



CAUSES, EFFECTS AND POSSIBLE SOLUTIONS OF VARIATION ORDER IN
PROJECT PERFORMANCE

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ABSTRACT

This thesis deals with the variation order that occurs in every construction project and how it affects the performance of the projects itself. Variation order is defined as the additions, omissions, alterations and substitution in terms of quality, quantity and schedule of works. Malaysia as a developing country is overgrown with various type of construction project here and there and the occurrence of variation order in each of this project is inevitable. So, the objective of this thesis is to identify the causes of variation order in construction project, to investigate the impact of variation orders and to determine the proactive measure regarding the existence of the variation order. The scope of the study is on any on-going construction projects in Kuantan area to identify the variation order that may occurs in each and every projects. In order to achieved the objective stated, a questionnaire is distributed to three parties involve in the construction area ; the client, consultant and contractor. Questionnaire is given according to how many projects that is still progressing handled by them. The questionnaire consists of demographic, causes of variation order, effects of variation order and the possible solution on how to avoid variation order. After 100 questionnaire is distributed and the result is tabulated, it is known that the main cause of variation order is the change of plan or scope is the main reason why variation order occurs in those construction project. It is known that the main effect of the occurrence of variation order is the increase in the project cost. There will be an overrun in the cost of the project. The best possible solution to avoids variation order is to have a very good and proactive communication between all parties (the clients, contractors and consultants) throughout the construction of the project from start to finish. In a nutshell, it is known that the client, contractor and also the consultant all played a vital and important role in order to have a zero variation order or at least to minimize the variation order itself in each of the projects that are handled by them. Variation order should be taken as a serious matter as it will affects the project performances and also the growth of development in Malaysia in a long term period of time.

ABSTRAK

Tesis ini berkaitan dengan perintah perubahan yang berlaku dalam setiap projek pembinaan dan bagaimana ia memberi kesan kepada prestasi projek-projek itu sendiri. Arahan perubahan didefinisikan sebagai penambahan, pengurangan, perubahan dan penggantian dari segi kualiti, kuantiti dan jadual kerja. Malaysia sebagai sebuah negara yang membangun dengan pelbagai jenis projek pembinaan yang sedang dijalankan dan setiap arahan perubahan dalam setiap projek ini tidak dapat dielakkan. Objektif tesis ini adalah untuk mengenal pasti punca-punca arahan perubahan dalam projek pembinaan, untuk menyiasat kesan arahan perubahan dan untuk menentukan langkah proaktif untuk mengelakkan arahan perubahan daripada berlaku di setiap projek pembinaan. Skop kajian ini difokuskan kepada projek-projek pembinaan yang sedang dijalankan di kawasan Kuantan. Untuk mencapai objektif tersebut, soal selidik telah diedarkan kepada tiga pihak yang terlibat dalam bidang pembinaan; klien, perunding dan kontraktor. Borang soal selidik diberikan mengikut berapa banyak projek-projek yang masih berjalan yang sedang dikendalikan oleh mereka. Borang soalan soal selidik ini terdiri daripada 4 bahagian iaitu demografi, faktor kepada arahan perubahan, kesan kepada arahan perubahan dan langkah-langkah penyelesaian untuk mengelakkan berlakunya arahan perubahan. Setelah 100 borang soalan soal selidik diedarkan, punca utama berlakunya arahan perubahan adalah perubahan pelan atau skop dalam projek pembinaan mereka. Hasil daripada kajian tersebut pula menunjukkan kesan utama sekiranya arahan perubahan berlaku dalam projek pembinaan ialah peningkatan kos projek. Penyelesaian terbaik untuk mengelakkan arahan perubahan daripada berlaku ialah dengan adanya komunikasi dua hala yang baik dan proaktif di antara semua pihak (klien, kontraktor dan perunding) di setiap fasa pembinaan projek iaitu dari awal hingga akhir. Sebagai kesimpulannya klien, kontraktor dan juga perunding perlu memainkan peranan masing masing supaya arahan perubahan dapat dikurangkan dalam setiap projek yang dikendalikan oleh mereka. Arahan perubahan perlu diambil sebagai satu perkara yang serius kerana ia akan memberi kesan kepada prestasi projek dan juga pertumbuhan pembangunan di Malaysia dalam tempoh jangka masa yang panjang.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In a developing country such as Malaysia, there is a lot of development happening everywhere in order to provide the citizens a comfortable life. A lot of construction project, building shoplots, schools, housing area, hotels are just an example of a lot of undergoing construction that is happening out there. This construction involves a lot of people and authorities. The occurrence of variation order in each of this projects is inevitable and it will affects the project performance itself.

