



Approaches of Clients, Consultants and Contractors to Causes of Delays in Construction Projects

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Abstract

In construction projects, delays are common problems often encountered with possible vital financial effects on the overall construction industry. In an effort to uncover the main attributes characterizing construction delays, this integrated study proposed a comprehensive framework dealing with both causes and the effects of delays by presenting survey findings of clients, consultants and contractors in Palestine construction market. In addition to providing a detailed analysis of the delay causes according to frequency of occurrence and degree of severity, this study also differentiated among approaches of clients, contractors and consultants. The findings revealed that clients, contractors and consultants have remarkably different approaches regarding delay causes considering both the frequency of occurrence and degree of severity. Although numerous delay causes that are apparently under the responsibility of different parties exist, this study revealed that each party is holding the others responsible for the causes of delays. Hence, it may not be possible for any of the three specified major parties to solve this problem separately and the findings suggest that an effective coordination and communication network should exist among all three of these parties throughout the whole project. The clients, consultants and the contractors in the relevant sectors will be able to use the framework provided within this research to recognize the approaches of other parties in a more detailed and accurate manner, to identify the areas to focus for effective coordination, to improve performance and to minimize both the causes and the effects of delays.

Keywords: Delay Causes, Delay Effects, Frequency of Occurrence, Degree of Severity, Construction Industry.

Müşteri, Danışman ve Yüklenicilerin İnşaat Projelerindeki Gecikme Sebeplerine Yaklaşımları

Öz

İnşaat projelerinde gecikmeler, genel inşaat sektörü üzerinde olası hayati finansal etkiler gösterebilen ve sıklıkla karşılaşılan yaygın sorunlardır. İnşaat gecikmelerini karakterize eden ana özellikleri ortaya çıkarmak amacıyla, bu entegre çalışma, Filistin inşaat pazarındaki müşteriler, danışmanlar ve müteahhitlerin anket bulgularını sunarak gecikmelerin hem nedenlerini hem de etkilerini ele alan kapsamlı bir çerçeve önermiştir. Ortaya çıkma sıklığına ve ciddiyet derecesine göre gecikme nedenlerinin ayrıntılı bir analizini sağlamanın yanı sıra, bu çalışma müşteriler, yükleniciler ve danışmanların yaklaşımları arasındaki farklılaşmayı da analiz etmiştir. Bulgular, müşterilerin, yüklenicilerin ve danışmanların hem meydana gelme sıklığı hem de ciddiyet derecesi göz önüne alındığında gecikme nedenleri konusunda oldukça farklı yaklaşımlara sahip olduğunu ortaya koymuştur. Farklı tarafların sorumluluğunda olan çok sayıda gecikme sebebi bulunsa da, bu çalışma her bir tarafın gecikmelerin nedenlerinden diğerlerini sorumlu tuttuğunu ortaya koymuştur. Bu nedenle, belirtilen üç taraftan herhangi birinin bu sorunu ayrı ayrı çözmesi mümkün olmayabilir. Araştırma bulguları tüm proje boyunca bu üç taraf arasında etkili bir koordinasyon ve iletişim ağının olması gerektiğini göstermektedir. İlgili sektörlerdeki müşteriler, danışmanlar ve yükleniciler, diğer tarafların yaklaşımlarını daha detaylı ve doğru bir şekilde tanımak, etkili koordinasyon için odaklanılacak alanları belirlemek, performansını artırmak ve gecikmelerin hem nedenleri hem de etkilerini en aza indirmek için bu araştırmada sağlanan çerçeveyi kullanabileceklerdir.

Anahtar Kelimeler: Gecikme Sebepleri, Gecikme Etkileri, Meydana Geliş Sıklığı, Ciddiyet Derecesi, İnşaat Endüstrisi.

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1. Introduction

The course of the construction process within pre-determined duration is shaped and affected by many factors predicted already in the planning stage well before construction stage started. Construction delay is simply the time overrun beyond the date the parties agreed regarding the delivery of the project. The problem of encountering delays in projects is a common and global phenomenon, which may sometimes lead to disputes and litigation. Despite today's advanced technology and project management techniques, many construction projects continue to suffer delays. Delay in a construction project has severe consequences on many project goals (Enshassi et al., 2010, Kazaz et al., 2012). Over the years, many researchers have investigated various aspects of delay causes and their contribution to disputes. Despite being a popular area of research, the problem of construction delays continues and this fact keeps on harming the construction industries and hence overall economies. Especially in developing countries, the problem stands as a major barrier having vital negative effects to both companies and clients the industry. Studying this phenomenon actually deserves attention since it imposes very crucial economical and financial consequences in general and on the construction industries in particular. The causes for this phenomenon are shared between stakeholders that is the owner, consultant, contractor and external bodies. Given the persistence of the problem and the fact that delay is usually 'costly', this topic has been given a great deal of attention and investigated by many researchers in an effort to determine the real causes and hence minimize delays in construction projects.

Considering the importance of the effects of construction delays, numerous researchers have been conducting research regarding delays in construction industry. Empirical studies regarding causes of delays under varying circumstances for different types of construction projects have been analyzed throughout the world. In Palestine, construction industry is one of the main factors contributing to economic growth of the country that helps in providing job opportunities for the workforce as well as its social role in providing the houses, general facilities and infrastructure for the economic institutions (Mahamid, 2012). The project delay is one of the major and most common problems encountered in the governmental construction projects in Palestine. Considering the vital negative financial effect of construction project delays on all the parties included and hence on the general construction industry, a study to investigate this crucial issue thoroughly and creating a framework to clarify this complex and important process is needed.

