

Variation Orders and Their Effects of Erbil Governorate Projects

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ABSTRACT

Variation order plays an important role in calculating the final cost and time. The paper aims to determine the causes of variation orders in projects performed between 2007-2014 in Erbil governorate projects. Data was collected from contract documents. Performed in the Erbil governorate projects from 2007-2014. The study seeks to identify the most significant causes of delays by assessing the common causes of delays in terms of frequency, severity and important indices of owners, consultants and contractors related to the implementation of public construction projects in Erbil Governorate. The data acquired from the questionnaire given to the engineers involved in executing of these projects and 73 forms were returned. The results showed that the ranking of overall causes of variation order from highest to lowest was "Contractor's financial difficulties", "Change of plans or scope by owner", "The required labor skill are not available", "Differing site conditions", "Owner's financial problems", "Design change originated by owner", "Errors and omissions in design", "The required equipment and tools are not available", "Inadequate working drawing details", and "Change in design by the engineer or consultant". The source of "Errors and omissions in design", "Inadequate working drawing details", and "Change in design by the engineer or consultant" is consultant.

Keywords: construction; variation order; overruns; owner; contractor; consultant

أوامر التغيير وآثارها على مشاريع محافظة أربيل

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الخلاصة

يلعب أمر التغيير دورًا مهمًا في حساب التكلفة والوقت النهائيين. الغرض من هذه الورقة هو تحديد أسباب أوامر التغيير في المشاريع المنفذة بين 2007-2014 في مشاريع محافظة أربيل. تم جمع البيانات من وثائق العقد. نفذت في محافظة أربيل مشاريع من 2007-2014 ، وتسعى الدراسة إلى تحديد أهم أسباب التأخير من خلال تقييم الأسباب الشائعة للتأخير من حيث التكرار

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والشدة و مؤشرات مهمة للمالكين والاستشاريين والمقاولين تتعلق بتنفيذ مشاريع البناء العامة في محافظة أربيل. البيانات التي تم الحصول عليها من الاستبيان المقدم للمهندسين المشاركين في تنفيذ هذه المشاريع وأعيدت 73 استمارة. أظهرت النتائج أن ترتيب الأسباب الإجمالية لترتيب التباين من الأعلى إلى الأدنى كان "الصعوبات المالية للمقاول" ، "تغيير الخطط أو النطاق من قبل المالك" ، "مهارة العمالة المطلوبة غير متوفرة" ، "اختلاف ظروف الموقع" ، "المشاكل المالية للمالك" ، "نشأ تغيير التصميم من قبل المالك" ، "الأخطاء والسهو في التصميم" ، "المعدات والأدوات المطلوبة غير متوفرة" ، "تفاصيل رسم العمل غير الكافية" ، و "التغيير في التصميم من قبل المهندس أو الاستشاري" . مصدر "الأخطاء والسهو في التصميم" ، "تفاصيل رسم العمل غير الملائمة" ، وتغيير التصميم من قبل المهندس أو الاستشاري " هو استشاري.

1. INTRODUCTION

Variation order Definition

It is actually rare for a construction project to be completed without changes being made.

The standard construction contract contains a provision authorizing the owner or owner representative to order changes or modifications to the project within the general scope of the contract. A change (variation) order is referred to as the document directing such changes (Nunnally, 2007)

Mokbel (Mokbel, 2003) defined the variation (change) order as: "an action that specifies and justifies a change to the scope of a construction contract that alters the original time of completion of the total project cost, or both" (Cited by Enshassi et al. 2010)

Variations in Iraqi Conditions of Contract for Civil Engineering Works

The REPUBLIC OF IRAQ, MINISTRY OF CONSTRUCTING AND HOUSING, (2010) and the REPUBLIC OF IRAQ, MINISTRY OF PLANNING, LEGAL DEPARTMENT (1987) authorize the engineer to make a variation in works as follows:

The engineer shall make any variation in the form, quality or quantity of the works, or any part thereof, which, in his view, may be necessary or desirable, and shall have the power to order the works to be carried out by the contractor. The contractor shall do any of the following:

1. Increase or decrease the quantity of any work included in the contract.
2. Omit any part of the work.
3. Change the character or quality or kind of any of the works.
4. Change the levels, lines, position, and dimensions of any part of the work, and
5. Execute additional work of any kind necessary for the completion of the works.

