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Major Factors Causing Delay in the Delivery of Manufacturing and Building Projects in Saudi Arabia

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Abstract: There have been many studies done on the causes of delay on construction projects and building projects all around the world. They use different methods, on different geographical areas, and they come up with different results. There are, however, few studies on industrial and building projects. This paper focuses on industrial/manufacturing projects in Saudi Arabia. The aim of this paper is to identify the major causes of delay in the manufacturing projects in Saudi Arabia. The top causes of delay have been identified through a literature survey and interviews with experts from the industrial field in Saudi Arabia. Twenty-two factors have been identified and listed in a survey that was distributed to professionals in the same field. Two categorizations were made: the first is based on the impact of the cause, and the second is based on the frequency of occurrence of the identified cause. It has been found that the top five impacted causes of delay in the delivery of industrial projects in Saudi Arabia are: difficulties in financing project by contractor/manufacturer, late procurement of materials, late delivery of materials, delay in progress payments, and delay in approving design documents, respectively. In terms of frequency, the top five identified causes are: delay in progress payments, difficulties in financing project by contractor/manufacturer, slowness in decision making, late procurement of materials, and delay in approving design documents, respectively. The diversity of the participants is an important point; therefore, the respondents were from different job positions (management, engineering, etc.), and different categories (contractor, owner, manufacturer, consultant, etc.). It is worth noting that this paper serves not only as an authentic study of the causes of delay in the delivery of industrial projects in Saudi Arabia which is a field that is not widely covered, but also as a fresh paper that gives an indication of the changes that happen to the business over time as compared to previous work.

Keywords: industrial projects; delay factors; scheduling; RII; building projects

1. Introduction

The main objective of the project management team is to complete the project on time, within its budget, and according to the required quality/specifications. The literature review indicates that many factors can influence the project objectives. Those factors may vary in importance based on the perspective of the owner, contractor, sub-contractor, and consultants. The project also needs to be completed under a safe environment, without any litigation, and as per the authorities' regulations. Construction projects are often the focal point when project planning, scheduling and management is considered. Nevertheless, it must be noted that every construction project requires materials/products, and these materials/products go through a manufacturing process. A delay in the delivery of some materials/products, may cause an overall delay in the project. For instance, if an electrical substation is to be constructed, equipped, and commissioned as a lump-sum/turnkey project, an essential part of the

project completion and delivery would be the manufacturing of the electrical products that are to be installed in the substation. This example, in fact, is the main point of this research paper.

From the perspective of the original equipment manufacturer (OEM), and in addition to the project main objectives, the profit must be maximized which adds to the complexity of the project's overall delivery. For example, the bulk material manufacturing is going to affect the price of the product and thus the profit, an OEM would like to manufacture more units of the same type of multiple projects at one time. This, however, is constrained with the project's deadlines, sizes, etc.

This paper investigates assess, analyze, and evaluate the major causes of delay in the delivery of industrial projects in Saudi Arabia. In addition, the paper covers a wide range of published papers that discuss the causes of delay in projects. The literature survey lists the references in a chronological order.

2. Methodology

Causes of delay in construction projects is an important function that has got the attention of both researchers and field experts. Therefore, it was important to identify those causes of delay in order to avoid those causes, have a solution for them in case they happen, and eventually save time and money. It is essential to tie the causes of delay with the geographical location as by experience, it is found that different locations have different regulations, practice, authorities, etc. Additionally, the field of study is also important as for example, most studies focus on the construction and building projects but less focus on the industrial/manufacturing projects. As the field of work changes, different requirements, regulations may well change, and a completely different behavior might be encountered. This paper focuses on the industrial/manufacturing projects in Saudi Arabia. The paper focuses on the causes of delay in such projects. The research methodology followed to achieve the above-stated objectives involve a sequence of steps. It includes the following:

1. Conducting a comprehensive literature review to identify the factors that cause schedule delays during the construction phase of industrial/manufacturing projects.
2. Determining unreported factors based on interviewing the local experts who are involved in the construction of industrial/manufacturing projects in Saudi Arabia.
3. Combining the identified factors from the literature with that obtained from interviewing project engineers/managers.
4. Designing and developing a questionnaire survey to be used for collecting feedback from experts regarding the importance of the identified factors.
5. Conducting a pilot study with experts to assess the identified factors and to evaluate the developed questionnaire survey before sending it to the targeted professionals.
6. Distributing the questionnaire survey to the population of 106 professionals working in this class of projects in the eastern province of Saudi Arabia.
7. Analyzing the data received using the statistical analysis method to identify the level of importance for the identified factors.
8. Obtaining the important index value and the rank of each factor.
9. Drawing conclusions and recommendations based on the obtained results.

3. Literature Review

The main goal of the project management team is to complete the project successfully. This includes completing the project on time, within its budget, and according to the required quality/specifications. Completing the project on time requires the identification of causes that may lead to delay during construction phase. The literature reveals that many studies have been carried out to identify the causes of the delay of construction projects in general. However, very limited research concerning the construction delay of the delivery of industrial/manufacturing projects. Causes of delay and/or cost overruns may vary based on the geographic location where the project is constructing. In Turkey, for example, where the investment in construction adds up to 50% of the total investments, some

major causes of delay were identified to be a lack of cash flow, resources, design delay, and changes in the order, which happen frequently [1]. Not only the causes of a delay are important, but so, too, are the factors that suppress the delay. That is what was carried out in [2] in which the top factors for a successful project completion were identified.