Mahamid et al. (2012) focused on causes of delays in road construction projects and aimed to determine the main causes that lead to the delay and the degree of severity of the causes that leading to this delay. The study concluded that five main reasons leading to the delay in road construction projects were the political conditions, fragmentation of the West Bank, choosing the contractor with the least price, late funding and payment by the owner and the shortage in equipment. Kazaz et al. (2012) conducted a study about identifying the main factors that lead to the delay in completing the construction projects in Turkey from the contractor's point of view and compared the results with the findings in other countries that are neighbors to Turkey. 'Design and material changes' was found to be the most predominant factor, followed by 'delay of payments' and 'cash flow problems'.

The study concluded that managerial causes of time extensions are encountered in developed and developing countries, while financial causes are important in developing countries only. Sweis et al. (2008) carried out a study to determine the main causes leading to delay in the construction projects in Jordan and found that the financial problems with the contractor and the repeated change orders from the owner affected delays significantly, whereas severe weather conditions and changes in government regulations were the factors having the lowest degree of importance from the point of view of all the parties of the project. Alaghbari et al. (2007) conducted a study about building construction projects in Malaysia using a questionnaire including 31 factors and concluded that the financial problems emerged as the most important factor affecting delays, followed by problems in coordination and problems regarding materials. The study also proposed possible improvements that could be made in order to reduce delays in the construction industry. Assaf and Al-Hejji (2006) carried out a research in Saudi Arabia about causes of delays specifically in large construction projects and found 'change orders' as a very common factor affecting delays in the industry. Odeh and Battaineh (2002) conducted a research in order to identify the main causes that lead to the delay in the big private and public construction projects in Jordan, from the point of view of two parties of the construction project (the contractor and the consultant). The findings revealed that main causes of delay in public projects relate to designers, user changes, weather, site conditions, late deliveries, economic conditions and increase in quantity. Aziz and Abdel-Hakam (2016) carried out a study in Egypt about delay causes of road projects and proposed a model for predicting road construction actual project duration. Marzouk and Rasas (2014) discusses that delays are common in construction projects in Egypt and carried out a study by distributing a questionnaire survey to 33 construction experts including owners, consultants and contractors. The findings revealed that good correlation existed among the different groups whereas significant differences existed in their approaches for some specific delay causes only. Sambasivan and Soon (2007) carried out an integrated study with the aim of identifying delay factors and their impact on project completion and identified 10 most important causes of delay and 6 different effects of delay from a list of 28 different causes. The most important cause for delay was found as 'contractor's improper planning' while the most important effect of delay was found as 'time overrun'. Gluszak and Lesniak (2015) discusses that in spite of the fact that many tools exist for supporting management of construction projects, delays keep occurring in construction project and hence presented findings aimed at determining the major causes of delays in Poland from the clients' perspective. Ardit et al. (2017) conducted a study in US and India to explore the relationship between firm's organizational culture and delay in construction industry and concluded that there was a significant relationship between the two. Alsuliman (2019) categorized the causes of delay according to the different stages of construction project and identified 20 top causes of delay in their study carried out in Saudi Arabia. The study proposed a formula to calculate the effects of these factors on delay. Doloi et al. (2012) identified the major factors affecting delay in Indian construction industry. The factor analysis carried out revealed the most important factors as lack of commitment, inefficient site management, poor site coordination, improper planning, lack of clarity in project scope, lack of communication and substandard contract. Yap et al. (2021) employed a field survey to determine the approaches of 148 construction practitioners in Malaysia. A factor analysis was

carried out and five main managerial capabilities affecting delays were identified as competency management, communication and coordination management, financial management, risk management and site management.

Although the existing studies provide very valuable findings about such a crucial topic, an integrated and extensive study dealing specifically with public projects, providing an enhanced insight into both causes and the effects of delays from the perspectives of clients, consultants and contractors is needed for public projects. Considering the significant effect of the delays in all the parties of construction project, a comprehensive and detailed study was conducted to create an overall framework.

Hence, the main objective of this research was to provide an insight into both causes and the effects of delays in the governmental construction projects in South West Bank, Palestine. In an effort to uncover the main attributes characterizing construction delays, this integrated study proposed a comprehensive framework dealing with both causes and the effects of delays. In addition to providing a detailed analysis of the delay causes according to frequency of occurrence and degree of severity, this comprehensive study also differentiated among approaches of clients, contractors and consultants as well.

In summary, this research would elicit responses from the clients, contractors and consultants on their perceptions of a set of delay causes considering the frequency of occurrence and degree of severity of the causes. The findings of this study will provide a comprehensive framework for clients, contractors and consultants in the relevant sectors for recognizing the approaches of other parties in a detailed and accurate manner, identifying the areas to focus for effective coordination, improving performance and minimizing both the causes and the effects of delays.

2. Material and Method

A questionnaire-based survey was employed and the research sample has been drawn from the parties involved in construction works of municipalities in Palestine. The contracting institutions that completed governmental construction projects and were registered to Palestinian Contractors Union, the consultants that were hired by the municipalities for such projects and the administrative staff of municipalities who were involved in such projects on behalf of the municipalities were the three different respondent groups included in the survey. In order to ensure that they have the proper knowledge to answer the questions in the survey accurately, the survey was limited to parties involved in projects that were completed in the last 4 years.

The sampling method used included 2 stages, which were selection of the municipalities followed by selection of the construction projects carried out by the selected municipalities. The study was conducted in the Westbank region of Palestine. A random selection of municipalities and a random selection of projects of municipalities was carried out. 19 of the 28 municipalities existing in the specified region were selected randomly and included within the study. Then, 96 different types of construction projects carried out by the selected municipalities were selected randomly.