Types of Variation Orders

Variation orders are of different types based on benefit and detrimental or directed and constructive (nature) (Sherif, 2016).

Beneficial Variation Orders

Beneficial variation orders are issued for reducing the cost, time, or project difficulty. These variation orders lead to remove the extra costs and raise the benefits of the owner (Ndihokubwayo and Haup, 2009).

Detrimental Variation Orders

Detrimental variation orders that negatively affect the value of the owner or his performance.

Due to financial difficulty, the owner may sacrifice the quality of the work(s) (Enshassi, et al., 2010)



Directed Variation Order

The owner directs the contractor to perform work that varies from that defined in the contract or is an addition to the stated work that specified in the contract.

In keeping with the relevant clauses in the contract, guided variations are typically given. This form can also be deductive in nature. The scope of the work could, for example, be reduced from the original scope of the work specified in the contract.

After the owner's order, the contractor will determine the works needed and agree with the owner on the works (A-Dubaisi, 2000).

Construction Variation Order

Due to an informal approving act or guiding a change by an act or failure to act as per contract, this type of variation is provided. In this case, the contractor will conduct various works other than those specified in the contract, increasing the contractor's costs and/or time of performance, which must be treated as a variation order (Sherif, 2016; Klee, 2015).

Impacts of Variation Orders

The impact of variation of orders is mostly an increase in the project's cost (i.e., cost overruns), delay in delivery of the project (or time overrun), delay in payment, quality degradation, etc. Later details of these impacts will be covered in some previous research works. Out of 81 projects, the data of 72 projects (about 90%) are obtained.

2. LITERATURE REVIEW

Causes of Variation Orders

The occurrence of variation orders in the construction industry is a regular trend all over the world. They are the major problems in construction projects. Many research papers were conducted locally and abroad.

(Agele and Al-Hassan, 2009) studied the reasons for cost deviation in Iraqi construction projects. They concluded that the major causes are: the inability of the company to meet project requirements, inadequate planning, inaccurate estimation of the cost, delayed cash flows by owners, inefficient executive manager of the project, lack of control by the time of the project or predict the date of its end, the negative impact of the population in the project area, multiple sources of the decision and the overlap of powers, poor performance of the contractor. (Mustafa and AL Hariri, 2015) studied the causes of variation in a Syrian project. They showed that the owner or the engineer supervising the project is the party who is responsible for change orders in the project. The ten most important causes of variation of highway projects studied by (Msallam, et al., 2015) are change of schedule, ambiguous design details, change of plan or scope, the conflict between contract documents, lack of coordination, safety considerations, client financial problem, change in design by the consultant, socio-cultural factors, and change in government regulations.

(Alaryan, et al., 2014) identified the causes and effects of variation orders on construction projects in Kuwait. The first cause was the change of plans by the owner, and the increase in cost was the first effect. Otherwise an increase in the cost of the project is the first effect. (Enshassi et al., 2010) identified the ten top causes of variation orders in Ghazza projects are: lack of materials and equipment spare parts due to closure, change in design by the consultant, lack of consultant's knowledge of available materials, errors and omission in design, conflicts between contract documents, owners financial problems, lack of coordination among project parties, using the inadequate specification for local markets by international consultant, internal politics, and change



in specification by owners. In South Africa, (Ndiokubwayo and Haupt, 2009) found that the most predominant origin agent of variation orders resulted from unclear briefing and changing requirements.

In another study (Memon, et al., 2014), most variation order causes in Malaysia's JKR projects are unavailability of equipment, poor workmanship, and design complexity. The most significant VO effects on the projects are increased project cost, delay in completion, and logistic delays. (Mohammad, et al., 2010) studied the causes of variation. They concluded that the three most significant cause variation orders are: 'Change of plan by owner', 'Substitution of materials by owner', and 'Changes of design by consultant'.

(Staiti, et al., 2016) studied the main causes of change orders of construction projects in West Bank to highlight change order management's potential effects on the Palestinian Industrial construction. The main source of the causes was the owner due to financial problems, changes in mind, or non-compliant design with the owner's requirement. The second main cause was Consultant wrongs and canceling in design, specifications, and contract documents clashing.