In Nigeria the main cause of project cost overruns was identified to be related to the shortage of materials and the deficiency in the financing, and a recommendation to overcome that was to reduce the mistake of handling human resources and materials [3]. Due to the lack of research in identifying and evaluating the causes of delay and their effects on industrial/manufacturing projects, the literature shows that some researchers have used game theory and transaction cost economics to address this issue [4,5]. A study in Nigeria [6] found that the main reasons for cost overrun in construction projects are: fluctuations in costs of material, and manpower in addition to the delay of invoice payments. It is revealed that to finish a project successfully, multiple factors and sub-factors need to be examined. That can be done with the help of techniques such as the resource-based view (RBV). The advantages of the resources based view (RBV) were presented in [7,8]. An important advantage of the RBV is that it allows utilization of the right resources at the right place with the best use of capabilities [9,10]

In [11], multiple reasons for cost and time overrun is the lack of material and the deficiency in payments. In the study, it was recommended that solution must be carried out on an organizational level as well as a governmental and international level for developing. In [12,13]. Each factor that contributes to the delay was given a numerical value through the relative importance index (RII). Looking at the studies based on the geographical location, it is noticed that only a few studies examine the causes of delay in Europe (e.g., [14–17]). The majority of studies into the causes and effects of delay in construction projects focus on identifying these causes and effects, but they do not really dive into the dependency between these factors [18–20].

The complexity of project of construction urge the need for developing an understanding of the dependency between the different causes of delay. For example, study in Hong Kong identified 83 causes of delay in construction projects [21]. The change of order was the top cause of delay in a study conducted in Taiwan which was based on the application of the RII [22]. Multiple studies have been done on the Iranian region in terms of causes and delay [23–28]. Other similar studies were conducted in Ghana [29,30], South Africa [31–33], Singapore [34,35] and Palestine [36,37], Libya [38], Nigeria [39–41], India [42–44], Taiwan [45,46], UAE [47], Egypt [48–51], Oman [52], Pakistan [53–56], Malawi [57], Zambia [58], Jordan [59], Malaysia [60–63], Turkey [64–66], Syria [67], Vietnam [68], Kenya [69], Iraq [70], Qatar [71,72], Saudi Arabia [73,74], Cambodia [75,76], Ethiopia [77], Botswana [78], Burkina Faso [79], Rwanda [80], USA [81], Zimbabwe [82], Benin [83], Afghanistan [84], Australia [85], Tanzania [86], Uganda [87,88], and Canada [89]. Another technique called Structural Equation Modeling (SEM), which is a statistical technique, has also been used in the literature [90–92]. It should be noted that when there is a set of requirements, a good way is to use the resource-based view (RBV) [93].

4. Causes of Delay Identification

In this section, the identified causes of delay based on points 1–4 in the methodology have been listed down in a tabulated form in Table 1 to be compact, and a brief about each point is provided. It is worth noting that out of 29 causes, the experts have decided to eliminate seven and not to add any. Therefore, 22 causes of delay have been identified. It is also to be noted that the factors are mentioned in more than one reference and since more than 100 references are used, only one reference will be mentioned for each factor.

Table 1. The identified causes of delay.

#	Cause	Category	Brief	Reference
1	Inadequate contractor experience	Contractor/Manufacturer Related	The low level of contractor experience can cause chaos as he is the key connection between all subcontractors and his poor experience can collapse the whole project	[66]
2	Ineffective project planning and scheduling	Contractor/Manufacturer Related	Poor planning can cause schedule delay, cost overrun, and low quality output	[94]
3	Poor site management and supervision	Contractor/Manufacturer Related	Poor site management would not only cause project delay but it could also lead to safety issues and accidents	[24]
4	Unreliable subcontractors	Contractor/Manufacturer Related	Every subcontractor has a portion of the project to deliver and any delay from any subcontractor will most probably delay the whole project	[17]
5	Late procurement of materials	Contractor/Manufacturer Related	Especially in the manufacturing/ industrial projects, material related points shall be of top priority. Late procurement will lead to late delivery and late project submission	[81]
6	Difficulties in financing project by contractor/manufacturer	Contractor/Manufacturer Related	The lack of finance can lead to many other causes of delay such as the delay of procurement of material	[95]
7	Late delivery of materials	Material Related	The material might be procured on time but still delivered late and that could be to many reasons including the customs	[96]
8	Non-availability of material	Material Related	Sometimes if alternatives are not acceptable by the owner, the non-availability of material can put the project on hold	[27]
9	Delay in performing inspection and testing	Consultant/Contractor/ Manufacturer Related	In manufacturing, a product cannot be delivered without inspection and testing. A delay in inspection surely delay the last stages of the product delivery	[49]
10	Poor communication and coordination with other parties	Consultant Related	Poor communication leads to having some abandoned tasks that no one works onto	[41]
11	Unqualified/ inexperienced workers	Labor Related	Unqualified workers will surely have a low production rate and probably low quality output	[76]
12	Low productivity of labor	Labor Related	Low production rate means that the employee will take more time to finish a task that could be finished in less time	[97]

Table 1. *Cont.*

#	Cause	Category	Brief	Reference
13	Design changes by owner or agent during Execution/Change Orders	Owner Related	Depending on the stage the project is at, change order affects both the project duration and cost. Sometimes it might not be even feasible	[98]
14	Delay in approving design documents	Owner Related	The manufacturing process cannot be started without having the design approved. A delay in design surely delays the project	[79]
15	Delay in progress payments	Owner Related	Delay in progress payments can put the manufacturer in a position of not being able to purchase the rest of the materials on time	[33]
16	Slowness in decision making	Owner Related	If the owner does not make his decision on time, the rest of the chain has to stay on hold	[50]
17	Shortage of labors	Owner Related	Less labor in other words means low or very low production rate	[35]
18	Unexpected conditions (bad weather, etc.)	External related	In a typical construction project, foggy, rainy, or windy weather can stop the work completely	[51]
19	Mistakes and deficiencies in design documents	Scheduling Related/All Parties	Mistakes in design documents will lead to longer design approval process and thus a direct delay in the project duration	[99]
20	Insufficient data collection and work preparation	Scheduling Related/All Parties	The lack of information means the inability to take the right decision at the right time	[63]
21	Last minute tasks	Scheduling Related/All Parties	Last minute tasks cause pressure, and sudden change to the project schedule	[48]
22	Unclear demands from project manager	Scheduling Related/All Parties	The vague demands from the project manager can leave his subordinates in a confusion that delays the project	[46]

5. Survey Design and Statistics

The survey has been designed online and distributed among professionals in the field of focus of the paper. It first collects general but important information about the respondents including their job level, years of experience and the category of their organization. After that, the 22 points were listed, and the respondent was asked to choose an impact level and a frequency level for each point. The levels were (very low, low, moderate, high, and very high). The survey was intended to be as clear and direct as possible to encourage the respondents to complete it. The impact level shows how badly this factor affects the project and the frequency level shows how often this factor is encountered. A sample of the survey is attached into the appendix.