Although it was not possible to list all of the attributes regarding such an extensive process, a comprehensive list of factors was included. The preliminary consultation with experts in the market and the previous studies formed the basis of the questionnaire. Furthermore, a pilot study was carried out to allow

the respondents evaluate each factor for clarity and representativeness. According to the recommendations of the respondents in the pilot study, necessary changes were made to finalize the questionnaire. The anonymity of the respondents participating in the survey was assured in order to make sure that respondents are not withholding information.

Before interpreting the research findings, the consideration of general characteristics of the respondents is vital. The sample of respondents consisted of 3 different parties, namely clients, consultants and contractors for 96 public construction projects already completed by the municipalities selected. Hence the survey was carried out with clients who were administrative staff on behalf of the municipalities, consultants who were hired by the specified municipalities and contractors who carried out these 96 projects. The contractors included in the study were all registered in Palestinian Contractors Union. Considering that the total number of municipalities in the specified region is 28, 19 municipalities corresponded to 71% of the total number, which can be considered fairly high.

The questionnaire included three main sections. Section 1 of the questionnaire requested information about the respondents, whereas Sections 2 and 3 were used to define the approaches of the respondents to causes of delay and degree of severity of delays respectively. The total number of 56 factors listed in Sections 2 and 3 of the questionnaire included delay causes grouped into 4 main categories, namely client related, consultant related, contractor related and external related which were unrelated to any of the three specified parties of the project.

Data in Sections 2 and 3 of the survey was analyzed by considering the frequency of occurrence and degree of severity of each specified delay cause to overall project delays. The first part will measure the extent these delay causes occur during the implementation of the project, whereas the second part will measure the level of effect the specified delay cause on the total project time.

Data from the questionnaires were extracted and the delay causes were then rank ordered. For each one of the delay causes, the frequency of occurrence (FOO) and the degree of the severity (DOS) of the delay cause were calculated by using the formulas:

$$FOO = \frac{\sum W_f}{N} \dots\dots\dots(1)$$

$$DOS = \frac{\sum W_s}{N} \dots\dots\dots(2)$$

Where FOO= frequency of occurrence value of the delay cause; W_f = weighting assigned to each delay cause by respondents considering the frequency of occurrence (ranging from 1 to 5) and N = total no of respondents. Applying this formula yielded a FOO value range from 1 to 5, where 1 represented “the specified delay cause extremely rarely occurs” and 5 represented “the specified delay cause almost always occurs”. On the other hand, DOS= degree of severity value of the delay cause on the overall project delay; W_s = weighting assigned to each delay cause by the respondents considering degree of severity of the delay cause (ranging from 1 to 5) and N = total no of respondents. Applying this formula yielded a DOS value range from 1 to 5, where 1 represented “the specified delay cause has extremely low effect on the overall project delay” and 5 represented “the specified delay cause has extremely high effect on the overall project delay”. In order to cross-compare the relative importance of the factors as perceived by different parties,

the calculated FOO and DOS values were used to rank the factors for each different category of respondents.

In order to be able to differentiate among the possible behavior variations of different parties involved in the projects, a number of categories within the surveyed sample were defined and analyzed. Furthermore, Spearman Rank Correlation Coefficient (S.R.C.C.) test was performed on the pairs of ranks, obtained for different categories of respondents to determine the possible correlation in behavior of varying types of respondents. Spearman's Correlation Coefficient does not require the assumption of normality. Hence, S.R.C.C test was chosen to show the degree of agreement between the rankings. Spearman's coefficient ρ was calculated by using the formula:

$$\rho = 1 - \frac{6\sum di^2}{n(n^2-1)} \dots\dots\dots(3)$$

where d_i = difference between the ranks of corresponding pairs of values; n = the total number of pairs of rank. The formula for Spearman's coefficient returns a value between -1 and 1; where a value of 1 means that the two variables have an extremely strong positive relation, a value of -1 means that the two variables have an extremely strong negative relation and a value of zero means that the variables possess no correlation.

3. Results and Discussion

3.1 Delay Causes According to Frequency of Occurrence

The first part of the analysis was about investigating how the respondents prioritize the delay causes in the construction projects according to frequency of occurrence of the causes. The respondents were asked for assigning weight to each delay cause considering the frequency of occurrence of the delay cause in the specified construction projects. A list of 'Frequency of Occurrence (FOO)' values and 'Ranks' determined from the survey results is presented in Table 1. The average FOO values of 2.847, 2.904 and 2.823 are found for clients, consultants and contractors respectively. These values are remarkably high, indicating the high emphasis assigned to the listed delay causes by the respondents.

The findings in Table 1 confirm that there is an extremely significant variation of FOO values and ranks among different respondent types. S.R.C.C. test revealed correlation only between 'consultants' and 'contractors', which was a negative correlation with an S.R.C.C value of -0.363. These findings apparently indicate that these three major parties have no parallel approaches to delay causes at all. Considering the vital importance of the effects of project delays on the overall construction industry, this finding actually reveals a major problem that should be analyzed.

A crucially high score was assigned to 'the estimated project time being short' by the contractors and the consultants demonstrating the vital emphasis of this specific factor that is determined before the project even started. Without a carefully and realistically determined project duration, it seems that project delays are inevitable. However, clients assigned a very low value to the same factor. The 2nd and the 4th factors were both related to payments and 'late payments to the supplier' and 'delay in funding the project by the owner' were assigned very high scores by different types of respondents. Financial issues has been traditionally known as a common factor causing delays and these findings are actually not surprising. 'Weather effect' on the construction site emerged as a very important external factor for contractors, which was outside the control of the parties involved.

The delay causes from 5th to 8th, namely 'changes in government regulations', "fragmentation of the West Bank and barriers", "problems with neighbors around the construction site" and the "changing of banking policy for loans" were all external factors. As displayed in Table 1, these factors were assigned high ranks and importance values by different types of respondents. 'Delay of consultants in giving approvals at certain stages' and 'design errors or lack of clarity of design or tender documents' emerged as major delay causes that can be prevented by consultant firms involved in the projects by applying a carefully planned working schedule.

