participants (owner, contractor, and consultant) were responsible for delay. They also found that the most significant sources of overrun were site management, unforeseen ground conditions, low of decision-making and necessary variations of work.

Literature review concludes that the causes and effects of delay factors in construction industry can vary from country to country due to different location, local environment and technology applied in construction processes. It is found that

questionnaire survey was a widely used method to identify the causes and effect of delays in construction industries. In the view of competitive environment and globalisation, it is assumed that a comparative study on the delays between Libya and other countries, particularly UK, is very important and timely needed. Therefore, the paper focuses to discover the causes of delay in the construction industry, and rank them according to the frequency of the occurrence. The paper also develops a comparative study of the causes of delays between Libyan and UK construction industries. The next section discusses the research methodology.

3. RESEARCH METHODOLOGY

Previous research studies highlighted that questionnaire survey is one of the most cost effective ways to collect and analyse a large number of responses from various involved parties in order to achieve better statistically analysis of the data [2]. Therefore, the questionnaire survey was selected as a research methodology to collect and analyse the causes of delay in construction industries. A questionnaire survey was designed aiming to estimate the frequency of occurrence and severity level of delay factors in construction projects. The survey includes seventy causes of delay related to contractors, consultants and owners that were identified through literature reviews. The survey was designed in two languages: English and Arabic in order to collect the responses from UK and Libya.

Out of 300-designed survey questionnaires, 175 were distributed in the UK by post and the rest 125 were distributed in Libya by researcher in person. The survey covered different construction projects around UK. Similarly, the survey questionnaires also were distributed in construction project located in different cities in Libyan. Total 35 % responses were received. The details of questionnaire distribution and responses are presented in table 1.

Table 1, Number of respondents

Questionnaires	Contractors		Total	Consultants		Total	Owners		Total	Total
	L	UK		L	UK		L	UK		
Distributed	38	68	106	45	57	102	42	50	92	300
Respondents	24	13	37	20	19	39	28	12	40	116

L: Libya, UK: United Kingdom

3.1. SURVEY DATA COLLECTION

The survey data gathered from the UK and Libyan Construction projects were analysed using expressive statistical method. For effective and efficient analysis, it is necessary to collect the large number of data in an organized and consistent way. The respondents were asked to rank the level of frequency and severity of each cause using the range of weights provided. The survey data was collected through post, email in UK and in person in Libya.

3.2. SURVEY ANALYSIS

Different sorts of ranking analysis is presented and discussed as part of survey data analysis. In data analysis, importance-based ranks is included in a group ranking, either by the total answers of each professional group (contractors, consultants and owners) or a country group (respondents from Libya and UK respectively). Moreover, three ways are used for ranking all delay causes, subcategories rank, and main categories rank. The analysis and discussion of ranking focuses directly on the importance of delay causes rather than ranking them based on frequency and severity separately, because of the significance values of presenting the rank of delay causes based on frequency and severity separately. For testing the data, a Statistical Package for Social Science (SPSS) was selected as the best available options. The following statistical methods were used to analyse the data and outline the survey results:

Frequency index method was selected for the ranking of delay causes considering the frequency of occurrence identified by participants in the questionnaire survey.

$$(F.I.) (\%) = \sum_{a=1}^4 a \times \left(\frac{n}{N}\right) \times \frac{100}{4} \dots\dots\dots (1)$$

Where *a* is the constant expressing weighting given to each response (ranges from 1 for never up to 4

for constantly), *n* is the frequency of the responses, and *N* is total number of responses

Severity index: A formula is used to rank causes of delay based on severity as indicated by the participants.

$$(S.I.) (\%) = \sum_{a=1}^4 a \times \left(\frac{n}{N}\right) \times \frac{100}{4} \dots\dots\dots (2)$$

Where *a* is the constant expressing weighting given to each response (ranges from 1 for no effect up to 4 for very severe), *n* is the frequency of the responses, and *N* is total number of responses

$$IW = \frac{[F.I.(\%) \times S.I.(\%)]}{100} \dots\dots\dots (3)$$

Importance Weight: The importance index of each cause is calculated as a function of both frequency and severity indices [8].