The three statistical models used to analyze the data are the relative importance index (RII), and the frequency adjusted importance index (FAII).

The RII is an easy but effective tool in analyzing the data. It can be understood by everyone and it helps ranking the many factors listed in this paper. The RII equation is:

$$\mathrm{RII} = \frac{\sum \mathrm{SR}}{\mathrm{W} * \mathrm{N}} \quad (1)$$

where:

- RII is the relative importance index used to rank the factors obtained based on importance. Its value varies from 0–1. The higher the value is, the higher the rank/importance of the factor is.
- SR is the factor scale. The scale used here is 1–5 and, thus, SR is the scale inputted by the respondent for the impact/importance.
- W is the maximum value of the scale which is 5 here since the scale is from 1– 5.
- N is the number of respondents to the survey.

Equation (1) considers the importance only but not the frequency. To consider the frequency, the frequency index (FI) is used. It is calculated in a similar way to the RII as follows:

$$\mathrm{FI} = \frac{\sum \mathrm{SF}}{\mathrm{W} * \mathrm{N}} \tag{2}$$

where:

- FI is the frequency index used to rank the factors obtained based on frequency. Its value varies from 0 to 1. The higher the value is, the higher the rank/frequency of the factor is.
- SR is the factor scale. The scale used here is 1 to 5 and thus, SR is the scale inputted by the respondent for the frequency.
- W is the maximum value of the scale which is 5 here since the scale is from 1–5.
- N is the number of respondents to the survey.

To combine the two indices in one, the RII and FI are combined into the FAII, which is a simple multiplication combination of the aforementioned factors:

$$\mathrm{FAII} = \mathrm{RII} \times \mathrm{FI} \times 100 \tag{3}$$

6. Results and Discussion

The survey respondents of this survey were chosen to be professional from the field of different job levels, and different experience levels as well. All the respondents are university graduates. The manufactures/contractors represent 80.0% of the respondents, the consultants are 16.7% and the owners represent 3.3%. The Engineers sum up to 46.7% of the respondents while the managers represent 40% and 13.3% lie in other categories. In terms of years of experience, 10% of the respondents had 1–5 years of experience, 10% had 5–10 years of experience, 26.7% had 10–15 years of experience, and 53.3% had more than 15 years of experience.

The result of the survey has been listed in Table 2 to be in a compact form. The table shows the identified 22 factors, their average, standard deviation (SD), RII, and rank based on the RII. The average and SD are based on the impact values.

Table 3 shows the 22 factors ranked based on FI and based on FAII. Additionally, the average and SD are shown based on the frequency values.

Table 2. The identified causes of delay, their average, SD, and RII.

#	Cause	Category	Average	SD	RII	Rank
1	Inadequate contractor experience	Contractor/Manufacturer Related	3.53	1.11	0.706	8
2	Ineffective project planning and scheduling	Contractor/Manufacturer Related	3.53	1.36	0.706	8
3	Poor site management and supervision	Contractor/Manufacturer Related	3.2	1.24	0.64	17
4	Unreliable subcontractors	Contractor/Manufacturer Related	3.5	1.33	0.7	11
5	Late procurement of materials	Contractor/Manufacturer Related	3.83	1.37	0.766	2
6	Difficulties in financing project by contractor/manufacturer	Contractor/Manufacturer Related	3.9	1.21	0.78	1
7	Late delivery of materials	Material Related	3.83	1.26	0.766	2
8	Non-availability of material	Material Related	3.53	1.22	0.706	8
9	Delay in performing inspection and testing	Consultant/Contractor/ Manufacturer Related	3.17	1.02	0.634	18
10	Poor communication and coordination with other parties	Consultant Related	3.57	1.14	0.714	6
11	Unqualified/inexperienced workers	Labor Related	3.1	1.24	0.62	21
12	Low productivity of labor	Labor Related	3.13	1.11	0.626	19
13	Design changes by owner or agent during Execution/Change Orders	Owner Related	3.3	1.12	0.66	12
14	Delay in approving design documents	Owner Related	3.6	1.07	0.72	5
15	Delay in progress payments	Owner Related	3.77	1.07	0.754	4
16	Slowness in decision making	Owner Related	3.57	1.17	0.714	6
17	Shortage of labors	Owner Related	3.23	1.1	0.646	14
18	Unexpected conditions (bad weather, etc.)	External related	2.4	1	0.48	22
19	Mistakes and deficiencies in design documents	Scheduling Related	3.13	1.2	0.626	19
20	Insufficient data collection and work preparation	Scheduling Related	3.23	1.19	0.646	14
21	Last minute tasks	Scheduling Related	3.3	1.02	0.66	12
22	Unclear demands from project manager	Scheduling Related	3.23	1.28	0.646	14

Table 3. The identified causes of delay, their average, SD, and RII.