According to clients, top three delay causes are 'the poor management of workers', 'the difficulties in financing the project from the contractor's side' and 'shortage of skilled labor' which are all contractor related factors. On the other hand, three highest ranked factors according to contractors are 'the estimated time for the projects being short', 'changes in the government regulations' and the 'weather effect on the construction activities'. These findings actually reveal that contractors consider 'client related' or 'external' factors as the most important causes of delays, unlike clients. When the three highest ranked factors of consulting organizations are observed, it is apparent that first two factors are contractor related while the third one is an external factor. 'Late payments to the supplier', "difficulties in financing the project from the contractor's side" and "the fragmentation of the West Bank and the barriers" emerged as the three leading delay causes according to consultants. The fact that all three major parties do not agree on major delay causes at all and keep the other parties responsible for delays, emerged as a major and vital problem from these findings.

Of specific interest, when the highest ranked twenty factors are considered, it can be observed that clients and consultants have 10 common factors out of the top 20 causes. 'Poor management of working crews' was ranked first by the clients and 13th by the consultants while the 'difficulties in financing the project from the contractor's side' was ranked 2nd by both of these two parties. However, 'late payments to the supplier' was ranked first by consultants while it was ranked 25.5th by the clients. The other factors that were perceived important and ranked in the top 20 criteria by both parties are found as; 'fragmentation of the West Bank and barriers', 'the contractor's responsible person being unexperienced', 'lack of effective planning and coordination of the project', 'absence of coordination within the project parties', 'low productivity of the crews', 'lack of required materials' and 'delays in the supply of materials to the workplace'. The fact that there exist two different factors regarding coordination is important and should be given enough emphasis by all three contributing parties. The only delay cause, that was ranked in the top 20 by all three types of respondents was 'fragmentation of the West Bank and barriers' that was an external factor not related to any of the three parties.

When the analysis of the results of the clients and the contractors are compared, the two parties agreed on seven common causes in the top twenty although their ranks varied remarkably. 'Lack of monitoring and follow-up by supervision', 'delay of consultant in giving approvals at certain stages', 'delays in the approval of the design documents', 'problems with neighbors around the construction site' and 'weather effect on construction activities' were among the major delay causes identified by both of these specified parties. These findings apparently indicate that both the contractors and the clients agree on the delay causes that are related to the consultant or the external factors while they disagree on factors regarding themselves. The

comparison of the results of the consultant and the contractors reveals that there are only three common causes between the consultant and the contractors in the 20 highest ranked factors. These three causes are “fragmentation of the West Bank and barriers”, “the estimated project time being short” and the “hesitation in the decision-making process”. Interestingly, clients and contractors have more common factors than consultants and contractors which was surprising. Considering the fact that clients are not experts in construction, consultants and contractors were expected to have more common causes. When the three specified delay causes are observed, it is apparent that they are client-related or external factors.

3.2 Delay Causes According to Degree of Severity

The second part of the analysis was about investigating how the overall respondents prioritize the delay causes in the construction projects according to degree of severity of the causes. In addition to frequency of occurrence of any delay cause, the extent of the effect it will have on the overall delay of the project is vitally important. A list of ‘Degree of Severity (DOS)’ values and Ranks determined from survey results is presented in Table 2. The average DOS values of 2.761, 2.713 and 2.916 are found for clients, consultants and contractors respectively. These values are remarkably high, indicating the high emphasis assigned to the listed delay causes by the respondents.

The findings in Table 2 reveal that there is a very significant variation of DOS values and ranks among different respondent types. S.R.C.C. test revealed no correlation between any of the groups. These findings clearly indicate that the approaches of the specified three major parties to the delay causes according to degree of severity are not parallel. Considering the vital importance of the degree of severity of the delay factors on the overall construction industry, this issue needs to be investigated thoroughly.

A remarkably high score was assigned to ‘unexpected subsurface and ground conditions’ demonstrating the vital emphasis to this specific factor that has very major effect to the overall project duration when encountered during any construction project. Considering the major effects it might have on the overall project duration, precautions should be taken before construction stage with proper ground investigation, surveys and analysis in order not to run into a surprise after the construction started. The 2nd and the 3rd factors were both related to financial issues. ‘Delay in funding the project by the owner’ and ‘late payments to the supplier’ were assigned very high importance by consultants and contractors. Financial issues have been traditionally known for being major delay causes with severe effects on the project outcome and these results are actually expected. ‘Lack in the experience of the contractor firm in general’, ‘failure in the administrative stability of the owner’s side’ and ‘lack of monitoring and follow-up by supervision’ were assigned very high DOS scores, by different parties. Actually, it seems that the causes with major effects on the overall duration of the project are related to all of the three parties involved. This finding indicates the need for them to accept their responsibility, coordinate effectively and aim to reach a common goal, which is minimizing project delays due to any possible reason. ‘Ineffective communication and coordination’ emerged as another major delay cause having high severity emphasizing the importance of coordination among the different parties in construction projects. ‘The requirement of using materials that are not easy to obtain’ is found as a delay cause with severe effects while this can be

minimized by using standard materials that are available in the market. Considering the negative effect of the delay of any project, every effort should be made to minimize it before the construction started.