1.2 BACKGROUND OF STUDY

Any construction project usually starts with an idea of a client that is then proceeded to the consultant and lastly to the contractor. A contract is usually produced as a result of agreement and discussion between these 3 parties ; the clients, consultant and contractors. Construction contract usually contain the subject matter, terms and conditions and compromised of : (Alaa and Gorold, 1993) [1]

- i. Bid form.
- ii. Agreement form
- iii. General conditions or standard specifications
- iv. Special provisions
- v. Plans
- vi. Addenda

A construction contract is defined as a business agreement that is subjected to variability. Construction clauses related to changes will allow parties to freely initiate variation orders within the scope of the works. This is possible to be done without any alteration of the original contract. Variation orders consists of the additions, omissions, alterations and substitution in terms of quality, quantity and schedule of works. According to Arain & Pheng, 2005b [2], variation order is known as any modification made to the contractual guidance provided to the contractor by the client him/herself or their representatives. Edward (1998) [3] says that variation orders is the formal document that alert some conditions of the contract documents. The word 'formal' is referred to the legal binding and all variations should be in writing forms. Verbal variations should be avoided.

Malaysian construction industry plays a vital and major role in the development of this country. This industry has a lot of connection to other industry such as the manufacturing and electrical industries. Since construction project did not prepare for the related management problem, it is inevitable that one of the major problem facing construction project, the variation order will most likely to happen during the construction phase. It doesnt matter how careful or how well built the contracts are, there will always a variation order to rise during the project.

According to Koskela and Vrijhoel (2000) [4], there are two principles underlying theory of waste reduction. The first one is the variability and the second one is the time compression. Both of this principles will lead to waste reduction. The term variability in construction is referred as variation orders so the more variation orders happens to the project, the greater the cost will be and the project will become more time consuming. So in order to avoid this waste reduction, the variation order will must be handled first. The occurrence of variation order in every project is normal and common but their effect and impact on the project performance is usually overlooked by the clients, contractors and consultant.

Waste reduction is divided into two categories. A value-adding activities and a non value-adding activities. This non value-adding activities usually arise from defects and inspections, non-productive use of resources, injuries or ill-health problems, municipality systems, traditional competitive tendering and cost hidden in taxes

(Saukkoriipi, 2004) [5]. These non value-adding activities is associated with the changes and variation orders that is likely to occur during the construction stage.

So, when a variation order is issued, tonnes of non value-adding activities/cost will happen. Some of them are unplanned site meetings, travelling and communication expenses, idle plant and labour during the waiting time, demolitions, time taken by the engineer or architect to understand the changes in the design and also the cost and time for litigation in case misunderstanding happens between the client and contractor. This will eventually leads to the client paying for all of it.

Most of construction industry nowadays is lacking the knowledge to identify a non value-adding costs which will eventually leads to variation order. This non value-adding costs will affect the client and worst, this cost is underestimated. For example, you can calculate the cost for delayed works but you non value-adding costs from non-productive time, redesign and overheads does not included into the activity and this makes it hard to correctly decide the cost.

In Malaysia, Persatuan Arkitek Malaysia(PAM) is an organization that is introduced to promote and enlarged the knowledge, study and the practice of architecture among themselves. PAM also provides the central organization for architecture and qualification of the profession itself in Malaysia. According to PAM in clause 11, variation order is define as an alteration or modification of the design, quality or quantity of the works as shown in the contract drawing and as described and referred to the contract bills. Rajoo (1998) [6] summarized clauses that is related to variation order, adapted from PAM98 is as followed.

- i. Clause 1.1 : Generally explains on the definition of the term of variation order, instruction regarding the provisional sum, variation of variations, rules of variation and also valuation of variation order claim by the contractor.
- ii. Clause 11.1 (i) – 11.1 (iv) : Explains in details the definition of variations which intend a tangible change in the works and also excludes any default and/or breach of contract by the form contractor being a variation.

