

# Necessity for minimize variations construction essay



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ABSTRACT This research presents results of a study on " Necessity for minimize variations to avoid project delay in construction industry". In a Construction industry, Construction project is a temporary endeavour to create a unique product or service. Every project have a clear, definitive objective and activity tasks, generally the construction project manager is a responsible person to the overall project. Client is the project owner or investor of the investment, design team, Consultants or management teams engage with project as per the requirement of client. Finally selected contractor legally bind with the Contract to build and successfully complete the project within schedule, cost and Quality. In a Construction project, Variations are much common in most Contracts due to incomplete Drawings, Specifications, Bill of Quantities and other Contract Documents. And also due to lack of information from the Client to the Consultant with regards to the Project, lead to Variations. This situation inevitably generates unnecessary project delays and disputes. Therefore it is an essential requirement to find ways to minimize the possible occurrences of Variations in a Contract. The research methodology employs to achieve the research objects through the complete literature Survey to explore type of variations and identify the causes for occurrence of variations & mitigation actions (using Books, Web Articles, Magazines and specific researches & findings done by different professionals) and Collect and Study data of Dubai based project that involved in variations work to identify causes to Project delays due to variations. Also carry out discussions, interviews and Questioner Surveyor, etc; with various professionals working under contractors and clients in construction projects, to analyze and identify the necessity of minimize variations to avoid project delay incurred due to Variations and necessary

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mitigation actions. In this research of 'Necessity for Minimize Variations to avoid project delays' is conducted as a part of Author's fulfilment for BSc degree programme in Quantity surveying and Construction management, at Sheffield Hallam University, UK. The reason why the Author selected this research is to understand the various causes for the construction delays and to share the research work with construction community. The author believes that, it would be an assistance to mitigate unnecessary expenses due to construction delays in the industry. Keywords: Standard form of building contract, Owner, PAM 1998, Variation Orders. GLOSSARY OF TERMSMM7 - Standard Method of Measurement 7CESMM3 - Civil Engineering Standard Method of MeasurementFIDIC - Federation Internationale Des Ingenieurs-ConseilsJCT - Joint contract TribunalICTAD- Institute of Corporation Training and DevelopmentPMBok- Project Management guide bookAED / Dh- Arab Emirates Dirham

## **CHAPTER 01 - INTRODUCTION**

### **BACKGROUND**

The Construction industry is expanding regularly everyday due to various reasons such as developments, increase of populations etc. However there are limited resources available in the world to use for constructions (Faisal and Low). The complexity of the construction industry due to different stakeholders' participation makes it change from other industry. This complication gives rise mostly to unwanted condition like variations with their attached effects, and the more variations on a project, the greater the possibility that they become time consuming and costly in construction projects as stated Mohamed in his 2001 report (Ayodeji 2010). The most

fundamental objective of a client in a project is to achieve a successful project, a project that has been correctly planned, designed and constructed in accordance with plans and specifications, and completed within time and cost originally anticipated (Stanslaus 2011). The Chamer in his 1990 report described as " Time is an extremely important issue in construction, together with cost and quality, it is a primary objective of project management, and a major criterion by which the success of a project is judged (cited in John and Will 1998). The construction projects are typically unique in terms of the final products and the parties who are involved in the project. Typically over 1000 activities are involved in a medium size construction project, which can increase the unpredictability of project schedule and planning. Uncertainty circulates in a project as each activity is influenced by other upstream and downstream activities (Kiavash, Hazhir , Ali Haghan 2010). The projectIn a Construction Industry, Project is a temporary endeavour to create a unique product or service. Every project have a clear, definitive objective and activity tasks, also the construction projects are complex in terms of the number of the activities and parties that are involved in the project and their relations (PMBok 4). Generally the construction project manager is a responsible person to the overall project. The Client is the project owner in the Construction project, and Design team, Consultants or Management teams engage with project to implement project objectives in accordance with the contractually bind. As well as selected contractor legally bind with the Contract in accordance with requirement of contract agreement to build and complete the project successfully within the schedule, cost and quality. As examples for Construction Projects; such as Infrastructure works,

Industrial Buildings, Railways and highways, Dams, Residential Complex, Bridges, etc;

## **The Contract**

A Contract is an agreement formed between two or more parties that is intended to be legally enforceable, should have following essential elements. Such as, Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance. (FIDIC 1987). Under the general law of contract, when a party makes an offer to provide goods and/or services for some certain consideration and the party to whom the offer is made accepts it, then, provided it does not involve any illegal act, a contract which is enforceable at law exists"(Jack Ramus, Simon Birchall and Phil Griffiths 2006).

## **Influence of Contract Documents for the Contract**

There are specific Contract Documents that have been used in Construction industry some are vitally important to form a contract and maintain a contract avoiding cost and time overruns due to variations and Extension of Time until the end of contract period. The Contract documentation is the means by which a designer's intent to convey to the client, the legislative authorities, the quantity surveyor, the contractor and the sub-contractors (John Murdoch and Will Hughes 2000) . The contract documents includes, practically all the standard-form contracts make out the articles of agreement, conditions of contract, appendix, drawings and bills as key contract documents. However, there are differences between forms when it comes to such items as programmes, specifications, etc. (John Murdoch and <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>

Will Hughes 2000) . Furthermore study about the Contract document according to the " Contract Practice for Surveyor" (Jack Ramus, Simon Birchal and Phil Griffiths 2006) they noted in it as follows. Form of ContractIn older days used JCT form of Contract (Joint Contract Tribunal) as principal document, and in these days principally use FIDIC form of Contract or as other form of contract such as NEC form, ICTAD form of contract in Sri Lanka.

**Conditions of the Contract**The condition of contract document set out the duties and rights of the parties, and the detailed conditions as per the standards condition of contract Such as the JCT Form, FIDIC Condition of Contract and ICTAD Condition of Contract (51. 1, 51. 2, 52. 1, 52. 2, and 40. 1 of FIDIC Red Book). Bills of QuantitiesA Bill of Quantities facilitates to price a contract especially for contractor since all the materials and works to be carried out are listed. Basically variations are occurred due to inadequately prepared BOQ. The standard methods of measurements; such as, POMI, SMM7, CESMM3. etc; are used as benchmarks for taking-off measurements.