According to clients, the delay causes with the highest degree of severity are ‘unexpected subsurface and ground conditions’, ‘the difficulties in financing the project from the contractor’s side’ and ‘fragmentation of the West Bank and barriers’ and ‘low productivity of the crews’. The specified causes are all contractor and consultant related or external factors but not related to clients. On the other hand, the highest ranked 3 factors according to contractors are ‘lack of monitoring and follow-up by supervision’, ‘ineffective communication and coordination’ and the ‘unexpected subsurface and ground conditions’. These findings actually reveal that contractors consider ‘client related’, ‘consultant related’ or ‘external’ factors as the most important causes of delays, unlike clients. ‘Lack in the experience of the contractor firm in general’, ‘the requirement of using materials that are not easy to obtain’ and ‘lack of effective planning and coordination of the project’ emerged as the three leading delay causes possessing the highest degree of severity according to consultants. The fact that each of the major parties keeps the other parties responsible for delays also exists in the second part of the analysis about degree of severity of delay causes.

When the highest ranked twenty factors are considered, it can be observed that clients and consultants have 9 common causes out of the twenty. ‘Unexpected subsurface and ground conditions’ is ranked first by the client and 17th by the consultant while the “lack in the experience of the contractor firm in general” was ranked 1st by the consultant and 5th by the client. The other factors that were perceived important by both clients and consultants are ‘late payments to the supplier’, ‘failure in the administrative stability of the owner’s side’, ‘the requirement of using materials that are not easy to obtain’, ‘misunderstanding of owner needs by the consultant’, ‘difficulties in financing the project from the contractor side’, ‘poor management of workers’ and ‘the estimated project time being short’. Out of these 9 factors, first 6 were also perceived important by the contractors. Compared to ‘frequency of occurrence’ results, the ‘degree of severity’ results of three different categories of the respondents were more similar.

When the analysis of the results of the owners and the contractors are compared, in addition to previously mentioned factors, the two parties agreed on four more common causes in the top twenty although their ranks varied remarkably. ‘Lack of monitoring and follow-up by supervision’, ‘Ineffective communication and coordination’, ‘fragmentation of the West Bank and barriers’ and ‘design errors or lack of clarity of design or tender documents’ were among the major delay causes identified by both of these two parties. These findings apparently indicate that both the contractors and the clients agree on the delay causes that are related to the consultant or the external factors but not themselves except for ineffective communication which may be considered as related to all of the parties.

The comparison of the results of the consultants and the contractors revealed that there are four common causes between the consultant and the contractors in the top 20 factors in addition to the ones previously mentioned as common to all three categories. These four causes were ‘delay in funding the project by the owner’, ‘problems with neighbors around the construction site’, ‘weather effect on construction activities’ and the “lack of required materials” and they were either client related or external.

Table 1. The causes of delay according to their frequency of occurrence by the type of the respondent ^a

No	Delay Cause	Client		Consultant		Contractor	
		FOO	Rank	FOO	Rank	FOO	Rank
1	The estimated project time being short	1.737	52	3.811	7	4.208	1
2	Late payments to the supplier	3.000	25.5	4.030	1	3.687	7
3	Weather effect on construction activities	3.170	12	2.541	42	3.919	3
4	Delay in funding the project by the owner.	1.526	54	3.223	25	3.859	4
5	Changes in government regulations.	2.053	47	2.595	41	3.929	2
6	Fragmentation of the West Bank and barriers.	3.142	15	3.935	3	3.152	15
7	Problems with neighbors around the construction site.	3.267	8	3.243	22.5	3.232	11
8	Changing of banking policy for loans.	2.925	30	2.838	38	3.364	8
9	Delay of consultant in giving approvals at certain	3.316	7	1.487	50	3.737	6
10	The contractor's responsible person being unexperienced	3.842	6	3.568	11	2.778	26
11	Design errors or lack of clarity of design or tender	2.737	38	1.541	47.5	3.748	5
12	Change requests to the project by the owner	1.474	55	3.919	5	3.020	16.5
13	Currency exchange rate fluctuations	2.684	39.5	2.189	46	3.333	9
14	Owner not having enough experience	1.421	56	3.108	29.5	3.202	12
15	Changes in the prices of materials	3.103	19	2.297	45	3.172	13.5
16	Hesitation in the decision-making process	1.684	53	3.541	12	2.960	19.5
17	Lack of effective planning and coordination of the project	3.211	11	3.920	4	2.485	38.5
18	Accident during construction	2.842	35.5	2.865	36.5	2.960	19.5
19	Absence of coordination within the project parties	3.094	20	3.865	6	2.505	37
20	Poor management of workers	4.211	1	3.514	13	2.354	47.5
21	Conflicts between joint-ownership of the project	2.579	44	3.054	32	2.838	24
22	Low productivity of the crews	3.216	10	3.297	20	2.616	31.5
23	Misunderstanding of owner needs by the consultant	1.790	51	3.233	24	2.899	21
24	The requirement of using materials not easy to obtain	2.917	31	2.865	36.5	2.798	25
25	Unexpected subsurface and ground conditions	2.632	41.5	2.351	43.5	3.020	16.5
26	Delays in the approval of the design documents	3.263	9	1.324	55	3.273	10
27	Shortage of skilled labor.	4.053	3	3.273	21	2.364	46
28	Delay due to searching for a sub-contractor.	3.077	21	3.800	8	2.333	50.5
29	The personal conflict between labor and management	3.158	13.5	3.135	28	2.566	33
30	Equipment failure in work at the workplace	2.977	27	3.460	14	2.475	40
31	Difficulties in financing the project from the contractor	4.105	2	4.027	2	2.030	56
32	Poor communication with the other parties	1.842	49	3.405	15	2.707	29.5
33	Lack of required equipment	2.895	32.5	3.784	9.5	2.333	50.5
34	Lack in the experience of the contractor firm in general	2.947	28.5	3.216	26.5	2.515	36
35	Late payments to the sub-contractor	3.133	16	3.243	22.5	2.465	41
36	Weakness of contractor's supervision to subcontractor	2.947	28.5	3.081	31	2.556	34.5
37	Contractor's teams not understanding the role of	3.053	22.5	3.324	19	2.424	42
38	Low penalty (or no penalty) for late completion	3.947	4.5	2.919	34.5	2.384	43.5
39	Lack of monitoring and follow-up by supervision	3.947	4.5	1.378	52	2.970	18
40	Lack of required materials	3.158	13.5	3.378	16.5	2.343	49
41	Delays in the supply of materials to the workplace	3.105	17.5	3.784	9.5	2.192	53
42	Shortage in the total number of labor in workplace	3.053	22.5	3.351	18	2.354	47.5
43	Redesign many times during design phase	2.842	35.5	1.270	56	3.172	13.5
44	The contractor not following the consultant's instructions	2.895	32.5	3.108	29.5	2.384	43.5
45	Rises of conflicts between contractors and the other	3.000	25.5	3.378	16.5	2.242	52
46	Failure in the administrative stability of the owner's side	1.842	50	2.730	40	2.707	29.5
47	Shortages of administrative staff in contractor company	2.790	37	2.790	39	2.485	38.5
48	Delay in performing final inspection and certification	1.947	48	2.946	33	2.556	34.5
49	Consultant experience not suitable for the project	3.022	24	1.541	47.5	2.849	23
50	Choosing inappropriate equipment	2.875	34	3.216	26.5	2.152	54
51	Ineffective communication and coordination	3.105	17.5	1.457	51	2.748	27.5
52	Delay in approval of samples submitted by the contractor	2.526	45	1.351	53.5	2.859	22
53	Not having complete documents during project	2.632	41.5	1.496	49	2.748	27.5
54	Poor management of project machinery	2.602	43	2.919	34.5	2.121	55
55	The inability to resolve conflicts and judicial disputes	2.421	46	2.351	43.5	2.374	45
56	Lack of commitment of consultant to working hours	2.684	39.5	1.351	53.5	2.616	31.5
Average		2.847		2.904		2.823	