#	Cause	Category	Average	SD	FI	Rank	FAII	Rank
1	Inadequate contractor experience	Contractor/Manufacturer Related	2.87	1.04	0.574	10	6.58952	10
2	Ineffective project planning and scheduling	Contractor/Manufacturer Related	2.93	1.05	0.586	8	6.86792	8
3	Poor site management and supervision	Contractor/Manufacturer Related	2.7	0.95	0.54	16	5.832	16
4	Unreliable subcontractors	Contractor/Manufacturer Related	2.67	1.12	0.534	17	5.70312	17
5	Late procurement of materials	Contractor/Manufacturer Related	3.23	1.28	0.646	4	8.34632	4
6	Difficulties in financing project by contractor/manufacturer	Contractor/Manufacturer Related	3.47	1.22	0.694	2	9.63272	2
7	Late delivery of materials	Material Related	3.2	1.21	0.64	6	8.192	6
8	Non-availability of material	Material Related	2.83	1.15	0.566	14	6.40712	14
9	Delay in performing inspection and testing	Consultant/Contractor/ Manufacturer Related	2.67	0.99	0.534	17	5.70312	17
10	Poor communication and coordination with other parties	Consultant Related	3	1.17	0.6	7	7.2	7
11	Unqualified/inexperienced workers	Labor Related	2.37	0.96	0.474	21	4.49352	21
12	Low productivity of labor	Labor Related	2.73	1.05	0.546	15	5.96232	15
13	Design changes by owner or agent during Execution/Change Orders	Owner Related	2.87	1.17	0.574	10	6.58952	10
14	Delay in approving design documents	Owner Related	3.23	1.14	0.646	4	8.34632	4
15	Delay in progress payments	Owner Related	3.5	1.14	0.7	1	9.8	1
16	Slowness in decision making	Owner Related	3.27	1.31	0.654	3	8.55432	3
17	Shortage of labors	Owner Related	2.57	1.01	0.514	19	5.28392	19
18	Unexpected conditions (bad weather, etc.)	External related	2	0.98	0.4	22	3.2	22
19	Mistakes and deficiencies in design documents	Scheduling Related	2.5	1.07	0.5	20	5	20
20	Insufficient data collection and work preparation	Scheduling Related	2.87	1.14	0.574	10	6.58952	10
21	Last minute tasks	Scheduling Related	2.9	1.16	0.58	9	6.728	9
22	Unclear demands from project manager	Scheduling Related	2.87	1.38	0.574	10	6.58952	10

It has been found that the top three causes of delay in the delivery of industrial projects in Saudi Arabia in terms of impact are: difficulties in financing project by contractor/manufacturer, late procurement of materials, and late delivery of materials, respectively. In terms of frequency, the top three causes have been identified to be: delay in progress payments, difficulties in financing project by contractor/manufacturer, and slowness in decision making, respectively. Using the FAII helps combine both the frequency and importance in one rating and the result of the FAII ranking is similar to the FI rating for the top three factors. It can be noticed that difficulties in financing project by contractor/manufacturer lies in both the highest impact and highest frequency categories. For manufacturing processes, the availability of material is a key. Additionally, to have the material, money must be available and any lack in finance from the owner side or the contractor side will surely lead to delays in getting the material and, thus, delay in the delivery of the project. Therefore, it is concluded that the results are related.

To overcome the issues related to the materials and their availability or purchase, supply chain management techniques may be used. There are several techniques that could assist in solving this issue such as just in time where the material is purchased and planned to arrive at the factory just at the right time when it is supposed to be. That will help in both making sure that the material will be available when needed and adjusting the cash flow to avoid having lack of money at some point of the project which could delay the next batch of the material that are to be ordered. In addition, the owner must consider his ability to finance the project as part of the scheduling of the project. In other words, finance-based scheduling is to be applied involving both the contractor's and owner's financial capability. Lastly, the slowness in decision making by the owner could be resolved by tracking the actual cause of this delay. It is possible that this slowness is because of not using an automated system that has built in reminder and notification function. It could also be due to an archaic system approach which shall be revised.

In addition to the surveyed causes of delay, some of the professionals who submitted the survey have added extra causes they believe are worth considering. This is because at the end of the survey, there was an option for the respondents to add more causes if they feel they are worth considering too. Those extra reasons have been summarized in Table 4.

Table 4. Extra Factors added through the survey.

Cause/Factor	Impact Out of 5 *	Frequency Out of 5 *
Port customs delay	4	4
Project specifications	-	-
Government restrictions	-	-
Shutdown request only limited to certain periods	-	-
Port customs' clearance delay	3	2
Poor company organization	4	3
Multi-tasking of worker	4	4
Custom Clearance	4	3
Cash Flow problem	4	4
Port custom duties	5	4
Access to customs	4	4
Lab test and reports	5	3

* The scale is from 1–5 where 1 means very low, 2 low, 3 moderate, 4 high, and 5 very high.

It must be highlighted that the responses in Table 4 have been listed as given by the respondents in the survey without any processing. The respondents might have stated extra causes of delay that are similar to the ones in the survey. They also might have not stated the impact or frequency at some points. However, a very noticeable result out of these inputs is that the majority of the respondents who decided to add extra causes of delay agree on a new cause of delay. This cause of delay is the port customs. Though only nine respondents have decided to add more factors to what was in the survey, most of them agreed on the port customs clearance delay as an extra factor is worth paying attention

to. Probably, adding this cause to future surveys will reveal that it is one of the most important causes of delay in terms of impact and frequency. It is a known fact that when a manufacturing process is involved, material is required usually from both local and foreign suppliers. That is especially the case when the manufacturing process is a part of a big project delivery which is the scope of this paper. And if the port customs cause a delay, then, that surely will lead to a delay in the availability of the material. Customs delay of the material could lead to the top causes of delay that have been identified in this research which involve material related causes. This interrelation between the identified causes is considered as one of the key findings of this research. That could help the project managers track the chain of causes of delay and tackle the actual and most important cause of delay. Eventually, this highlights the importance of the choice of this research for the industrial sector as a focused part of the construction one. Many projects that involve construction and building require a part of manufacturing and thus, it is important to add focus on the manufacturing/industrial projects as well.