In roadway construction projects, (Ismail, et al., 2012) studied the causes and effects of variation orders. The most causes of variation orders were: the change in scope by the owner, errors, and omissions in design, and site condition changing. Also, the financial difficulties of contractors are the critical factors causing variation orders. The study in a mega hydropower project in Pakistan (Hanif, et al., (2016) showed that the error and omissions in design, change in scope, and change in design were among the three causes of variation orders. In Oman, a study was conducted on the change orders and effects on public construction projects (Al-Nuaiml, et al., 2010). It was found that the most frequent causes are the clients' additional works and design modification. The second, later cause was due to the nonavailability of manuals and procedures. (Sherif, 2016) showed that the three significant causes of change orders for the repetitive residential units in Egypt are change of plans or scope by the owner, change of schedule sequence by owner, and change in specifications by owner. **Table 1.** illustrates the summarized causes of variation orders referred to previously.

(Mohammad N., et al., 2017) studied the causes and effects of change orders in the Construction of Terrace Housing Project in Malaysia revealed four most significant causes variation orders which are: 'Change of scope by owner', 'Substitution of materials by owner', 'Changes of specification by owner' and 'Changes of design by consultant'. Meanwhile, the effects of the variation orders are time and cost overrun. The finding concludes that the owner is the major source of the variation orders in construction of building projects and suggested that the owner should have adequate planning and recourses before initiating a project to avoid variation order during the construction stage. (Varghese and Xavier 2018) found that there were two main causes for change orders in construction sites by owner and financial problems while the effects of change orders were cost overrun and increase in project duration.

The cost and time effect of variation orders in the Sulaimani Govenotate projects performed between 2007 and 2012 was assessed by (Muhamad et al., 2020).

With an average of 16 percent cost overruns, more than 95 percent of the projects surveyed were affected with an average of 16 percent cost overruns and more than 98 percent of the projects were affected with time overruns of more than 40 percent.



Table 1. Summary of Studies in Review

Causes	Authors												
	Agele and Al-Hassan (2016)	Mustafa and AL Hariri (2015)	Msallam et al. (2015)	Alaryan et al. (2014)	Enshassi et al. (2010)	Ndihokubwayo and Haupt (2009)	Memon et al. (2014)	Mohammad et al. (2010)	Staiti et al. (2016)	Ismail et al (2012)	Hanif et al (2016)	Nuaiml et al. (2010)	Sherif (2016)
	Iraq	Syrian	Jordon	Kuwait	Gaza Strip-Palestine	South Africa	Malaysia	Malaysia	West Bank Palestine	Iran	Pakistan	Oman	Egypt
Inability of the company to meet project requirements	√												
Inadequate planning	√												
Inaccurate estimation of the cost,	√												
Delayed cash flows by owners,	√												
Inefficient executive manager of project,	√												
Lack of control to the time of the project or predict the date of its end	√												
Predict the date of its end	√												
Owner		√											
Engineer supervising		√											
Schedule (Time)			√			√							√
Ambiguous design details			√										
Change of plan or scope			√	√		√		√		√	√		√
The conflict between contract documents			√		√								
Lack of coordination			√		√								
Safety considerations			√										
Clientfinancial problem			√										
Change in design by consultant			√		√	√		√					
Socio-cultural factors			√										
Change in government regulations			√										



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	Iraq	Syrian	Jordon	Kuwait	Gaza Strip-Palestine	South Africa	Malaysia	Malaysia	West Bank Palestine	Iran	Pakistan	Oman	Egypt
Lack of materials and equipment, spare parts due to closure					√								
Lack of consultant's knowledge of available materials					√								
Errors and omission in design					√	√				√	√		
Owner's financial problems					√								
Using inadequate specification for local markets by international consultant					√								
Internal politics					√								
Change in specification by owner/or consultant					√	√							√
Unclear briefing and changing requirements							√						
Poor workmanship and design complexity							√						
Substitution of materials by owner								√					
Owner due to financial problems									√				
Client's additional works												√	
Design modification.											√	√	
No availability of manuals and procedures												√	
and site condition changing										√			
Safety considerations			√										
Client financial problem			√										
Change in design by consultant			√		√	√		√					
Socio-cultural factors			√										