4. RESULTS OF INDUSTRY SURVEY

The causes of delays were grouped into four categories as shown in table 2. The Average Weight (AW) was used in analysing the causes of delay under four categories including contractors, consultant, owners and externals factors. However, analysing with AW method for a particular category is practical in determining the average importance weight of the same category. In other words, the contractor performance category includes 35 individual delay factors, while the consultant category includes 10, owner category includes 14 and others category includes 11delay factors. The AW of consultant delays causes by a particular group in Libya is higher than the AW of contractor, owner and other delay causes. Although there are many causes in contractor category, the important AW of each one is less than the causes in consultant and owner category because of less important causes identified in the contractor category.

Table 2, Importance average weight of major delay categories by country's respondents

Ctg	Libya				UK				Average			
	I W	R	A W	RANK	I W	R	A W	RANK	I W	R	A W	RANK
C	2416.81	1208	2.001	4	1644.4	720	2.284	2	4166.4	1928	2.161	3
OWN	821.52	392	2.096	2	448.89	156	2.878	1	1240.6	548	2.264	2
CNS	647.62	200	3.238	1	242.97	190	1.279	4	889.43	370	2.404	1
Other	1362.9	680	2.004	3	596.6	392	1.522	3	1572.16	754	2.085	4

Moreover, the causes of delays were also grouped into eight subcategories as shown in table 3. The detailed discussions of survey results related to the

causes of delays grouped into eight subcategories are presented below.

Table 3, Importance index and rank of delay subcategories by country's respondent

Ctg	Libya				UK				Average			
	M	A W	II	RANK	A W	II	RANK	A W	II	RANK		
C/MP	0.086	2.746	0.236	7	1.289	0.111	8	2.09	0.179	8		
C/EQ	0.174	1.715	0.298	6	1.109	0.193	5	1.31	0.228	7		
C/MT	0.214	2.592	0.555	2	2.616	0.560	2	2.55	0.546	3		
C/PM	0.300	1.609	0.483	3	3.126	0.938	1	1.99	0.596	1		
OWN	0.200	2.096	0.419	5	2.672	0.534	3	2.26	0.453	4		
CNS	0.143	3.238	0.463	4	1.279	0.183	6	2.4	0.344	5		
EP	0.114	1.522	0.174	8	1.423	0.162	7	2.1	0.239	6		
EF	0.286	2.173	0.621	1	1.570	0.449	4	2.08	0.594	2		

Ctg: category, IW: importance weight, R: respondents, AW: average weight, II: importance index, M: modulus of the number of the causes in the delay category, C: contractor, MP: manpower, EQ: equipment, MT: material, PM: project management, OWN: owner, CNS: consultant, EP: early planning and design, EF: external factor

4.1 CONTRACTOR DELAY FACTORS

The identified causes of delay related to contractor were considered to analyse and subdivided into four groups: materials, equipment, manpower and project management. Table 2 presents categories result between both countries. In Libya, the survey results show that contractor was ranked at the fourth responsible party whereas in UK, the survey results show that contractor was ranked as second responsible party for delay.

4.1.1 MATERIALS

Concerning the Importance Index (II) of the material subcategories, delay due to materials found at second important subcategory by Libyan and UK respondents as shows in table 3 in both Libya and the UK. Therefore, Libyan projects suffer delays because of materials-related factors more than UK projects, because of change in materials prices, delay in materials delivery, change in materials specifications and shortage of required materials. Delays occur because of materials matters, which held the first of average importance weight among eight subcategories, as shown in table 3. While it takes higher position in the Libya and UK projects

4.1.2 EQUIPMENT

Concerning the Importance Index (II) of the equipment subcategories, delay due to equipment found at sixth rank in Libya, and fifth in UK. The details of delay ranking due to equipment in construction project are presented in table 3. Survey result was found that due to factors related to causes of equipment categories as shortage of required equipment, breakdown of equipment,

shortage of skills operators for excavations and inadequate equipment used for the works.