Since most respondents are manufacturers, they might be biased towards selecting the causes of delay that are not related to them. Thus, comparing the type of respondent with the category of the top causes of delay might give better insights. Since most of the respondents are manufacturers, they will be the only respondent type studied. By looking at the top five causes of delay in terms of both frequency and impact, 4 of them are common. This results in a total of six factors that cause delays in terms of both impact and frequency. The first cause is the difficulties in financing project by contractor/manufacturer. It should be noted that this cause can lie under the manufacturer category or the contractor category. There is a high chance the manufacturers have selected it as a cause that lies under the contractor category. The same analysis applies to the second factor which is late procurement of materials. The third factor which is the late delivery of materials is a material related cause and, thus, it is related to the supplier who supplies the customer, as well as the shipper and customs. The last three factors considered are: delay in progress payments, delay in approving design documents, and slowness in decision making. They are all owner-related factors.

7. Conclusions

In conclusion, a literature survey has been carried out to make an initial identification of the causes of delay in projects in general. The papers reviewed cover a wide geographical area of study. After that, the top causes of delay from the literature and from meetings held with experts were listed. These factors have been put in a designed survey that was distributed to professionals and responses to collect feedback. Different professionals from different positions and organizations were targeted to guarantee the diversity of the responses which helps giving a general and better view of the data. The collected responses were analyzed using the average, standard deviation, relative importance index, frequency index, and the frequency adjusted importance index. The output of the mathematical analyses has revealed that the top causes of delay in terms of frequency and importance are difficulties in financing project by contractor/manufacturer, late procurement of materials, late delivery of materials, delay in progress payments, and slowness in decision-making. This paper has focused on industrial projects where manufacturing process is involved and that is a point of research that is not heavily revealed in the literature. Most studies focus on the causes of delay in the construction and building projects. That is another key point that makes this research more valuable. The port customs can be assessed in future work as an important cause of delay. For future work, the type of manufacturing process that is tied with a construction process can be evaluated. Mechanical products manufacturers might be different from electrical products manufacturers and they might be different from raw material manufacturers. Lastly, the survey can try to reach a point at which the percentage of the respondents of each category is equal.

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References

1. Arditi, D.; Akan, G.T.; Gurdamar, S. Reasons for delays in public projects in Turkey. *Constr. Manag. Econ.* **1985**, *3*, 171–181. [CrossRef]
2. Ashley, R.; Jaselskis, E.; Lurie, C. The determinants of construction project success. *Proj. Manag. J.* **1987**, *18*, 69–79.
3. Okpala, D.C.; Aniekwu, A.N. Causes of High Costs of Construction in Nigeria. *J. Constr. Eng. Manag.* **2009**, *114*, 233–244. [CrossRef]
4. Winch, G. The construction firm and the construction project: A transaction cost approach. *Constr. Manag. Econ.* **1989**, *7*, 331–345. [CrossRef]
5. Peckiene, A.; Komarovska, A.; Ustinovicius, L. Overview of risk allocation between construction parties. *Procedia Eng.* **2013**, *57*, 889–894.
6. Dlakwa, M.; Culpin, M. Reasons for overrun in public sector construction projects in Nigeria. *Int. J. Proj. Manag.* **1990**, *8*, 237–241. [CrossRef]
7. Conner, K.R. A Historical Comparison of Resource-Based Theory and Five Schools of Thought Within Industrial Organization Economics: Do We Have a New Theory of the Firm? *J. Manag.* **1991**, *17*, 121–154. [CrossRef]
8. Barratt, M. Antecedent of supply chain: A source base theory perspective. *J. Oper. Manag.* **2007**, *25*, 1217–1233. [CrossRef]
9. Barney, J. Firm Resources and Sustained Competitive Advantage. *J. Manag.* **1991**, *17*, 99–120. [CrossRef]
10. Grayson, K. Critical Perspectives on Human Security. *Int. Stud. Rev.* **2009**, *11*, 626–628. [CrossRef]
11. Mansfield, N.; Ugwu, O.; Doran, T. Causes of delay and cost overruns in Nigerian construction projects. *Int. J. Proj. Manag.* **1994**, *12*, 254–260. [CrossRef]
12. Assaf, S.A.; Al-Khalil, M.; Al-Hazmi, M. Causes of Delay in Large Building Construction Projects. *J. Manag. Eng.* **2002**, *11*, 45–50. [CrossRef]
13. Faridi, A.S.; El-Sayegh, S.M. Significant factors causing delay in the UAE construction industry. *Constr. Manag. Econ.* **2006**, *24*, 1167–1176. [CrossRef]
14. Nkado, R.N. Construction time-influencing factors: The contractor's perspective. *Constr. Manag. Econ.* **1995**, *13*, 81–89. [CrossRef]
15. Elhag, T.; Boussabaine, A. Evaluation of Construction Cost and Time Attributes. In Proceedings of the 15th Annual ARCOM Conference, Liverpool, UK, 15–17 September 1999; Volume 2, pp. 473–480.
16. Couto, J.P.; Teixeira, J.C. The Evaluation of the Delays in the Portuguese Construction. In Proceedings of the CIB World Building Congress, Cape Town, South Africa, 14–17 May 2007; pp. 292–301.
17. Arantes, A.; Da Silva, P.F.; Ferreira, L.M.D.F. Delays in construction projects—Causes and impacts. In Proceedings of the 2015 International Conference on Industrial Engineering and Systems Management (IESM), Seville, Spain, 21–23 October 2015; pp. 1105–1110.
18. Alkass, S.; Mazerolle, M.; Harris, F. Construction delay analysis techniques. *Constr. Manag. Econ.* **1996**, *14*, 375–394. [CrossRef]
19. Aibinu, A.A.; Jagboro, G.O. The effects of construction delays on project delivery in Nigerian construction industry. *Int. J. Proj. Manag.* **2002**, *20*, 593–599. [CrossRef]
20. Sambasivan, M.; Soon, Y.W. Causes and effects of delays in Malaysian construction industry. *Int. J. Proj. Manag.* **2007**, *25*, 517–526. [CrossRef]
21. Chan, D.W.M.; Kumaraswamy, M.M. A comparative study of causes of time overruns in Hong Kong construction projects. *Int. J. Proj. Manag.* **1997**, *15*, 55–63. [CrossRef]
22. Yang, J.-B.; Wei, P.-R. Causes of Delay in the Planning and Design Phases for Construction Projects. *J. Archit. Eng.* **2010**, *16*, 80–83. [CrossRef]
23. Khoshgoftar, M.; Bakar, A.H.A.; Osman, O. Causes of delays in Iranian construction projects. *Int. J. Constr. Manag.* **2010**, *10*, 53–69. [CrossRef]