^a Spearman Rank Correlation Coefficient (r_s) between the groups 1&2= no correlation; 1&3=no correlation; 2&3=-0.363 correlation is significant at 1% level.

Table 2. The causes of delay according to their degree of severity by the type of the respondent ^a

No	Delay Cause	Client		Consultant		Contractor	
		DOS	Rank	DOS	Rank	DOS	Rank
1	Unexpected subsurface and ground conditions	4.158	1	2.892	17	3.886	3
2	Delay in funding the project by the owner.	2.263	48.5	3.838	4	3.768	4
3	Late payments to the supplier.	2.790	18	3.568	6	3.707	5
4	Lack in the experience of the contractor firm in general.	3.947	5	3.973	1	3.273	8
5	Failure in the administrative stability of the owner's side	2.842	16.5	3.649	5	3.566	6
6	Lack of monitoring and follow-up by supervision	3.211	10	2.054	50.5	4.020	1
7	Ineffective communication and coordination	3.000	12	2.297	44	3.939	2
8	The requirement of using materials that are not easy to	3.474	8.5	3.892	2	3.192	13
9	Problems with neighbors around the construction site	2.220	50	2.892	18	3.505	7
10	Fragmentation of the West Bank and barriers	4.000	3.5	2.460	39.5	3.263	9
11	Lack of effective planning and coordination of the project	2.476	38	3.865	3	2.990	21.5
12	Misunderstanding of owner needs by the consultant	3.474	8.5	2.965	12	3.020	19
13	Difficulties in financing the project from the contractor side	4.053	2	2.865	19.5	2.930	28
14	Weather effect on construction activities	2.158	53	3.027	9.5	3.141	14
15	Conflicts between joint-ownership of the project	2.211	51.5	2.703	28	3.253	10
16	Lack of required materials	2.316	46.5	2.913	16	3.081	15.5
17	The contractor's responsible person being unexperienced	2.684	23.5	2.856	21	3.020	19
18	Poor management of workers	3.850	6	3.243	7	2.606	44
19	The estimated project time being short	2.895	14.5	3.081	8	2.818	35.5
20	The contractor not following the consultant's instructions	2.421	43.5	2.578	35	3.081	15.5
21	Not having complete documents during project scheduling	3.842	7	2.135	47.5	2.970	23.5
22	Rises of conflicts between contractors and the other parties	2.679	26	2.730	27	2.950	25.5
23	Hesitation in the decision-making process	2.444	41	2.955	13.5	2.889	32
24	Poor communication with the other parties	2.790	19.5	2.838	22.5	2.828	34
25	Delay in approval of samples submitted by the contractor	2.526	36.5	2.000	53.5	3.202	12
26	Changes in government regulations	2.474	39	2.000	53.5	3.212	11
27	Weakness of contractor's supervision to subcontractor	2.533	35	2.541	38	2.990	21.5
28	Delay due to searching for a sub-contractor	2.450	40	2.676	29.5	2.939	27
29	Contractor's teams not understanding the role of consultant	2.211	51.5	2.676	29.5	2.929	29.5
30	Change requests to the project by the owner	1.895	56	2.784	26	2.950	25.5
31	Low productivity of the crews	4.000	3.5	2.568	36.5	2.616	43
32	Equipment failure in work at the workplace	2.681	25	2.955	13.5	2.717	40
33	Owner not having enough experience	1.947	54.5	2.405	42.5	3.051	17
34	Delays in the approval of the design documents	3.053	11	2.135	47.5	2.929	29.5
35	Poor management of project machinery	2.526	36.5	3.027	9.5	2.687	41
36	Accident during construction	2.263	48.5	2.811	24.5	2.818	35.5
37	Delay of consultant in giving approvals at certain stages	2.895	14.5	2.081	49	2.970	23.5
38	Design errors or lack of clarity of design or tender	2.947	13	1.865	55	3.020	19
39	Choosing inappropriate equipment	2.579	31.5	2.595	34	2.727	39
40	Changes in the prices of materials	2.579	31.5	2.973	11	2.576	45.5
41	Consultant experience not suitable for the project	2.660	27	2.243	45.5	2.838	33
42	Delay in performing final inspection and certification	2.737	21	2.568	36.5	2.677	42
43	Redesign many times during design phase	2.543	34	2.027	52	2.919	31
44	Absence of coordination within the project parties	2.636	28	2.054	50.5	2.818	37
45	Lack of required equipment	2.550	33	2.838	22.5	2.495	49
46	Currency exchange rate fluctuations	2.439	42	2.622	32.5	2.576	45.5
47	Shortages of administrative staff in contractor company	2.842	16.5	2.432	41	2.566	47
48	The personal conflict between labor and management team	2.330	45	2.626	31	2.556	48
49	Lack of commitment of consultant to working hours	2.421	43.5	1.811	56	2.798	38
50	Delays in the supply of materials to the workplace	2.684	23.5	2.934	15	2.182	53
51	Shortage in the total number of labor in workplace	2.790	19.5	2.243	45.5	2.394	51
52	Shortage of skilled labor	1.947	54.5	2.405	42.5	2.475	50
53	The inability to resolve conflicts and judicial disputes	2.632	29.5	2.622	32.5	2.212	52
54	Changing of banking policy for loans	2.632	29.5	2.865	19.5	2.091	55
55	Late payments to the sub-contractor	2.316	46.5	2.811	24.5	2.162	54
56	Low penalty (or no penalty) for late completion	2.694	22	2.460	39.5	1.505	56
Average		2.761		2.713		2.916	