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	Agele and Al-Hassan (2016)	Mustafa and AL Hariri (2015)	Msallam et al. (2015)	Alaryan et al. (2014)	Enshassi et al. (2010)	Ndihokubwayo and Haupt (2009)	Memon et al. (2014)	Mohammad et al. (2010)	Staiti et al. (2016)	Ismail et al (2012)	Hanif et al (2016)	Nuaiml et al. (2010)	Sherif (2016)
	Iraq	Syrian	Jordon	Kuwait	Gaza Strip-Palestine	South Africa	Malaysia	Malaysia	West Bank Palestine	Iran	Pakistan	Oman	Egypt
Change in government regulations			√										
Lack of materials and equipment, spare parts due to closure					√								
Lack of consultant's knowledge of available materials					√								
Errors and omission in design					√	√				√	√		
Owner's financial problems					√								
Using inadequate specification for local markets by international consultant					√								
Internal politics					√								
Change in specification by owner /or consultant					√	√							√
Unclear briefing and changing requirements							√						
Poor workmanship and design complexity							√						
Substitution of materials by owner								√					
Owner due to financial problems									√				
Client's additional works												√	
Design modification.											√	√	
No availability of manuals and procedures												√	
and site condition changing										√			



3. RESEARCH METHODOLOGY

The data collection is conducted in two phases. The first step consisted of literature reviews similar to previous studies of local and international countries through papers, conference proceedings, the internet, and international project management journals. The purpose of reviewing is to get information on the causes of variation orders likely to be occurring in our region. The second phase involved developing the questionnaire that provides a list of 26 causes of variance orders found in construction projects. To minimize the low number of a handdelivered questionnaire strategy was used for respondents. The questionnaire was broken down into three primary elements. The first part was to describe the concept and purpose of the survey and to identify the field of research in question.

The profile of the respondent was requested in the second section, such as the number of years employed in the building and the number of projects executed successfully by them.

The third part concerned the causes of the order of variance in the construction project in the form of a simple statement. Variation order considerations are grouped into 4 main participant categories: owner, consultants, contractors and other externals. Two measures, frequency and severity, are used for each factor. The respondents have four choices for each measure in the form of digit ranking from 1 to 4. **Table 2** shows the ordinary scale, and the given digits 1, 2, 3, and 4 are a numerical indication of the dissimilar level of grade. Questionnaires were delivered to respondents in the public project from almost all governorate sectors who directly participated in the construction of projects as a project manager. The procedure used was aimed at establishing the relative importance of various factors of a project variation order. The following statistical techniques were used to analyze the data:

Frequency Index:

The following equation is used to evaluate the causes of the order of variance based on the frequency of respondents' occurrences.

$$\text{Frequency Index (F.I)} = \left[\frac{\sum f_i x_i}{4 \sum x_i} \right] \times 100 \tag{1}$$

Where the

x_i = constant expressing weight (scale) given to i^{th} response: 1, 2, 3, 4

f_i = variable expressing frequency of i^{th} response

i = response category index of 1, 2, 3, 4

Severity Index:

The following equation is used in the manner of frequency to evaluate the severity index:

$$\text{Severity Index (S.I) (\%)} = \left[\frac{\sum s_i x_i}{4 \sum x_i} \right] \times 100 \tag{2}$$

Where

s_i = variable expressing the severity of i^{th} response.

Important index:

By using the following equation, the important index (I.I) of each cause is calculated:

$$\text{Important Index (I.I) (\%)} = \left\{ \frac{\text{F.I.(\%)} \times \text{S.I.(\%)}}{100} \right\} \tag{3}$$



For this purpose, a survey is conducted on a sample of executed projects after 2006 in almost of all sectors of Local Governorate, Works and Housing, High Education, Health, Awqaf (Religions affairs), Water Supply, Sanitary, Irrigation, Roads and Electrical Works. The survey involves data on cost of contract, time of contract, actual cost (per final measurement), and completion time. The percentages of cost and time are calculated.

Table 2. Scale Used for Measurements of Variation Order Factors

	Frequency				Severity			
Delay Scale xi	1	2	3	4	1	2	3	4
Scale	Rarely happens	Sometimes happens	Often happens	Always happens	Little	Moderate	Great	Extreme
Factors	f1	f2	f3	f4	S1	S2	S3	S4

4. RESULT ANALYSIS AND DISCUSSION

Based on results and literature review, some common causes are available and discussed in the followings.