24. Pourrostam, T.; Ismail, A. Significant Factors Causing and Effects of Delay in Iranian Construction Projects. *IACSIT Int. J. Eng. Technol.* **2011**, *5*, 450–456.
25. Pourrostam, T.; Ismail, A. Causes and Effects of Delay in Iranian Construction Projects. *Int. J. Eng. Technol.* **2014**, *4*, 598–601. [CrossRef]
26. Abbasnejad, B.; Izadi Moud, H. Construction delays in Iranian civil engineering projects: An approach to the financial security of construction business. *Life Sci. J.* **2013**, *10*, 2632–2637.
27. Fallahnejad, M.H. Delay causes in Iran gas pipeline projects. *Int. J. Proj. Manag.* **2013**, *31*, 136–146. [CrossRef]
28. Saeb, S.; Khayat, N.; Telvari, A. Causes of Delay in Khuzestan Steel Company Construction Projects. *Ind. Eng. Manag. Syst.* **2017**, *15*, 335–344. [CrossRef]
29. Wu, S.H.; Tsai, S.J. Contact stress analysis of skew conical involute gear drives in approximate line contact. *Mech. Mach. Theory* **2009**, *44*, 1658–1676. [CrossRef]
30. Amoatey, C.T.; Ameyaw, Y.A.; Adaku, E.; Famiyeh, S. Analysing delay causes and effects in Ghanaian state housing construction projects. *Int. J. Manag. Proj. Bus.* **2015**, *8*, 198–214. [CrossRef]
31. Aiyetan, A.; Smallwood, J.; Shakantu, W. A systems thinking approach to eliminate delays on building construction projects in South Africa. *Acta Structilia* **2011**, *18*, 19–39.
32. Bekker, M.C. Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa. *Acta Structilia* **2016**, *18*, 51–67.
33. Oshungade, O.O.; Kruger, D. A Comparative Study of Causes and Effects of Project Delays and Disruptions in Construction Projects in the South African Construction Industry. *J. Constr. Eng. Proj. Manag.* **2017**, *7*, 13–25. [CrossRef]
34. Israngkura, B. Evaluation of Common Delay Causes of Construction Projects in Singapore. *J. Civ. Eng. Archit.* **2011**, *5*, 1027–1034.
35. Hwang, B.G.; Zhao, X.; Ng, S.Y. Identifying the critical factors affecting schedule performance of public housing projects. *Habitat Int.* **2013**, *38*, 214–221. [CrossRef]
36. Mahamid, I.; Bruland, A.; Dmaidi, N. Causes of Delay in Road Construction Projects. *J. Manag. Eng.* **2011**, *28*, 300–310. [CrossRef]
37. Mahamid, I. Frequency of time overrun causes in road construction in Palestine: Contractors' View. *Organ. Technol. Manag. Constr. Int. J.* **2013**, *5*, 720–729. [CrossRef]
38. Shebob, A.; Dawood, N.; Xu, Q.; Egbu, C.; Lou, E.C.W. Analysing construction delay factors: A case study of building construction project in Libya. In Proceedings of the 27th Annual ARCOM Conference, Bristol, UK, 2–4 September 2011; Association of Researchers in Construction Management: Bristol, UK, 2011; pp. 1005–1012.
39. Ameh, O.J.; Soyingbe, A.A.; Odusami, K.T. Significant Factors Causing Cost Overruns in Telecommunication Projects in Nigeria. *J. Constr. Dev. Ctries.* **2010**, *15*, 49–67.
40. Gandhak, P.; Sabihuddin, S. Stakeholders' Perception of the Causes and Effect of Construction Delays on Project Delivery-A Review. *J. Constr. Eng. Proj. Manag.* **2015**, *4*, 41–46. [CrossRef]
41. Mohammed, K.A. Causes of Delay in Nigeria Construction Industry. *Interdiscip. J. Contemp. Res. Bus.* **2012**, *4*, 785–794.
42. Doloi, H.; Sawhney, A.; Iyer, K.C. Structural equation model for investigating factors affecting delay in Indian construction projects. *Constr. Manag. Econ.* **2012**, *30*, 869–884. [CrossRef]
43. *Annual Report 2011/2012 Report No. 20 of 2011–2012 for the period ende March 2010*; Union Government Defence Service (Air force Navy): Mumbai, India, 2012.
44. Parikh, G.M.; Joshi, D.J. Modelling for time overrun prediction due to disputes in highway projects in India. *IMPACT Int. J. Res. Eng. Technol.* **2013**, *1*, 23–34.
45. Chen, Y.Q.; Zhang, Y.B.; Liu, J.Y.; Mo, P. Interrelationships among Critical Success Factors of Construction Projects Based on the Structural Equation Model. *J. Manag. Eng.* **2011**, *28*, 243–251. [CrossRef]
46. Yang, J.B; Chu, M.Y.; Huang, K.M. An empirical study of schedule delay causes based on Taiwan's litigation cases. *Proj. Manag. J.* **2013**, *44*, 21–31. [CrossRef]
47. Motaleb, O.; Kishk, M. An Investigation into the Risk of Construction Projects Delays in the UAE. *Int. J. Inf. Technol. Proj. Manag.* **2013**, *4*, 50–65. [CrossRef]
48. Aziz, R.F. Ranking of delay factors in construction projects after Egyptian revolution. *Alexandria Eng. J.* **2013**, *52*, 387–406. [CrossRef]