- iii. Clause 11.2 : Stated the power of architect to issue instruction in regards with the variation orders. This provision is only applicable as when the employer gives direct instruction to contractor. It's also stated that the instruction must be in written and also signed by the architect.
- iv. Clause 11.3 : This clause required the architect to issue instruction for the expenditure of any prime cost and provisional sum included in the contract bill.
- v. Clause 11.4 : Provides for the measurement and valuation of variations.
- vi. Clause 11.5 : Explain the rules for valuation. It set out several method of valuation based on types of the variation order.
- vii. Clause 11.6 : This clause deals with the issue of direct loss and or expense arising from variations.
- viii. Clause 11.7 : Stated the requirement for the contractor to submit necessary detail for the claim made by the contractor.

Costing a variation order that rise from any construction project can become hard to solve depending on the type of contract during procurement phase. It can be a challenge if the contract is fixed price or lump sump type of contract. The following procedure usually used during this costing.

- i. The price and schedule adjustments are usually negotiated prior to the start of the implementation.
- ii. If price units are part of the contract, they will be used as basis change of work pricing. The unit prices quoted in the contract should not be used to cost the variations without considering the change variation.
- iii. A quantity limit of unit price validity may be used.
- iv. The contractor is directed to proceed after the fact adjustments.

This procedure will help both the client and consultant to reach an agreement regarding the costing variations that happen in their project.

In a developing country like Malaysia, with a lot of building project being built each day and numerous of infrastructure being upgraded or replaced, the occurrence of variation order cannot be avoided. The more variation orders in a construction project, the greater the chances that they will become time and costly consuming (Mohamed,

2001) [7]. The presence of variation order will affect the project performance, the time and cost, the quality, health and safety of the project and also the professional relations between the client, contractor and consultant. This is why a lot of parties involved should have the knowledge and awareness about variation order ; the factors and the impacts of it toward their project.

1.3 PROBLEM STATEMENT

The problem statement for this research is that in every construction project, there is always a variation order that occurs during the progress of the on-going of the project. This will somehow increase the cost of the project and will affect the development of the project. Additional value of the cost is referred as waste and this will cause many problem towards the contractors, consultant and the client himself. By identifying and knowing the causes and factors of why variation order occurs, we can know what is the impact of it and may find ways on how to prevent it.

1.4 RESEARCH OBJECTIVE

- i. To identify the causes of variation order in construction project.
- ii. To investigate the impact of variation orders.
- iii. To determine the proactive measure regarding the existence of the variation order.

1.5 SCOPE OF STUDY

This scope is centered on an on-going construction project in Kuantan. A close study about this project is held to identify the variation order that may occurred in this project. Some parties that involved in this study is the client, the consultant and also the contractors. Any undergoing construction project in Kuantan is then categorized in two types depending on whether the construction is a government based-project or private based-project.

1.6 EXPECTED OUTCOMES

Expected outcome for this study is that the change of scope and plan, unclear or confusing design details and poor or unsatisfactory site condition is the three main

causes of variation order chosen by the client, consultant and contractor respectively. There will be an increase of the project cost as the main effect of the occurrence of the variation order.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The nature of a variation order can be determined by referring to both the reasons for their occurrence and subsequent effects. Arain and Pheng (2005) [8] states that there are two type of variation orders; beneficial and detrimental variation order.

2.2 BENEFICIAL VARIATION ORDER

A a beneficial variation order is the one that is issued to improve the quality, the standard, the cost reduction, the schedule and also degree of difficulty in that project. This type of variation order is initiated for value analysis purposes to realize the balance between the cost, then functionality and also the durability aspects of the project so that the client is satisfied. This variation order also eliminates unnecessary cost from a project so that the client's benefits against the resources input can be optimized. However, eventhough it is a beneficial variation order, the non value-adding cost still applied. For example, a variation order is issued to solve the discrepancies between contract documents will involve the abortion of works that has been completed. The cost for this aborted works should not be included if discrepancies is not found in that contract document.

2.3 DETRIMENTAL VARIATION ORDER

A detrimental variation order is defined as a variation order that has a negative impacts on the client's value and their project performance. Detrimental variation order compromises the client's value system. A client who is experiencing a financial problems may substitute their materials of a quality standard expensive materials to

sub-standard cheap materials. For example, a construction project that is situated in a salty environment, steel oxidation will occur to the steel window frames if it is chosen as the material to build the window frames instead of timber or aluminium frames.