**Project Specifications**Generally project specifications consist with technical and workmanship requirement which have to be fulfilled in construction project. This requires planning to make sure a construction project is successfully completed (Manda Gilbert 2013). Hence some changes of the specifications; it will effect to create variations to the project as well.

**Project Drawings**Basically Project Drawings are provided with detailed for site location, position of the building, access to site, floor plans and elevations. Therefore some changes of details which mentioned in drawings, it will be a reason for variation arises to the project.

**Schedule of Rates**Where Bills of Quantities are not provided, a Schedule of Rates is usually used as a basis for pricing the work, As well as for pricing of variations especially in Lump

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Sum Contracts. Schedule of works Particularly as an alternative to a specification in the case of 'without quantities' contracts tenderers may be supplied with a Schedule of Works. This lists the work comprised in the contract under appropriate headings. The tenderers may be required to price the schedule. The Contract Documents are highly important part of the Contract; however, if there are ambiguities, discrepancies or contradictions in contract documents, hence improper contract documents directly create variations to the project during the construction period, it may lead to delays of the project.

### **The contract sum**

The price stated in the owner-contractor agreement, which is the total amount payable by the owner to the contractor for the performance of the work, The main reasons for alterations of the contract sum for which the Conditions create provision are: the adjustment of provisional sums; variations to the design; additions or reductions to the scope of the work, loss or expense incurred by the contractor for specified reasons and increases or decreases in the costs of labour and materials or in taxes, levies or contributions imposed by Government. (Jack Ramus, Simon Birchall and Phil Griffiths 2006)

### **Method of Contracts**

There are different types of Method of Contracts are used by different clients and consultants in construction industry such as, Traditional method, Re-measure contracts, Lump sum contracts, Cost reimbursement contracts, Cost plus percentage, Cost plus fix fee, Cost plus variable fee, Design and build contract, Management path, etc. The Clients and consultants use to <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>

select a suitable type of contract for a project according to the project complexity, value of the project, construction duration, client's requirement etc (Jack Ramus, Simon Birchall & Phil Griffiths 2006).

## **Importance of Study**

The Contract variations are much common in most Contracts due to incomplete Drawings, Specifications, Bill of Quantities and other Contract Documents. And also due to lack of information from the Client to the Consultant with regards to the Project, lead to Variations. This situation inevitably generates unnecessary project delays. Therefore it is an essential requirement to find ways to minimize the possible occurrences of Variations in a Contract.

## **Scope of Research**

This study critically analysis the type of variations in constructions projects, Identify key elements that cause to occurrences of project delays that incurred due to variations and investigate how to mitigate/ avoid the variations in construction projects. The research methodology utilizes to achieve the research objectives through the complete literature Survey towards identifying of what are the variations in Constructions Projects. As well as find-out methods that are being used to mitigate the variations in construction projects using different sources (case study), carry out discussions, interviews, etc; with various professionals working under contractors and clients in construction projects.



## **Aim & objectives**

Aim of this research is to identify " Necessity for minimize variations to avoid Project delays incurred due to Variations in a Construction Project". The main objectives of this study included the following: Explore the type of variations in constructions projects. Identify key elements that cause to occurrences of project delays that incurred due to variations in the construction Projects. Investigate how to mitigate/ avoid the variations in construction projects.

## **Methodology**

To suit the hypothesis and achieve the objectives of this research a two stage approach was taken as stated below; Secondary dataExplore type of variations and identify the causes for occurrence of variations & mitigation actions through the complete literature Survey (using Books, Web Articles, Magazines and specific researches & findings done by different professionals). Primary dataCollect and Study data of Dubai based project that involved in variations work to identify causes to Project delays due to variations. Carry out discussions, interviews and Questioner Surveyor, etc; with various professionals working under contractors and clients in construction projects, to analyze and identify the necessity of minimizing of variations to avoid project delay incurred due to Variations and necessary mitigation actions. In addition this research methodology, it could be described by below given Diagram as well.

## **LITERATURE REVIEW**

Investigate type of variations, Causes & mitigation actions by using of Books, Web Articles, Magazines and other Resources.

## **DATA COLLECTION**

Project data, Discussions, Interviews and Questioner Surveyor, etc

## **CONCLUSION AND RECOMMENDATIONS**

Literature review. Discussions, Interviews and Questioner Surveyor, etcThe research methodology used to achieve the above aim, objectives is explained in next chapters.

## **CHAPTER 02 - LITERATURE REVIEW**

### **Introduction**

This chapter identifies previous literature on the subject of variations and provides a brief discussion of past findings to achieve the objectives of this research. Such as try to explore type of variations and identify effect causes to occurrences & mitigation actions within particular sources of data obtained reading material such as specific books, magazines, Articles, journals, web sites and specific researches & findings done by different professionals relevant to the topic of variation.

### **Explore the type of variations and Identify key elements that cause to occurrence of variations.**

#### **Explore what is the Variation?**

General DefinitionsAccording to the Oxford English Dictionary defined, " A variation is something which deviates from a former or normal state, standard or type" (Oxford, 2001). Variations in construction contracts can mean changes to the terms of the contract or it can mean changes to the scope or character of the works (Lim Chuen Ren 2013). However variations to the scope of construction works are necessary, because no project is

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perfect and changes are required to meet unforeseen circumstances or changed requirements. Thus, Variations can be in the form of additions, omissions or substitutions (Lim Chuen Ren 2013). According to the definition of FIDIC 1987, " The Engineer shall make any variation or the form, quality or quantity or the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate he shall have the authority to instruct the Contract to do and the Contractor shall do any of the following" (FIDIC 1987). As define in JCT 98, Variation order involved additions, omissions, alterations and substitution in term of quality, quantity and schedule of work (cited in John and Will 2000). The ICE definition of a variation appears in clause 51. It includes additions, omissions, substitutions, alterations, changes in quality, form, character, kind, position, dimension, level or line, and changes in any specified sequence, method or timing of construction. (cited in John and Will 2000). When discover through the definitions that mentioned above, there is no single definition of what constitutes a variation. Generally, Variations are common in all types of contraction projects. After a contract has been signed it cannot be changed or varied by the parties. However, given the nature of the construction process, with all of its inherent risk and uncertainty, most standard forms of construction contract include the provision for variations or alterations to the works (Cartlidge 2009). A variation instruction will frequently direct to claims from the Contractor for additional payment and for an extension to the period for completion. The additional payment may consist of additional costs for delay, acceleration and/or disruption associated with the variation. Variations are one of the main reasons for cost and time overruns in construction contracts (© NSW 2008). In a Construction <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>