^a Spearman Rank Correlation Analysis showed no correlation between the groups

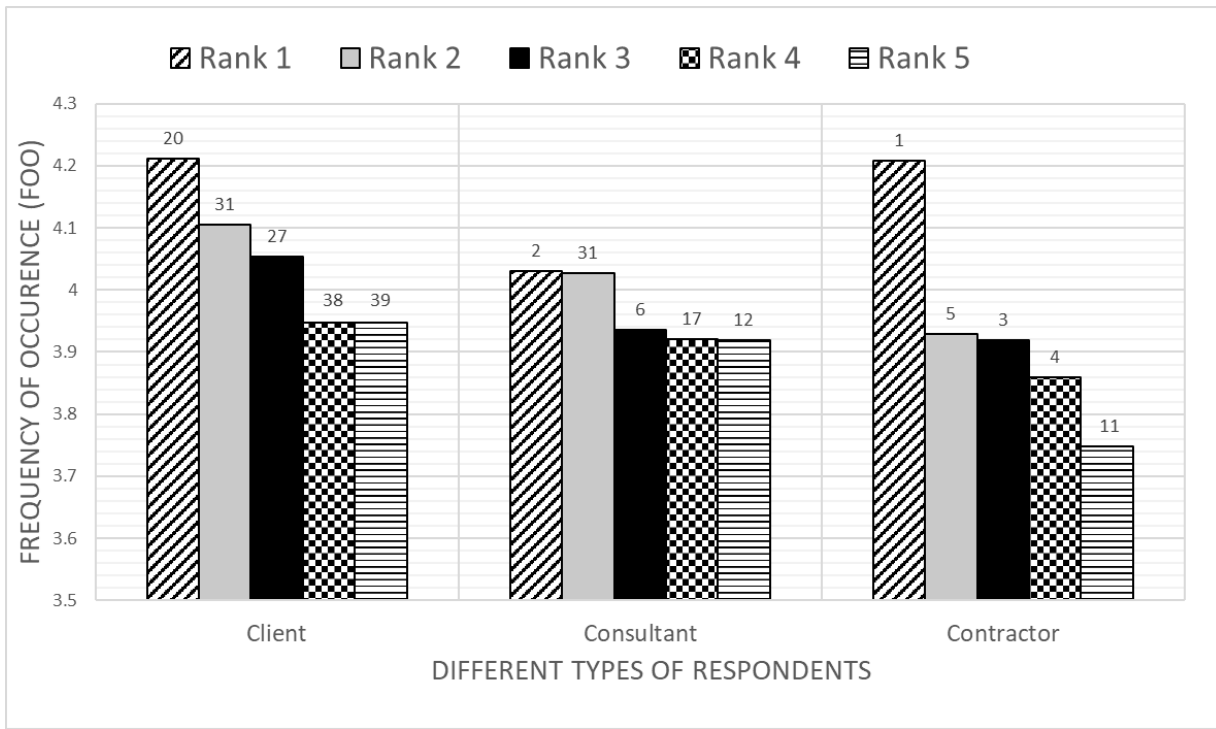


Figure 1. Five highest ranked causes of delay according to frequency of occurrence for different categories of respondents