2.4 ORIGIN AND CAUSES OF VARIATION ORDER

A study that is conducted by (Arain & Pheng, 2006) [9], suggest that there are four main origin agents as of why variation order occurs. These includes client, consultant, contractors and others.

2.4.1 CLIENT

The client is the project initiator and plays a major role in their project from the beginning until the project is completed. The clients has the power to decide the needs and the objectives of the project. He or she also establish the scope of works and also the required quality standards. The client should minimize the variations during the detail design and construction. (Cooper and Emory, 1995) [10] states that the most important steps in the development of a variation order are the scope definition. A poorly defined scope will not provide a clear base line which will lead to the variation order that will be evaluated within or outside the scope. Furthermore there are two types of client exists : the client who have the knowledge and experience in the construction industry and those without or very little knowledge and experience about this industry. The client that has no knowledge or experience tend to follow the guidance of the designer without any clear idea of what it is. Uyun (2007) [11] states that it is very difficult to determine the exact requirements of the client. The client that has no knowledge and experience usually leads to some major variation order as they will change their mind of what they want throughout the construction project. The changes will result in the quality standard degradation and high maintenance cost.

2.4.2 CONSULTANT

The consultant team usually consist of an architect, designers, specialist engineers, project managers, and cost consultants. Acharya et al. (2006) [12] suggested that consultants should aim at getting an understanding of the overall scope and goals of the project. However, the feeling of superiority of the consultant over the contractor may prevent the consultant from giving attention to the requests made by the contractor. So, if the consultant failed to interpret the requirements and needs of their client, it will results in the different in design from the perceived one and this will eventually leads to variation orders; issued to ensure compliance with the client's requirements. Zimmerman and Hart (1982) [13], states that it is impossible to have the knowledge of all new materials and products that is entering the construction market. This shows that the consultant maybe unaware of the affordable alternatives and when the full information about the materials is available, a variation order will be issued so as to change and give the project a better construction method. A change in technology may influence the consultant to initiate a variation order.

2.4.3 CONTRACTOR

In every construction project, it is the contractor's responsibility to advise consultant to issue a variation order when a technical problem is discovered. All parties involved in the contract should be aware that the information given by the consultant is not always correct. A contractor may propose alternative construction methods where his knowledge in the field will work better and fit the desired fitness and fuction of the design than the method proposed by the client or consultant. Contractors may discovers discrepancy, omission, errors and conflict in the documents and may request consultant opinion regarding the problem arise. Variation order will then be issued with additional cost to solve the problem.

Table 2.1 Origins and Causes of Variation Order (Adapted from Arain and Pheng 2006)

[9]

No	Causes of Variation	Client	Consultant	Contractor	Other
1	Change of plans or scope	<input type="radio"/>			
2	Change of schedule	<input type="radio"/>			
3	Client's financial problems	<input type="radio"/>		<input type="radio"/>	
4	Inadequate project objectives	<input type="radio"/>			
5	Replacement of materials or procedures	<input type="radio"/>			
6	Impediment in prompt decision making process	<input type="radio"/>			
7	Obstinate nature of the client	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
8	Change in specifications	<input type="radio"/>	<input type="radio"/>		
9	Change in design by the consultant		<input type="radio"/>		
10	Errors and omissions in design		<input type="radio"/>		
11	Conflicts between contract documents		<input type="radio"/>		
12	Inadequate scope of work for contractor		<input type="radio"/>		
13	Technology change		<input type="radio"/>		
14	Value engineering		<input type="radio"/>		
15	Lack of coordination		<input type="radio"/>		
16	Design complexity		<input type="radio"/>	<input type="radio"/>	
17	Inadequate working drawing details		<input type="radio"/>		
18	Inadequate shop drawing details		<input type="radio"/>		
19	Consultant's lack of judgement and experience		<input type="radio"/>	<input type="radio"/>	
20	Lack of consultant's knowledge of available materials and equipments		<input type="radio"/>		