project, Variations are much common in most Contracts due to incomplete Drawings, Specifications, Bill of Quantities and other Contract documents. And also due to lack of information from the Client to the Consultant with regards to the Project, lead to Variations. This situation inevitably generates project delays and disputes. Furthermore, about variations will be discussed onward within related standards clauses. Initiation of variation Generally variation can issue at any time, using a standard document. It is common, though, for variations to be made by issuing amended drawings, in a letter, or even by verbal site instructions, and so most types of contract also allow the contractor to initiate a variation request (Estate 2006) The most contracts exercise very common standards documents for issuing the variations, except specific government institutes, they employ own particular procedures and standards documents. In addition, the contractor have to keep a careful check on all drawings, information and details received and note any change from the contract drawings. It is on these that the price is based and settlement of any additional costs will be required. The contractor must request a variation for changes as soon as he is or could reasonably be aware of the change, as any delay in submission could affect his right to payment. (Estate 2006). However, the engineer issue instructions from time to time involving variations which the contractor is required under the terms of the contract to fulfil with. Any modification to the works must be the subject of variation orders which constitute an instruction from the engineer to the contractor.

## **Identify type of variations in Contract**

### **Introduction**

A Variation may arise in construction in various ways. It arises more often during the progress of work and rarely before the commencement of the work. Variation in construction industry will lead the impact to all parties involved in this sector. The main implication of variation is in term of time overrun and cost. Most of the variation occurs when major changes in the contract during construction works. Although Variation can identify in many different types depending on the basis and the purpose of categorization. In this review, the most common types are presented. Changes in a construction project can be classified based on the cause that forced them.

### **Useful variations**

Useful variations are necessary in order to minimize adverse effects due to unexpected events or circumstances. They may be required to avoid health, safety or security problems. They do not result in a change to the scope of the work (NSW 2008). Examples of unavoidable variations are: To minimise the increase in cost or other adverse impact of a hidden condition (for example unanticipated ground conditions, hazardous materials or existing services). To overcome a fault (for example an error, ambiguity or inconsistency other than an omission or lack of completeness which may be the responsibility of the Contractor) in the Principal's design or documentation which, unless it is remedied, could result in health, safety or security problems or prevent work from continuing. To overcome a change in statutory requirements that has occurred since tenders closed. A useful variation order is one issued to improve the quality standard, reduce cost,

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schedule, or degree of difficulty in a project as noted by Arain & Pheng, 2005, cited in (NSW 2008). Therefore, a variation is beneficial if it is initiated to enhance the client's value. Among others, the client's value system elements include time, capital cost, operating cost, environment, exchange or resale, aesthetic/esteem and fitness for the purpose as noted Kelly & Duerk, 2002, cited in (NSW 2008). A beneficial variation eliminates unnecessary costs from a project, therefore, seeks to optimise the client's benefits against the resource input by eliminating unnecessary costs. These benefits are understood to be the satisfaction of perceived needs for the development project that include social, economic and commercial aspects. Impliedly, a beneficial variation is initiated in the spirit of adding value to the project.

## **Harmful variations**

As discovered by Arain & Pheng, a harmful variation order is one that negatively impacts the client's value or project performance. Certainly, a harmful variation order compromises the client's value system. A client who is experiencing financial problems may require the substitution of quality standard expensive materials to substandard cheap materials. For example, on a construction project situated in a salty environment, steel window frames result in steel oxidation if selected in lieu of timber or aluminium frames (cited in Ruben 2008). According to the "Construction project Administration of Mississippi" harmful variations get worse the project outcomes, as frequent Harmful variations can be describe as follows; Change in Scope - Client or Designers request a design changes, Unforeseen Conditions - Site Condition differ from the expected, request by contractor or

professionals, Professional errors and omissions - requested contractor or professionals, Errors -Professional has incorrectly drawn the design plans and specifications, Omissions - Professionals has inadvertently omitted and item or element from the plan. A failure to provide an instruction in the above conditions may prevent the Contract from being completed and may therefore be a breach of contract by the Principal. The client has to be made aware of the effect of failing to respond on time to situations generating unavoidable variations. If an instruction is not given on time in response to the situation giving rise to the necessity for the variation additional extra costs will often be incurred, such as delays or rework (NSW 2008).

## **Identify possible Causes of occurrence of Variations in Contract**

Variations occur for a variety of reasons. Some are foreseeable, others are not. Some result from a genuine change of circumstances and others from the design team's own inadequacies. There are many reasons why variations occur, several studies deal with variations and how variations effect with occurrences of Project delays and disputes on the project. According to the research of the " Effective Management of Contract Variations using a Knowledge Based Decision Support System" (Faisal, Low ) they have identified comprehensive possible causes of variations and effect of them. Those can be described by below given table; Owner Related VariationsAs per the research of " Dr Faisal" noted, the Owner who create variations as per his requirements of changes of project objectives. As examples; Changes of plans or scopeChanges of schedule, Owner's financial problems, Inadequate project objectives, Replacement of materials or procedures,

Impediment in prompt decision making process, Obstinate nature of owner, Change in specifications by owner. Consultant Related VariationsThe Consultant who initiates the variations with subject to the necessary changes due on activities, in some cases, the consultant directly initiates variations or the variations are required because the consultant fails to fulfill certain requirements for carrying out the project. Change in design by consultant, Contractor Related VariationsThe Contractor who crates the variations in accordant to the practical reasons, the contractor may propose variations to the project, or the variations may essential because the contractor fails to fulfill certain requirements for delivery the project. Lack of contractor's involvement in design, Other VariationsAs per the research of " Dr Faisal" that identified as other variations, the effects of variations are not directly related to the participants. Weather conditions, Safety considerations, Change in government regulations, Change in economic conditions, Socio-cultural factors, unforeseen problems, etc; In contract document provide reliable guidance and clear definition of responsibilities for employees, material requirement, details of work, procedure and for coordinating all sections of the work under the contract document. Errors are mistakes made in the design Problems in bad design of the project always occur especially when there is poor communication between client and consultant. The client dissatisfied with the design made by the designer. In additions, the discrepancies between the works and statutory requirement are one of the factors of influenced of instruction of variations. There is a provision in the contract that allows the contractor to make variation to comply with the requirement of the law and local authorities. Extra works are necessary when the contract is lacking a contract item to complete an item of work as <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>



specified in the contract. For example, when there is not enough suitable on-site material to build an embankment, a new contract item for the required borrow would be added by variation to complete the work.