49. Ezeldin, A.S.; Abdel-Ghany, M. Causes of construction delays for engineering projects: An egyptian perspective. In *Proceedings of the AEI 2013: Building Solutions for Architectural Engineering: Proceedings of the 2013 Architectural Engineering National Conference, State College PA, USA, 3–5 April 2013*; American Society of Civil Engineers: Reston, VA, USA, 2013; pp. 54–63.
50. Marzouk, M.M.; El-Rasas, T.I. Analyzing delay causes in egyptian construction projects. *J. Adv. Res.* **2014**, *5*, 49–55. [CrossRef]
51. Aziz, R.F.; Abdel-Hakam, A.A. Exploring delay causes of road construction projects in Egypt. *Alexandria Eng. J.* **2016**, *55*, 1515–1539. [CrossRef]
52. Ruqaishi, M.; Bashir, H.A. Causes of Delay in Construction Projects in the Oil and Gas Industry in the Gulf Cooperation Council Countries: A Case Study. *J. Manag. Eng.* **2013**, *31*, 05014017. [CrossRef]
53. Gardezi, S.S.S.; Manarvi, I.A.; Gardezi, S.J.S. Time extension factors in construction industry of Pakistan. *Procedia Eng.* **2014**, *77*, 196–204.
54. Ritchie, L.D.; Yoshida, S.; Sharma, S.; Patel, A.; Vitale, E.H.; Hecht, K. Drinking Water in California Child Care Sites Before and After 2011–2012 Beverage Policy. *Prev. Chronic Dis.* **2015**, *12*, 140548. [CrossRef]
55. Balsari, S.; Greenough, P.G.; Kazi, D.; Heerboth, A.; Dwivedi, S.; Leaning, J. Public health aspects of the world's largest mass gathering: The 2013 Kumbh Mela in Allahabad, India. *J. Public Health Policy* **2016**, *37*, 411–427. [CrossRef] [PubMed]
56. Haq, S.; Rashid, Y.; Aslam, M.S. Effects of Delay in construction Projects of Punjab-Pakistan: An Empirical Study Effects of Delay in construction Projects of Punjab-Pakistan. *J. Basic Appl. Sci. Res.* **2017**, *3*, 87–96.
57. Kamanga, M.; Steyn, W. The South African Institution of Civil Engineers. *Aust. Surv.* **2012**, *28*, 536.
58. Muya, M.; Kaliba, C.; Sichombo, B.; Shakantu, W. Cost escalation, schedule overruns and quality shortfalls on construction projects: The case of Zambia. *Int. J. Constr. Manag.* **2013**, *13*, 53–68. [CrossRef]
59. Sweis, G.J. Factors Affecting Time Overruns in Public Construction Projects: The Case of Jordan. *Int. J. Bus. Manag.* **2013**, *8*, 120–129. [CrossRef]
60. Ramanathan, C.; Narayanan, S.P.; Idrus, A.B. Construction delays causing risks on time and cost - A critical review. *Australas. J. Constr. Econ. Build.* **2012**, *12*, 37–57. [CrossRef]
61. Tawil, N.M.; Khoiry, M.A.; Arshad, I.; Hamzah, N.; Jasri, M.F.; Badaruzzaman, W.H.W. Factors contribute to delay project construction in higher learning education case study UKM. *Res. J. Appl. Sci. Eng. Technol.* **2013**, *5*, 3112–3116.
62. Hameed Memon, A.; Abdul Rahman, I.; Abdul Aziz, A.A.; Abdullah, N.H. Using structural equation modelling to assess effects of construction resource related factors on cost overrun. *World Appl. Sci. J.* **2013**, *21*, 6–15.
63. Othuman Mydin, M.A.; Sani, N.M.; Taib, M.; Mohd Alias, N. Imperative Causes of Delays in Construction Projects from Developers' Outlook. *MATEC Web Conf.* **2014**, *10*, 06005. [CrossRef]
64. Kazaz, A.; Ulubeyli, S.; Tuncbilekli, N.A. Causes of Delays in Construction Projects in Turkey. *J. Civ. Eng. Manag.* **2012**, *18*, 426–435. [CrossRef]
65. Gunduz, M.; Nielsen, Y.; Ozdemir, M. Fuzzy Assessment Model to Estimate the Probability of Delay in Turkish Construction Projects. *J. Manag. Eng.* **2013**, *31*, 04014055. [CrossRef]
66. Gündüz, M.; Nielsen, Y.; Özdemir, M. Quantification of Delay Factors Using the Relative Importance Index Method for Construction Projects in Turkey. *J. Manag. Eng.* **2012**, *29*, 133–139. [CrossRef]
67. Ahmed, S.; Dlask, P.; Hasan, B. Deviation in the Cost of projects. In Proceedings of the Construction Maeconomics Conference 2014, Thakurova, Czech Republic, 9 May 2014; pp. 1–9.
68. Van Truong, L.; Sang, N.M.; Viet, N.T. A Conceptual Model of Delay Factors affecting Government Construction Projects. *ARPN J. Sci. Technol.* **2016**, *5*, 92–100.
69. Atibu Seboru, M. An Investigation into Factors Causing Delays in Road Construction Projects in Kenya. *Am. J. Civ. Eng.* **2015**, *3*, 51. [CrossRef]
70. Bekr, G.A. Causes of delay in public construction projects in Iraq. *Jordan J. Civ. Eng.* **2015**, *9*, 149–162.
71. Patil, S.K. Causes of Delay in Indian Transportation Infrastructure Projects. *Int. J. Res. Eng. Technol.* **2015**, *2*, 71–80.
72. Gunduz, M.; AbuHassan, M.H. Causes of Construction Delays in Qatar Construction Projects. *Int. J. Civ. Environ. Struct. Constr. Archit. Eng.* **2016**, *10*, 531–536.
73. Al-Kharashi, A.; Skitmore, M. Causes of delays in Saudi Arabian public sector construction projects. *Constr. Manag. Econ.* **2009**, *27*, 3–23. [CrossRef]