Respondent Profiles

The respondents are all practices engineers who carried out and supervised public projects in most facilities in the governorate institution; local government, works and housing, municipality, highways, irrigation, water supply, wastewater, electricity, religious affairs (Awqaf), and health. As shown in **Table 3**, the respondent's years of experience differs from 1 year to more than 25 years.

Table 3. Respondent’s Year of Experience.

Years of Experience	1-4	5-9	10-14	15-19	20-24	≥ 25
Percentage	13	15	29	23	10	10

The number and percentage of projects carried out and supervised by respondents are 1 to 50 projects as shown in **Table 4**, and the types of projects and their percentages are shown in **Table 5**.

Table 4. Number of Projects Executed and Supervised by the Respondents.

Number of Projects	1-9	10-19	20-29	30-39	40-49	≥ 50
Percentage	23	28	16	11	6	16

Table 5. Types of Projects Executed by the Respondents.

Sector Name	Buildings	Educational	Electrical	Irrigation	Health Buildings	Water Supply	Sewerage	Roads	Dwellings	Sport Centers
Percentage	20	13	7	10	9	10	10	17	2	2

The results of frequency, severity, and important indices are shown in **Table 6**. The highest rank of causes is due to contractor's financial difficulties related to the frequency



index of 61.8 percent (second rank), severity of 68.5 (first rank) percent, and an important index of 42.3 percent of the first rank. The second cause is *the modification of plans or scope by owner* with highest frequency of 62 percent, severity of 63.3 percent (second rank) and important index of 39.2 percent the second rank. The third cause of variation order is *the required labor skill are not available* (lack in skill labor) which is related to the contractor.

Table 6. Evaluation of Causes of Variations.

	Source of Variation order	Causes of Variation Orders	F.I %	S.I %	I.I %	Rank
1	Owner Related Change	Owner's financial problems	55.3	62.5	34.5	5
2		Change of plans or scope by owner	62.0	63.3	39.2	2
3		Replacement of material or procedures	51.0	53.2	27.1	15
4		Design change originated by owner	54.5	60.8	33.1	6
5		Change of schedule by owner	50.3	58.0	29.1	12
6		impediment or/and slow in prompt decision making process	52.0	56.3	29.3	11
7		Change in specifications by owner	43.4	63.5	27.5	14
8	Design Consultant Change	Change in design by engineer or consultant	51.8	58.2	30.1	10
9		Conflict between contract documents	48.0	54.8	26.3	19
10		Errors and omissions in design	50.5	61.0	30.8	7
11		The scope of work for the contractor is not well defined	49.2	54.0	26.6	18
12		Technology change	34.7	38.7	13.4	26
13		Inadequate working drawing details	45.5	48.5	22.1	22
14		Design complexity	39.8	51.5	20.5	24
15		Inadequate working drawing details	53.5	56.4	30.2	9
16		Consultant's lack of experience	44.2	50.7	22.4	21
17		Lack of consultant's knowledge of available materials and equipment	43.5	49.5	21.5	23
18	Ambiguous design details	45.5	56.3	25.6	20	
19	Contractor Related Change	Differing site conditions	57.3	62.0	35.5	4
20		Contractor's financial difficulties	61.8	68.5	42.3	1
21		The required labor skill are not available	61.3	58.5	35.8	3
22		The required equipment and tools are not available	52.0	59.1	30.7	8
23		Workmanship or material not meeting the specifications	50.8	56.5	28.7	13
24	Other Causes of Change	New government regulations	47.0	56.8	26.7	17
25		Strikes	34.0	50.3	17.1	25
26		Quality improvement	48.8	55.0	26.8	16

Table 7 presents the ten top of most causes related to owner and contractor which are: "Contractor's financial difficulties", " Change of plans or scope by owner", "The required labor skill are not available", "Differing site conditions", "Owner's financial problems", "Design change originated by owner", "Errors and omissions in design", " The required equipment and tools are not available", "Inadequate working drawing details", " Change in design by engineer or consultant". While out of these causes, only three of them, which are "Errors and omissions in design", "Inadequate working



drawing details", and "change in design by the engineer or consultant," are due to the consultant. The third source of variation order is the consultant's *errors and omissions in design, inadequate working drawing details, and change in design by the engineer or consultant* within the ten top causes of variation orders.

Table 7. Ranking of Overall Ten Top Causes of Variation Orders.