## **Identify the effects of Variations in Contract**

Variations during the project may affect the project progress and quality. Time has and the same monetary value even if the professional team tries its best to keep the project completion schedule intact. However, only major variations during the project may affect the project completion time. The contractor would usually try to accommodate the variations by utilizing (Faisal, Low ). The effects of variation on construction projects were observed by many researchers and quoted by Faisal and Low in their study according to the research of the " Effective Management of Contract Variations using a Knowledge Based Decision Support System" (Faisal, Low ), they have identified comprehensive possible causes of variations and effect of them. Hence, they have identified major reasons are as follows; Potential effects of variation orders. There are significant effects of variations they have identified by their researches, such as, These mentioned effects would be significantly varied by each project scope due to each project has different type of objectives. However, finally those effects will arise to any result to the project Time, Cost, Quality and Health and Safety circumstances. Cost overruns. Arain & pheng 2005 defined, various studies have revealed that variations contribute to construction cost overruns, the more the variation orders, the more they affect the overall construction delivery cost according to his study, cited in (Ndiokubwayo 2000). The occurrence of variation orders has direct and indirect cost implications; direct costs constitute the

additional costs incurred to perform the activities of the current variation.

Figure 5. 2 Project S-curve  
In addition when study the cost of variations; require study through S-curve factor, In Figure 5. 2, the cumulative budget projections have been plotted against the project's time duration (used ongoing project data). The S-curve figure represents the project budget baseline against which actual budget expenditures will be evaluated. To observe the status of a project using an S-curve, the cumulative project budget expenditures to date are compared with the actual spending outline at the end of each time period of interest. Any significant deviations between actual and planned budget expenditures constitute a potential problem area that must be investigated (Venkataraman and Pinto 2008). Time overruns  
Chan & Yeong 1995, Mohamed 2001 defined, various authors agree that variation orders could be one of the reasons behind project time overruns, It is expected that a project finished within the shortest time achieves some monetary savings. Unfortunately, each additional day on a project implies additional money. It was revealed that the variation orders issued during various phases of construction projects negatively affected both project's completion time and cost increase, cited in (Ndiokubwayo 2000). Hanna (2002) revealed that the more the variation order occurrence the more significant productivity losses, the productivity is the amount of output over a unit of time, therefore, the loss productivity implies loss of time and subsequent delays, cited in (Ndiokubwayo 2000). Quality degradation  
If variation orders are frequent, they may affect the quality of works. Quality may be compromised because contractors tend to compensate for the losses incurred to variation orders, cited in

(Ndiokubwayo 2000). Health and Safety  
The occurrence of variation orders  
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can affect health and safety condition. This is because change in construction methods, materials and equipment may require additional health and safety measures as per Arain & Pheng 2005, cited in (Ndiokubwayo 2000).

## **Standards Clauses related to Variations**

In construction industry, use of standards Conditions of Contract clauses are vital requirement for the projects successes due to its provide well-built contractual relationship with many benefits to contract, and protect inherent potential contract disputes and leads variations. In order to change the specification of the work, a contract would, in principle, have to be renegotiated. To avoid this, most contracts include clauses facilitating the employer's design team to differ the specification. Such provisions are usually called variations clauses (John and Will 2000). A variation becomes part of the contract and all the contract condition apply to the changed works, including provisions for extensions of time and site condition. Without contractual clauses, the building contractor would have to agree the erect without any change the building shown on the drawings and represented in the bills for a contract sum. There are comprehensive standards condition of contract document issued by reputed institute, such as FIDC, ICTAD, JCT and private companies own conditions. FIDIC 1987 Red Book FIDIC is an international agency that formulates conditions of contract recommended for construction works where tenders are invited on an international basis. FIDIC conditions of contract are also widely used in domestic projects with minor modifications." Variation" means any change to the Works, which is instructed or approved as a variation, refer to " Clause Variations and

Adjustments" (FIDIC 1987). The study of clauses of FIDIC Red book, 1987 4th edition referred to the variations for further identifying the necessity to minimize variations and to avoid project delays; it shows under the Variation clause as follows; Clause 51. 1 Alterations, Additions and Omissions (FIDIC 1987), Clause 51. 2 Instruction for Variations (FIDIC 1987), Clause 52. 1 Valuation of Variations (FIDIC 1987), Clause 52. 2 Power of Engineer to Fix the Rates (FIDIC 1987), Clause 52. 4 Day works (FIDIC 1987), Clause 53. 1 Notice of Claims (FIDIC 1987), Clause 53. 2 Contemporary Records (FIDIC 1987). Furthermore explaining within FIDIC Red book (1987), it says under the Variation clause 51. 1 as follows; FIDIC 1999 Silver Book A Variation is defined in the FIDIC 1999 Silver Book as any change to the Employer's Requirements or the works which is instructed or approved as a variation under Clause 13. 1 Right to Vary". " Variations may be initiated by Engineer at any time prior to issuing the taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal". (FIDIC, 1999)The Contractor is often put in a difficult position because he must execute each variation unless he promptly gives notice that he cannot implement it because of lack of goods, increased risk to safety or suitability of the time duration or to his ability to meet Performance Guarantees. Obviously the more sketchy the Employer's Requirements and the Works are described in the contract; the less likely it is that the Employers Comment will be seen as a change to the Employer's Requirements or to the Works. However, if the Employers Comment does require a distinct change, the Contractor should write to the Employer asking him to confirm whether the comment amounts to an instruction to change the Works under Sub-Clause 13. 1. When Employers Comments are deemed not to amount to a change or <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>