4.1.3 MANPOWER

Considering importance index (II) manpower subcategory of delay factor was ranked as the seventh positions in Libya, were as in UK it was found at eighth rank for the causes of delay in construction projects as shows in table 3. The survey result identified that the delay due to manpower was related to low skill and shortage of manpower's. The shortage of unskilled workers does not act as a major barrier in construction projects as there are sufficient foreigners labourers, however, the most of them are low skills.

4.1.4 PROJECT MANAGEMENT

Considering the importance index (II) the project management subcategory was ranked as third position in Libya and first position in UK as shows in table 3. It is ranked by respondents from both countries was the average weight is very high as shows in table 3. The survey result exposed that the delay factors such as poor site management, lack of skill by contractor, rework due to default in construction, delay in the preparation of contractor document submission were relate to project management categories in Libyan construction projects. Similarly, delay in sub-contractor work, contractor's poor coordination with the parties involved in project and difficulties in financing the project were related to contractors in UK construction projects.

4.2 CONSULTANT DELAY FACTORS

The consultant delay category in Libya was found the most important category. However in Libya the survey result shows that consultant are ranked as first responsible party for construction delay, where

in UK the result shows that consultant are ranked as less important for construction delay as shown in table 2. In Libya and the UK, the average importance weight of the causes of this category was ranked highest among the identified categories in this study. The causes of delay related consultant were: delay in preparation of drawing, delay in the approval of contractor submissions, slow in supervision and making decisions, lack of consultant's staff, slowness in giving instruction and poor qualification of consultant engineer's staff assigned to the project.

4.3 OWNER DELAY FACTORS

Considering the Importance of average weight (AW) delay factors related to owner, delay found at second in the ranking scale in Libya, but it was found at the highest rank in UK as shows in table 2 during the analysis of survey data separately in both countries. Considering survey responses from Libya and the UK, the average importance weight of owner related causes of delay was ranked at second position as shown table 2. The critical delay causes related to owner' categories were delayed in payment, lack of sufficient financial support, delay in providing the construction site to contractor, delay in issuing of change orders, lack of working knowledge, improper project feasibility study and order of additional works to the project and amendment in contract specifications).

4.4 OTHER FACTORS

This category contains causes that are not related to the three parties (contractor, consultant and owner) during the construction stage. It comprises two subcategories: early planning and design and external factors. This delay category held the third rank in Libyan and UK but fourth rank according to average weight in both countries as shown in table 2.

4.4.1 EARLY PLANNING AND DESIGN

The early planning and design delay subcategory includes poor early planning that leads to change in the scope of projects; these problems are occurred quite often in construction projects in Libya than in the UK. However, this category ranked eighth in Libya and seventh in UK among eight subcategories as shows in table 3. The survey result also identified that the delay impact was related to

early planning and design categories due to poor early planning that leads to change in the scope of the projects and ambiguities, mistakes and inconsistencies in specifications and drawings.

4.4.2 EXTERNAL FACTORS

Considering the importance index (II) external factors delay category it was ranked first important subcategory by Libyan, were as in UK it was found at fourth rank for the causes of delay in construction projects as shows in table 3. In both Libya and the UK, the average importance index of external factors for delay were ranked second among the eight major categories as shows in table 3. The survey result identified that delay impact was related to external factors categories were due to rise in the prices of materials, delay in agreement of design drawings and confirmation of tested materials, utility works concerning to public organization, economic crisis such as devaluation of currency and price inflation of materials, and shortage of required equipment on the local market. The next section discusses the Statistical test.

5 STATISTICAL TEST

Statistical test is necessary to analyse and identify the relationship and confidence level of the data validity or verify the correctness between or within groups of survey data [9]. Different types of statistical tests may be possible to decide more influential delay factors. In this paper, a statistical experiment of Paired Samples T-Test was selected to identify the relationship and confidence level of survey data. The test was performed in three categories: consultant, owners and contractors in Libya and UK. Table (4, 5 and 6) shows the relationship and confidence level of survey data from three categories: consultant, owners and contractors in Libya and UK in terms of frequency and severity scale.