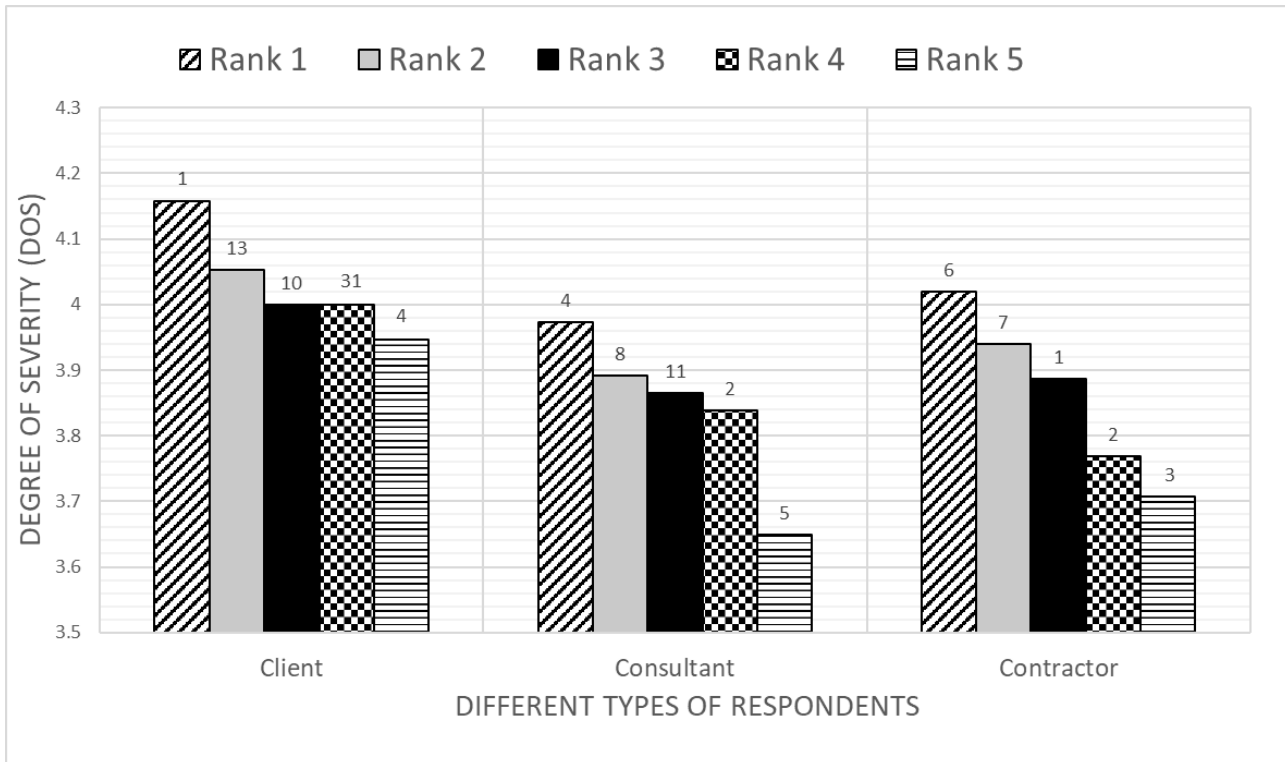


Figure 2. Five highest ranked causes of delay according to degree of severity for different categories of respondents

Five highest ranked causes of delay according to frequency of occurrence and degree of severity are displayed in Figures 1 and 2 respectively for different types of respondents. FOO and DOS values for each delay cause is displayed on y-axis while delay cause's ID numbers are shown on top of the columns and the ranks for different types of respondents are presented in different shaded columns.

4. Conclusions and Recommendations

Project delays are common problems encountered in construction industries, which may sometimes lead to disputes and litigation. Considering the vital negative financial effects of construction project delays on all the parties included and hence on the general construction industry, a study investigating this crucial issue thoroughly and creating a framework to clarify this complex and important process is needed. In order to uncover the main attributes that characterize construction delays, this integrated study proposed a comprehensive framework dealing with both causes and the effects of delays. In addition to providing an enhanced insight into the factors causing delay according to frequency of occurrence and degree of severity, this comprehensive study also differentiated among various types of respondents' behaviors in each of the specified stages in public projects to contribute to the related literature.

The findings in this study showed that there are many causes of delays according to frequency of occurrence and numerous different causes according to degree of severity. Although several factors that are apparently under the responsibility of each of the three main parties exist, the results of this study revealed that each party is holding the other parties responsible for the causes of delays. When the scores and ranks assigned by the clients, consultants and contractors are analyzed separately, it is obvious that respondents belonging to different categories have remarkably different approaches regarding delay causes considering both the frequency of occurrence and degree of severity. The distinct approach difference of clients and contractors apparently exist in the findings however even clients and their consultants have remarkably different approaches. This is actually an indication that it may not be possible for any of the three specified major parties to solve or minimize this problem separately. Therefore, these results suggest that an effective coordination and communication network should exist among all three of these parties, that can be organized by regular and frequent meetings among the three parties throughout the project. This will help them in understanding the approaches of the other parties, so that common solutions may be found for minimizing delays. The main aim should be being open minded about the causes of delays, coordinating and communicating effectively with the other parties and minimize delays to prevent their overall negative financial effects that will affect all the parties included.

When the delay causes according to frequency of occurrence are analyzed, the top delay cause was 'the poor management of workers' for clients while it was 'the estimated time for the projects being short' for contractors and 'late payments to the supplier' for consultants. On the other hand, the analysis of delay causes according to severity of delays revealed that the top delay causes were 'unexpected subsurface and ground conditions' for clients, 'lack of monitoring and follow-up by supervision' for contractors and 'lack in the experience of the contractor firm in general' for consultants. The fact that all three major parties do not agree on major delay causes at all and hold the other parties primarily responsible for delays, emerged as a major and vital problem from these findings.

In summary; despite many tools regarding management of construction projects, delays in projects keep occurring and the findings of this research suggest that clients, consultants and contractors have remarkably different approaches to delay causes. Hence, an overall comprehensive framework combining different parties' approaches to causes of delay considering both the frequency of occurrence and degree of severity is proposed. The

clients, consultants and the contractors in the relevant sectors will be able to use the framework provided within this research in recognizing the approaches of other parties in a more detailed and accurate manner, identifying the areas to focus for effective coordination, improving performance and minimizing both the causes and the effects of delays. In spite of the fact that this study was based on data provided by municipality projects in Palestine construction market, the approach and the overall comprehensive framework developed are valuable to clients, consultants and contractors working with similar projects in other construction markets all over the world.

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