variation then this is a more problematic area. The Contractor may choose to argue that the provision under the Conditions of Contract which allow the Employer to comment do not provide that the Employer can comment when the Contractors Documents conform with the Contract or the Employers Comments. Sub-Clause 5. 2 only allows the Employer to give notice to the Contractor if a Contractor's Document fails to comply with the Contract. JCT 05The JCT 05 Standard Building Contract (clause 5. 1) defines the term 'variation' as: Variations may arise in any of the following situations (Ramus, Birchall and Griffiths 2006). the contract bills does not provide the information required byThe JCT contracts allow for extension and adjustment of the completion date by the contract administrator under certain circumstances. These circumstances or events include where the extra works have been ordered. The JCT standard Contract 05 allows for extension of time where the contract administrator gives instructions relating to provisional sums, action regarding fossils, antiquities and testing the work. Where there are approximate quantities only, specified further time may be allowed if the approximation is not a reasonable forecast of the works required (Coleman 2009). Most contracts also state that all such instructions shall be in writing. Clearly a variation can change not only the work itself but also many of the contractor's obligations under the contract. Note, however, that it is the contractor's obligations that can be varied, not his rights, and the ability to make changes does not apply to the terms of contract - these can only be varied by agreement between the parties. The variations clauses which come out in most standard forms of contract is very important from the employer's point of view where the contract gives for the contractor to construct the works described in the contract for a lump sum. In the absence

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of a variations clause the contractor's obligation will be limited to completing the work described in the contract and there will be no obligation to undertake any variations or additional work. It has been argued that if the work is necessary to complete what is described in the contract then the contractor in relation to a lump sum contract will be obliged to undertake the work even though it may not have been referred to in the specifications or shown on the drawings. Thus, without a variation clause, the contractor would be entitled to refuse to make any alteration in the work, and the employer would effectively be in breach of contract and liable to pay damages if he varies the work. The courts do not imply a variation clause to be necessary in order for the project to be completed. A comprehensive clause is therefore usually essential, covering all the likely situations where variations will be permitted in the contract (Estate 2006) .

## **Value of Variations**

The issue of variation orders ensures that as Quantity Surveyors are kept informed of any changes to the contract works and have the opportunity to value the required variations in to determine their monetary effect. When requested by the architect, Quantity Surveyors would generally ascertain and advise of the likely cost effect of any proposed variation before he issues the variation order. This provides the architect and client with the opportunity to make an informed decision to proceed or to make an alternative proposal. Generally, Quantity Surveyors are involved in dealing with variations that may arise within contracts with regards to, (Jack Ramus, Simon Birchall, Phil Griffiths 2006). Identification of required variations, Immediate measurement and valuation of any variations / additional works,

Advising on the cost implications of variations, Agreeing contract variation. The measured quantities of the variation may be valued in accordance with any of the following methods as mentioned in " Contract Practice for Surveyor" (Jack Ramus, Simon Birchall, Phil Griffiths 2006). They are: by the inclusion in the variation accounts of a lump sum in accordance with a quotation submitted by the contractor and accepted by the architect, by pricing measured items in the variation accounts, by ascertaining the total prime cost of additional work and applying appropriate percentage additions. Under most standard forms of contract in the construction industry where Bills of Quantities are adopted the valuation of variations are generally made by Quantity Surveyors in accordance with four main valuation rules. The measured quantities of the variation may be valued in accordance with any of the following methods; Rates contained in the Bills of Quantities or Schedule of Rates, whichever is applicable On the basis of rates analogous to those above On the basis of a fair valuation, at fair rates or prices At Day work rates at the prices ruling at the date the work is actually carried out The Engineer issued variation orders, then Contractors' Quantity Surveyor takes off variation order quantities and calculates the affected variation amount of the contract sum; and Consultant Quantity Surveyor and the Client's Quantity Surveyor will finalise the Contractors' Cost Submissions in accordance with the Clause: for Variations in Contract Agreement. An Employer on the other hand argue that the purpose of clause 52. 3 (Variations exceeding 15%) is to compensate the Contractor, if appropriate, provided there are serious difference between the estimated and actual quantities (FIDIC 1987).

## **Identify of Delays and claims due to Variations**

Construction delays define in various ways. relates construction delay to progress compared to baseline construction schedule while and summarized that a delay is when there is time overrun or extension of time to complete the project. Generally a delay is a situation when the actual progress of a construction project is slower than the planned schedule (Abdullah, Azis and Rahman 2000). Bramble B. B., and Callahan M. T (2000) defined, the delay can be grouped into three types as follows, cited in (Abdullah, Azis and Rahman 2000). Ogunlana S. O , Promkuntong K, Jearkjirm, V(1996) and Chan D. W. M. and Kumaraswamy M. M (1997) stated, for the past 15 years, extensive research works on construction delay had been carried-out throughout the world. The main cause of construction delay in high-rise building construction projects in Bangkok, Thailand are; frequent changes by owners. While a comparative study of causes of time overruns in Hong Kong construction projects revealed that common causes of delays were: unforeseen ground condition; low speed of decision making involving all project teams; client-initiated variation and necessary variation of works (Abdullah, Azis and Rahman 2000). Claims for extensions of time (Due to Variations)Extension of time (EOT) claims An EOT claim is one in which the contractor claims for an extension of time to his contract duration, and/or additional costs associated with the extension, because of critical delays to the programme which were not his responsibility. An EOT claim arises from critical delays only; non-critical delays do not give rise to EOT claims. However, there could be disruption claims arising from non-critical delays. EOT claims are one of the most common claims and are very important for contractors and employers alike (Raj 2009). A further application of the issue <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>



is whether automatic changes in quantities would lead to variations in relation to extension of time. Under clause 44. 1 (Extension of time for completion), " the amount or nature of extra or additional work" is the base ground for extension. It may be arguable from the Employer's side that although no express statement of variation is made in clause 44. 1, the relationship between clause 44. 1(a) and clause 51. 1(a) in their wordings and (e) is sufficient to make it plain that extensions of time can be granted for variations depending upon the use of float available in the program. EXAMPLE 2 (Assumed)not the 4m<sup>2</sup>/hour assumed in the tender. That is, a loss of 1/6 hour/m<sup>2</sup>, not the 4m<sup>2</sup>/hour based on tendered data (Estate 2006).

### **Investigate how to mitigate/ avoid the variations in construction projects**

According to research of " The potential effects of variation orders in construction projects" Zulkfli OSMAN, Abdelnaser OMRAN, Choo Kim FOO School of Housing, Building and Planning, Universiti Sains Malaysia, MALAYSIA identify mitigation action for Proper management of variation orders or project planning. Variations can be minimized if the designs by the consultant are thorough and meticulously detailed.