74. Elawi, G.S.; Algahtany, M.; Kashiwagi, D.; Sullivan, K. Major Factors Causing Construction Delays in Mecca. *J. Adv. Perform. Inf. Value* **2016**, *7*, 1–11.
75. Santoso, D.S.; Soeng, S. Analyzing Delays of Road Construction Projects in Cambodia: Causes and Effects. *J. Manag. Eng.* **2016**, *32*, 05016020. [CrossRef]
76. Durdyev, S.; Omarov, M.; Ismail, S. Causes of delay in residential construction projects in Cambodia. *Cogent Eng.* **2017**, *4*, 1–12. [CrossRef]
77. Tebeje Zewdu, Z. Construction Projects Delay and Their Antidotes: The Case of Ethiopian Construction Sector. *Int. J. Bus. Econ. Res.* **2016**, *5*, 113. [CrossRef]
78. Adeyemi, A.Y.; Masalila, K. Delay factors and time-cost performance of construction projects in Gaborone City Council, Botswana. *J. Adv. Perform. Inf. Value* **2016**, *8*, 88–105.
79. Bagaya, O.; Song, J. Empirical Study of Factors Influencing Schedule Delays of Public Construction Projects in Burkina Faso. *J. Manag. Eng.* **2016**, *32*, 05016014. [CrossRef]
80. Amandin, M.M.; Kule, J.W. Project Delays on Cost Overrun Risks: A Study of Gasabo District Construction Projects Kigali, Rwanda. *ABC J. Adv. Res.* **2016**, *5*, 21–34.
81. Mohammadsoroush, T.; Candidate, L.E.E.D.; Pramen, P.; Shrestha, P.E. Investigating Causes of Delay in U.S. Construction Projects. In Proceedings of the ASC Annual International Conference, Seattle, WA, USA, 5–8 April 2017; pp. 611–621.
82. Nyoni, T.; Bonga, G.W. Towards Factors Affecting Delays in Construction Projects: A Case for Zimbabwe. *J. Econ.* **2017**, *2*, 12–28.
83. Akogbe, R.K.T.M.; Feng, X.; Zhou, J. Importance and ranking evaluation of delay factors for development construction projects in Benin. *KSCE J. Civ. Eng.* **2013**, *17*, 1213–1222. [CrossRef]
84. Niazai, G.A.; Gidado, K. Causes of Project Delay in the Construction Industry in Afghanistan. In Proceedings of the EPPM 2012, Engineering, Project and Production Management Conference, Brighton, UK, 10–11 September 2012; pp. 63–74.
85. Sato, H. International criminal responsibility concerning "control over an organization" and command responsibility Lato Sensu. *Int. Crim. Law Rev.* **2012**, *12*, 293–300. [CrossRef]
86. Kikwasi, G. Causes and Effects of Delays and Disruptions in Construction Projects in Tanzania. *Australas. J. Constr. Econ. Build. Conf. Ser.* **2017**, *1*, 52. [CrossRef]
87. Dube, M.R.; Dixit, S.K. Comprehensive Measurement Framework for Enterprise Architectures. *Int. J. Comput. Sci. Inf. Technol.* **2011**, *3*, 71–92. [CrossRef]
88. Muhwezi, L.; Acai, J.; Otim, G. An Assessment of the Factors Causing Delays on Building Construction Projects in Uganda. *Constr. Eng. Manag.* **2014**, *3*, 13–23.
89. Byers, M.; Webb, S. *Canada's Submarine Program Springs a Leak*; Canadian Centre for Policy Alternatives: Ottawa, ON, Canada, 2013.
90. Zhang, A.; Zeng, Y. Engineering project management evaluation based on team and structural equation modeling. In *Proceedings of the 20th International Conference on Industrial Engineering and Engineering Management: Theory and Apply of Industrial Management*; Springer: Berlin, Germany, 2013; pp. 531–538.
91. Khalili-Damghani, K.; Tavana, M. A comprehensive framework for sustainable project portfolio selection based on structural equation modeling. *Proj. Manag. J.* **2014**, *45*, 83–97. [CrossRef]
92. Qureshi, S.M.; Kang, C.W. Analysing the organizational factors of project complexity using structural equation modelling. *Int. J. Proj. Manag.* **2015**, *33*, 165–176. [CrossRef]
93. Prajogo, D.; Huo, B.; Han, Z. The effects of different aspects of ISO 9000 implementation on key supply chain management practices and operational performance. *Supply Chain Manag.* **2012**, *17*, 306–322. [CrossRef]
94. Zidane, Y.-T.; Andersen, B. Causes of delay and their cures in major Norwegian projects. *J. Mod. Proj. Manag.* **2018**, *5*.
95. Jalal, M.P.; Shoar, S. A hybrid SD-DEMATEL approach to develop a delay model for construction projects. *Eng. Constr. Archit. Manag.* **2017**, *24*, 629–651. [CrossRef]
96. Imran, M. Impact of Factors Causing Delays in Original Equipment Manufacturer (OEM) Intensive Capital Projects—The Case of Pakistan Public Sector. *ASBBS Proc.* **2016**, *23*, 248.
97. Sambasivan, M.; Deepak, T.J.; Salim, A.N.; Ponniah, V. Analysis of delays in Tanzanian construction industry. *Eng. Constr. Archit. Manag.* **2017**, *24*, 308–325. [CrossRef]
98. Odeyinka, H.; Oladapo, A.A. The Causes and Effects of Construction Delays on Completion Cost of Housing Projects in Nigeria. *J. Financ. Manag. Prop. Constr.* 1997; 31–34.

99. Acharya, N.K.; Lee, Y. Investigating delay factors in construction industry: A Korean perspective. *Korean J. Constr. Eng. Manag.* **2006**, *7*, 177–190.