21	Honest wrong beliefs of consultant		<input type="radio"/>		
22	Consultant's lack of required data		<input type="radio"/>		
23	Ambiguous design details		<input type="radio"/>		
24	Design discrepancies		<input type="radio"/>		
25	Non-compliant design with government regulations		<input type="radio"/>		
26	Non-compliant design with owner's requirement		<input type="radio"/>		
27	Lack of contractor's involvement in design			<input type="radio"/>	
28	Unavailability of equipment			<input type="radio"/>	
29	Unavailability of skills			<input type="radio"/>	
30	Contractor's desired profitability			<input type="radio"/>	
31	Differing site conditions			<input type="radio"/>	
32	Defective workmanship			<input type="radio"/>	
33	Unfamiliarity with local conditions			<input type="radio"/>	
34	Lack of a specialised construction manager			<input type="radio"/>	
35	Fast track construction			<input type="radio"/>	
36	Poor procurement process			<input type="radio"/>	
37	Lack of communication			<input type="radio"/>	
38	Long lead procurement			<input type="radio"/>	
39	Honest wrong beliefs of contractor			<input type="radio"/>	
40	Lack of strategic planning			<input type="radio"/>	
41	Contractor's lack of required data			<input type="radio"/>	
42	Weather conditions				<input type="radio"/>
43	Health and safety considerations				<input type="radio"/>

44	Change in government regulations				<input type="radio"/>
45	Change in economic conditions				<input type="radio"/>
46	Socio-cultural factors				<input type="radio"/>
47	Unforeseen problems				<input type="radio"/>

2.5 IMPACT OF VARIATION ORDER

Al-Hakim, (2005b) [14], says that it is rare for project to performs precisely in line with their original schedule due to reasons such as business condition changes, delivery slips and correction to design. Ibbs (1997) [15], concludes that variation order affect the project performance as they will affect the productivity and the project costs. It is known that variation order will impact the project performance in terms of costs overruns, time overruns, quality degradation, health and safety issues and professional relations.

2.5.1 COST OVERRUNS

Clients desire to know the in advance the total cost of their finished construction project. However, most construction project will incur cost overruns as a result of variation order. Variation orders have both direct and indirect effect on cost. Bower (2000) [16] identified the following direct cost associated with variation orders.

- i. Time and material charges related to immediately affected tasks.
- ii. Recalculation of network, increased time-related charges and overheads.
- iii. Reworks and standing time.
- iv. Timing effects for example winter time.
- v. Inflation change to cash flow and loss of earnings.
- vi. Management time, head office and site charges.

This direct cost is easier to calculate compared to indirect cost. Again, according to Bower (2000) [16], some of the indirect cost are as follows.

- i. Rework and making good on affected trades other than the actual variation order.
- ii. Change in cash flow due to effect on inflation and financial charges.
- iii. Loss of productivity due to interruption where the parties has to familiarise with new working condition, tools and materials.
- iv. Cost for redesign and administration of the variation order
- v. Litigation-related costs in case of disputes arises from the variation order.

2.5.2 TIME OVERRUNS

Koushki (2005) [17], states that variation order that rises during various phases in the construction project will negatively affect both the completion time and costs of the project. Clients want their projects to be completed within the time constrained. Contractors will be penalised if they exceed the original project delivery date and this penalty imposed is usually used to cover the damages suffered by the client regarding the prolonged delivery report. Hanna et al. (2002) [18] states that the more variation orders occur, the more significant the productivity losses become. Productivity is defined as the amount of output over a unit time so loss in productivity implies loss of time and subsequent delays.

2.5.3 QUALITY DEGRADATION

Patrick and Toler (n.d.) [19], wrote that contract with a significant degree of risk for unknown variables such as lump sum, the contractor may cut corners on quality and quantity to maximise their profits. Quality may be compromised as contractors try to compensate for losses they are not optimistic about covering.

2.5.4 HEALTH AND SAFETY

The Occupational and Safety (2003), Clause 5.3 (e) stipulates that where the changes are brought about, sufficient health and safety information and appropriate resources are to be made available to the contractor to execute the work safely. Arain and Pheng (2005) states that the change in construction methods, materials and equipment may require additional health and safety measures. This shows that variation orders can lead to the revision of health and safety considerations.

2.5.5 PROFESSIONAL RELATIONS

Dispute may arise due to variation orders. Misunderstanding will surface when contractors are not satisfied with the determination of the variation orders by the client's consultant. Bower (2000) states that tension between parties as the contractor continually pushes the client to settle claims for additional costs while invariably feeling that the reimbursement has been insufficient. This can be very damaging to the relationship among the parties. The excessive occurrence of variation order due to design