### **Chapter 01 Summary**

A Variation is generally defined as the Alteration or Modification to the Design with the effect of Quality or Quantity of the Contract Works. It lead to Project Delay such as Cost Overrun along with Time Extension, The Engineer may issue Instructions in accordance with the Standard Condition of Contracts such as referred to FIDIC, JCT , ICTAD, etc; The issue of Variation

Order Instructions ensures that Quantity Surveyors' Variation Order Value Submission is required, so as to determine Clients' Monetary Effect. Foreign

## **CHAPTER 03**

### **METHODOLOGY**

#### **Introduction**

The methodology of research is vital in directing the researcher to accomplish the aim and the objective of the study. This methodology chapter will illustrate the methodology process was to ensure that the information obtained for this research was relevant and capable of qualitative assessment. The Research plan ties up the entire features in a research project together.

#### **Research process**

Research process is a systematic development of analysis planned to understand, gather and improve facts. This intellectual investigation procedure produces a greater understanding of problems and makes practical applications through theories, questioning and reasoning to achieve the research objectives hoping to produce some new knowledge. Generally, research procedure is understood to follow a certain structural process. Though step order may vary depending on the subject matter and researcher, it could be described by below given Diagram as well.

### **LITERATURE REVIEW**

Investigate type of variations, Causes & mitigation actions by using of Books, Web Articles, Magazines and other Resources.

## **DATA COLLECTION**

Project data, Interviews and Questioner Surveyor, etc

## **CONCLUSION AND RECOMMENDATIONS**

Literature review. Interviews and Questioner Surveyor, etc

Figure 3. 2:  
General Research Procedure  
The research objectives were specifically design where it is systematically divided in three stages in consecutive sequence such as Literature Review, Case Study and Questioner & Interviews.

### **Literature Review**

Method used in conducting this research starting with literature review where the first section explained and discussed the type of variation and second section discussed about the causes/effect of variation which begin with the definition of variations. The source of data obtained from the reading material such as books, magazine, article, journal, web site and other published information supporting the topic of variation order.

### **Case Study (Document base)**

In the case study will be discussed for a past large scale construction project in Dubai base. Both qualitative and quantitative data will be collecting from the case study. The aim of the case study is identify how Variations are effected to the project, during the constructions period. Following things are expected to identify through the case study. Explore the selected project particulars as exacting details and relevant information from being available documents. Identify the involved parties for origin of variations, specially consider issued instructions for originate of variations either by Clients or Consultants or by Contractors. Study the causes to occurrences of variation

analyze them with involved parties, base on available data of selected project. Study the effects that occurred due to variations such as Cost overrun, Time Overrun. Analysis findings of case Study to identify the final outcomes of this case study as what causes are generating and affect them for project delays due to variations. InterviewsThe interviews will be conducted by the Researcher as face-to-face mode to obtain primary qualitative data. 3 nor of semi structured interviews will be conducted with selected professionals working in Dubai construction industry as each personality from Employer, Contractor and Cost consultant. The place and time for the interview will be selected as prefer to the interviewee as easy to him / her. Same questions will be asked from each interviewee in same order. The researcher will be able to ask some limited questions only within a questionnaire survey. But the researcher will be able to ask some few more questions from the interviewee and also the interviewer is able ask some reasons additionally for each answer giving for each question when the interviewer needs furthermore clarifications. Interviews will give clear ideas / opinions of the participant's and the interviewer will able to ask and get further clearance from the interviewee about their answers, ideas or opinions. Mainly in this section aim is to obtain comprehensive ideas and opinions about effect and causes of variations in a construction industry from the following professionals' referred to their involvement in projects. Client Quantity SurveyorConsultant Quantity SurveyorContractor Quantity SurveyorProject Manger ContractorThe following subjects will be discussed referred to the topic of research with the Questionnaire surveyor; Present Role and responsibility,(Example: Contractor Quantity Surveyors' work involvement for identifying and preparation of variation submissions)Past <https://assignbuster.com/necessity-for-minimize-variations-construction-essay/>

experience referred to variations,(Example: Analysis, valuing, negotiation, use of standards condition of contract clauses)How variations are identified? (Example: Referred to issued instructions, contract documents and detail drawings comparing with the original scope of work.)What are the reasons identified by experience to transpire variations? How variations are effected with the project delays? What types of Condition of Contract are used for administrating the variations? What was the method you applied to minimize the variations? QuestionnaireThe researcher expects to do a quantitative survey by circulating a questionnaire among professionals who are involving in construction industry in Dubai. This questioner will be circulating by electronically among specially quantity surveyors working to clients & contractors, project managers, engineers, suppliers etc. Quantitative primary data will be collecting from this survey. The questionnaire will be comprising with 10 number of questions and 1st 4 questions will be discussing about the participant's personal details, position, experiences in industry etc and balance questions will be discussed about the particular subject such as participant's experiences and his/her personal idea about " Necessity for minimize variation to avoid project delay in a construction industry. Few answers will be providing for each question and the participant has to choose one of them or more than one as required according to his / her experiences. This kind of arrangement of the questionnaire will make the process of analysis much simpler to the researcher to complete necessary graphs, charts etc. Approximately 45 no of responses expects by the researcher to get success from the questionnaire survey. Around 100 questionnaires will be circulating among above mentioned professionals to achieve the target.

Analyze and DiscussesAll the data receiving from above different surveys will  
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be analyze to find out the necessity for minimizing of variation to avoid project delays in a construction project. Conclusion /RecommendationIn this stage is the final stage of the research methodology. The final stage in this research is to define the conclusion and recommendation with reference to the objective, subsequently to the analysis from the document study, interview and questionnaire survey. Chapter 03 SummaryThe Research design is a long process that demands careful attention. The research design initially started from the first chapter in bits and pieces explain in the design that goes right though this chapter in describing means and ways in the creation of the whole research. The entire research designs were comprehensively describes in the research design procedure. Document study and structured interview and questionnaire were elaborated in huge aspect. By this clarification, it is easier to understand the proceeding chapter. CHAPTER 04

## **ANALYSIS AND RESULT DISCUSS**

### **Case Study (Document base)**

#### **Introduction**

The spirit of this research is to present an understanding on the causes and the effect of variations from project contributor in the construction industry. This chapter analyses the data collected from the project that involved in the variation works in UAE, questionnaires and structured interviews. The methods used are Frequency Analysis. The collected data from the questionnaires were tabulated and analyzed according to their ranking on average index. Bar charts and pie charts created from their rating scale shown to represent their ranking. Interviews from respondents are