Table 4, Paired Samples Test between Libya and UK consultants in the scale of frequency and severity

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 LibConsF - UKConsF	8.04167E	6.54957	1.19578E0	5.59602E0	1.04873E1	6.725	29	.000
Pair 2 LibConsS - UKConsS	6.36667E	3.19869	.58400	5.17226E0	7.56108E0	10.90	29	.000

LibConsF: Libyan consultant frequency scale, UKConsF: UK consultant frequency scale. LibCons S: Libyan consultant severity scale, UKConsS: UK consultant severity scale

Table 5, Paired Samples Test between Libya and UK Owner in the scale of frequency and severity

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 LibOwnF - UKOwnF	1.58534E	4.39435	.81601	1.41819E1	17.52497	19.42	28	.000
Pair 2 LibOwnS - UKOwnS	1.61034E	4.02477	.74738	1.45725E1	17.63439	21.54	28	.000

LibOwnF: Libyan owner frequency scale, UKOwnF: UK owner frequency scale. LibOwnS: Libyan owner severity scale, UKOwnS: UK owner severity scale

Table 6, Paired Samples Test between Libya and UK Contractors in the scale of frequency and severity

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence		t	df	Sig. (2-tailed)
				Lower	Upper			
Pair 1 LibConF -	7.48837E	3.83008	.58408	6.30965E0	8.66710	12.82	42	.000
Pair 2 LibConS -	9.00581E	3.37907	.51530	7.96589E0	1.00457E1	17.47	42	.000

LibConF: Libyan contractor frequency scale, UKConF: UK contractor frequency scale. LibConS: Libyan contractor severity scale, UKConS: UK contractor severity scale

The relative importance of each of the frequency and severity scale of delay factors perceived by the respondents were tested at 95% of confidence level. The P values of frequency and severity scale from t test for all three groups such as owners, consultants and contractors in both countries Libya and UK were found less than 0.05. Therefore, it is concluded that the survey results are significant. The significance of the result indicates that there is chance of delay in the construction project due to several delay causes identified through the research study. This result exposed that assumption

in this study related to the delay factors under different categories are significant and correct.

5. CONCLUSION

The research study identified several critical delays factors in UK and Libyan construction projects, which are discussed in this paper. These delay factors are classified into four main categories: related to owner, consultants, contractors and other. Similarly, the delay factors also categories into eight subcategories such Contracted related factors

including material, equipment, manpower, management issue, consulates, owner, planning and external factors. The survey identified critical causes of delay that have high impact in time and cost in the construction projects in the UK and Libya. According to contractor's point of views; low skill workers, rise in price of material, delay in materials delivery and changes in the scope of project were the most critical causes of delay in the Libyan construction industry. Whereas, rise in prices of material, poor communication between contractor and involved parties in the project are the most critical causes of delay in the UK construction industry.

Similarly, in the views of owners, the survey results revealed that the most critical causes of delay in the Libyan construction industry were low skill of manpower, delay in delivering site project to contractor, and modifications (replacement and addition) of new work to the project and changes in material specifications. Whereas interference by owner in the construction operations, financial problems such as delay in payments were the most critical delay causes identified in the UK construction industry.

Moreover, in the views of consultants, the survey result exposed that the most critical causes of delay in the Libyan construction industry were delay and slow supervision in making decisions, poor planning, slowness in giving instruction and poor qualification of consultant engineer's staff and waiting time for approval of drawings and test samples of materials. Whereas delay in the approval of contractor submissions by the consultant and poor communication between the consultant engineer and other parties, are most critical causes of delay in the UK construction industry.

The statistical test conducted that the survey results are significant. The significance of the result indicates that there is a probability of delay in project due to several delay causes identified from this research study. This result exposed that assumption in this study related to the delay factors under different categories are significant and correct.

6. FUTURE ACTIVITY

The next stage study will focus to run case studies for impact analysis of delay factors in terms of time and cost in Libyan construction industry using @ risk software and MS project. The outcome will be an indicative figure of possible delay in terms of time and cost in a Libyan construction project when considered the most critical delay factors.

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