Causes of Variation Orders	Related to	Rank
Contractor's financial difficulties	Contractor	1
Change of plans or scope by owner	Owner	2
The required labor skill are not available	Contractor	3
Differing site conditions	Contractor	4
Owner's financial problems	Owner	5
Design change originated by owner	Owner	6
Errors and omissions in design	Consultant	7
The required equipment and tools are not available	Contactore	8
Inadequate working drawing details	Consultant	9
Change in design by engineer or consultant	Consultant	10

Considering the source of variation order, the first ranked causes are "Change of plans or scope by owner", "Errors and omissions in design", and "Contractor's financial difficulties" relating to owner, contractor and consultant respectively as shown in **Table 8.**

Table 8. Ranked Causes of Variation Orders Sources.

Owner		Consultant		Contractor	
Cause	Rank	Cause	Rank	Cause	Rank
Change of plans or scope by owner	1	Errors and omissions in design	1	Contractor's financial difficulties	1
Owner's financial problems	2	Inadequate working drawing details	2	The required labor skill are not available	2
Design change originated by the owner	3	Change in design by engineer or consultant	3	Differing site conditions	3
Impediment or/and slow in the prompt decision-making process	4	The scope of work for the contractor is not well defined	4	The required equipment and tools are not available	4
Change of schedule by owner	5	The conflict between contract documents	5	Workmanship or material not meeting the specifications	5
Change in specifications by owner	6	Ambiguous design details	6		
Replacement of material or procedures	7	Consultant's lack of experience	7		
		Inadequate working drawing details	8		
		Technological change	9		



Comparing Variation Orders with Other Studies

Some causes of variation orders in this study are already in several studies. Some of them are as follows. **Table 6** illustrates these causes.

Change of plans or scope by owner

The change of plans or scope by owner factor is the second-ranked cause of variation order in this study and also pointed out in other earlier studies: **Msallam, et al., (2015)**- Jordan; **Alaryan, et al., (2014)**- Kuwait; **Ndihokubwayo and Haupt (2009)**- South Africa; **Mohammad et al. (2010)**- Malaysia; **Staiti et al. (2016)**- West Bank (Palestine); **Hanif, et al., (2016)**- Pakistan; and **Sherif (2016)**- Egypt also confirmed this result. In a study of **Alaryan (2014)** - Kuwait, this cause of variation order is in the first rank while in this it is at the second rank.

Change in design by consultant

The change in design by the consultant is at the 10th rank of overall causes also referred in the studies of **Msallam et al. (2015)**- Jordan; **Enshassi et al. (2010)**- Gaza Strip- Palestine; **Ndihokubwayo and Haupt (2009)**- South Africa; **Mohammad et al. (2010)**- Malaysia; **Ismail et al. (2012)**- Iran; In the study of **Alaryan (2014)** - Kuwait, this cause factor is at 13th rank.

Errors and omissions in design

Errors and omissions in design cause are at the 7th rank in this study at different ranks of previous studies: **Enshassi et al. (2010)**- Gaza Strip- Palestine; **Ndihokubwayo and Haupt (2009)**- South Africa; **Ismail et al. (2012)**- Iran and **Hanif et al. (2016)**- Pakistan.

5. CONCLUSIONS

The study aimed to identify the causes of variation and their sources. The study concluded the high ranked cause of the overall cause is contractor financial difficulties, lack of skilled labor, differing site conditions, and the owner's financial problems. The main sources are the contractor. Based on the source causes presents the ten top of most causes are related to the Owner and the Contractor which are: "Contractor's financial difficulties", "Change of plans or scope by owner", "The required labor skill are not available", "Differing site conditions", "Owner's financial problems", "Design change originated by owner", "The required equipment and tools are not available".

The major causes of variation related directly to consultant "Errors and omissions in design", "Inadequate working drawing details", "Change in design by the engineer or consultant".

It is worthwhile that the causes "Change of plans or scope by owner", "Change in design by a consultant" and "Errors and omissions in design" in this study confirm their existence in other foreign studies.

Finally, based on review and findings to avoid the variation orders, it is recommended to:

- Select a reputed consultant firm with similar project experience.
- Involve professionals of high experts at the beginning phase to clarify the requirements of the project.



- Involve experts in detailed design and minimize errors and ambiguous design details.
- Select a qualified contractor.
- Increase coordination and collaboration.

6. REFERENCES

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