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presented, together with relationship with questionnaires. The data obtained from the questionnaire survey based on the response from client, consultants and contractors. 55

## **Case Study (Document base)**

Introduction There is a Dubai based projects that selected in order to fully understand of the causes and effects of variation work and to determine that Project duration is prolonged for further some months to finish the construction. The case study of selected project present as follow:-

### **Explore the project particulars.**

Project Name:- Emirates aluminium smelter complex project, Al Taweelah, Abu Dhabi, Client:- Emirates aluminium company limited Main Contractor:- SNC Lavalin-Worley parsons JVMEP contractor: - BK GULF LLC. CONTRACT No. 4811 Contract Price- AED 8, 396, 692. 90 Preliminary - AED 1, 790, 349. 13 Final value of Contract - AED 12, 245, 451. 00 Project duration :- 365 days Delay (due to Variations works) -150 days The project is used the standards measure and pay basis contract procurement strategies, which are based on FIDIC Standard form condition of contract subject to the UAE government regulations being available. Project was completed with an extension time of delay incurred due to variations.

### **Identify the instructions and involved parties for originate of variations.**

Under this sub-heading, effort to identify the involved parties for originate of variations, specially consider issued instructions for originate of variations either by Clients or Consultants or by Contractors. It as follows by below

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given table 4. 01; VO Ref. No. InstructionsOriginAdd/Omi.(AED)VO-015Supply and installation of 6m shipping container complete with associated work to install as per site instruction SI no. 01766. Consultant200, 061. 00VO-017Modification works to the CPC panels as per construction SI no. 01777. Consultant158, 178. 00VO-021Installation of free issue fibber optic cable termination testing and commissioning as per IFC drawingClient1, 254, 200. 00VO-022Supply & installation of Earthing cables to emergency truck unloading station as per SI No. 01782Consultant425, 250. 00VO-031Additional power cable installation & termination as per SI no; 01799. Consultant585, 425. 00VO-032Remove 3 x single phase 16amp MCB's and their associated 100ma RCD's and wiring as per SI no; 01825. Consultant125, 425. 00

### **Study the causes to occurrences of variation.**

Base on available data of selected project, study the reasons to arise of variations and categorize them with involved parties as follows by below given table 4. 01; VO Ref. No. InstructionsCauseAdd/Omi.(AED)VO-015Supply and installation of 6m shipping container complete with associated work to install as per site instruction SI no. 01766. Design change200, 061. 00VO-017Modification works to the CPC panels as per construction SI no. 01777. Design change158, 178. 00VO-021Installation of free issue fibber optic cable termination testing and commissioning as per IFC drawingDesign change1, 254, 200. 00VO-022Supply & installation of Earthing cables to emergency truck unloading station as per SI No. 01782Design change425, 250. 00VO-031Additional power cable installation & termination as per SI no; 01799. Design change585, 425. 00VO-032Remove 3 x single phase 16amp MCB's



and their associated 100ma RCD's and wiring as per SI no; 01825. Design change125, 425. 00

### **Study the effects that occurred due to variations.**

For further study below given table 4. 02 will help to identify effects incurred due to variations of this project. It as follows; VO Ref. No.

InstructionsEffectAdd/Omi.(AED)VO-015Supply and installation of 6m shipping container complete with associated work to install as per as per IFC drawing. Cost & Time200, 061. 00VO-017Modification works to the CPC panels as per construction as per IFC drawing. Cost158, 178. 00VO-021Installation of free issue fibber optic cable termination testing and commissioning as per IFC drawing. Cost & Time1, 254, 200. 00VO-022Supply & installation of Earthing cables to emergency truck unloading station as per as per IFC drawingCost & Time425, 250. 00VO-031Additional power cable installation & termination as per as per IFC drawing. Cost & Time585, 425. 00VO-032Remove 3 x single phase 16amp MCB's and their associated 100ma RCD's and wiring as per as per IFC drawing. Cost125, 425. 00

### **Analysis the findings of project Study**

Below is the document study finding which is from the projects above, the analysis and the result of the causes and effects of variations can be shown in the table 4. 4 and chart 4. 01 based on the extract of above tables dates.

**VO Ref. No.****Causes****Effect****Add/Omi.****(AED)**

VO-15 VO-17 VO-21 VO-22 VO-31 VO-32 Design change Design change Design change Design change Design change Design change Cost & Time Cost Cost & Time Cost & Time Cost 200,061. 00158,178. 001,254,200. 00425,250. 00585,425. 00125,425. 00 Total Amount of Variations 2,748,539. 00 Table 4. 4: Causes of Variation order for Document Study Extended Time Chart 4. 4: Causes of Variation order for Document Study The analysis of data is done through the document study of the "Emirate aluminium complex project" on the tables 4. 01 and chart 4. 01 above, the most regularly sources of variation order are design changes. The major factor that influenced the instruction of variation made come from the designers itself. Also the client's requirement always changes time to time. As identified, the most frequent sources of variation order are design change due to incompleeted designs during detail design stage and indicate client requirement also subject to the efficiency requirement of final production.

**Delay analysis**

The following table illustrates the summary of number of days delay only. The construction Program is enclosed, which affected activities are incorporated in line with original Program activities. (Ref. Annexure 1. 01)

## **Construction Programme Activity**

### **Activity**

### **Contract Completion Date**

### **EOT Completion Date**

### **Delay Calendar Days**

Refer to Base Programme (Annexure 1. 01)Project Completion

(Civil/MEP)24th of Nov. 201024th of May. 2011180Table 4. 4: Causes of

Variation order for Document StudyCost overrunThe project document study through above tables illustrate very clearly cost overrun against to original contract price incurred due to variations.

## **Project**

### **Original Contract**

### **Final Contract (Except Other cost)**

### **Variations**

**%**

EMIRATES ALUMINIUM SMELTER COMPLEX PROJECT27, 485, 539. 0030, 234,

093. 002, 748, 539. 0010%Table 4. 4: Causes of Variation order for

Document StudyAs extract of cash study, the initial Project Value was Dhs.

27, 485, 539. 00 Project Duration was one year, due to variation instructed

at the end of the project, Completion date was prolonged for another six

month period. Main Contractor has approved the Variations and EOT claims

total the sum of Dhs. 2, 748, 539. 00. Subsequently, actual project certified

final value was to Dhs. 30, 234, 093. 00However, the major effect of

variation was identified as cost overruns and time overruns as shown in

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Table 4. 5 and cost overruns as shown in Figure 4. 2. As final findings identified throughout this cash study, comprehensively provide inherent judgment of project was delayed due to variations and cost overrun against to original contract sum.

## **Research Findings the Sources of Variation Order for Questionnaire.**

The author's intension of this chapter is to describe the results based on analysing quantitative data gathered from questionnaire survey on "Necessity for minimize variations to avoid project delay in a Construction industry". The analysed data would be presented as tables, graphs and discussions for the fulfilment of aims and objectives of the research. The evaluation process would be divided in to three (3) sections as follows according to the questionnaire survey implemented. Research finding 01 - Details of participants Research finding 02 - The causes, effect of occurrences of variations and mitigation actions Research finding 03 - Opinion of participants regards necessity for minimizing of variations to avoid project delay

### **Research finding 01: Participant's Information**

This section would be contained of the participants information where filled in the questionnaire survey.

### **Number of Participants**

The prepared questionnaire was sent to pre selected 35 no of Professional who work for the construction industry in UAE, Azerbaijan and Sri Lanka. Among them 41 personals were participated but only 35 were completed the

questionnaire survey fully. They have filled their names and email addresses under personal information section.

## **Participant's Name & Email Addresses**

Filling name was not mandatory in this questionnaire. 35 of 41 have filled their names and email addresses respectively. But the author has not published their names and email addresses to avoid their personal exposure.

## **Participant's Work Experience in UAE, Azerbaijan & Sri Lanka Construction Industry**

Figure 6. 1. 3: Participant's work experience

### **How many years' experience do you have in Construction Industry?**

Answer Options	Response Percent	Response Count
Up to 1 year,	0.0%	0
1-5 years,	12.8%	5
5-10 years,	33.3%	13
Above 10 years	53.8%	21

answered question39skipped question2Table of Participant's work experienceAmong 35 persons who have answered to this question 12.5% for 1 to 5 years, 33.5% for 5 to 10 years, and 53.8% for more than 10 years of experience in UAE, Azerbaijan & Sri Lanka construction industry. The accuracy of participant's judgement on questionnaire could be depended on their experience in the construction industry in related country.

## **Participants' profession in Construction industry**

Figure 6. 1. 4: To whom do they work for?

## What is your profession in Construction industry?

Answer Options Response Percent Response Count Quantity Surveyor

(Client /Consultant/ Contractor's) 95. 0% 38 Project Manager 2. 5% 1 Commercial manager 7. 5% 3 Planning Engineer 2. 5% 1 Construction Manger 2.

5% 1 answered question 40 skipped question 1 Figure 6. 1. 4: To whom do they work for? The objective of this question is to understand the participant's working environment. Generally the answers given by the participants would be fair to the party which they are working for. Therefore the balanced participants for each main party would give more accurate survey. According to the primary data collection, majority of participants were working for the Quantity Surveyor (Client /Consultant/ Contractor's) representing 95%. The others distributes among 7. 5% for Commercial manager and 2. 5% for others (Project Manager, Planning Engineer, Construction Manger). Quantity surveyor's contribution for this survey is the highest which were taken 95% and Generally Quantity surveyors have better knowledge on this topic because of their high involvement for the construction project.

## Participants' past experiences how was the occurrence of variations in construction industry

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

## In your past experiences how was the occurrence of variations in construction industry?

Answer Options Response Percent Response Count Never occurred 2.

6% 1 Rarely occurred 5. 1% 2 Always occurred 71. 8% 28 Very often occurred 15.

4% 6 Occasionally occurred 7. 7% 3 answered question 39 skipped

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question2Figure 6. 1. 6: How important is it to study of construction project delays in UAE? As per the primary data collection through survey, 87. 2% of participant's idea was that occurrence of variations is " occurred". 2. 6% of participants negatively respond, seem due to inadequate knowledge about variations, No one who works in the construction industry likes to experience the project variations.

### **Participants experienced any project delays due to variations in their construction projects?**

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

### **Have you experienced any project delays due to variations in your construction projects?**

Answer OptionsResponse PercentResponse CountYes94. 7%36No7.

9%3answered question38skipped question3Figure 6. 1. 6: How important is it to study of construction project delays in UAE? According to the primary data collection, majority of participants (94. 70%) were responded for having experience regarding project delay due to variations. 7. 9% of participant have no any experience.

### **Research finding 02 - The effects and causes of occurrences of variations and mitigation actions**

In this section the author is discussed about the causes of construction project delays in UAE with the mathematical figures, graphs, charts and tables based on primary data.

## **Involved parties to generate variations**

Under this question, study the involved parties for generating of variations as per participants experience. Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

**Which parties are involved frequently for generating of variations, from the below mentioned If your answer for question no. 5 above is " YES", please input your answer by ticking the appropriate box,**

Answer Options Response Percent Response Count Owner related 65.

8% 25 Consultant related 52. 6% 20 Contractor related 21. 1% 8 Others related,

please clarify 13. 2% 5 answered question 38 skipped question 3

Figure 6. 1. 6: How important is it to study of construction project delays in UAE? According to the participant responses indicate 65. 8% for owner related reasons for generate variations significantly, and 52. 6% of participants are Consultant related, also contractor related 21. 1% of participants was involved. As other related are 13. 2% of participants.

## **Cause of occurrences of variations as per the Participants' experience**

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?



## **What are the significant causes of occurrence of variations?**

### **Answer Options**

**Strongly agree**

**Agree**

**Disagree**

**Rating Average**

### **Response Count**

• Designers poorly designed at the design and planning stage. 151851. 7438• Errors of instructions by the engineer during construction period. 02992. 2438• At the briefing stage client had not given proper briefing/incomplete information. 102531. 8238• Incomplete Contract documents. 82461. 9538• Unacceptable natural surface features. 13072. 1638answered question38skipped question3Figure 6. 1. 6: How important is it to study of construction project delays in UAE? According to the data table 4. 01, it provide ratings for Cause of occurrences of variations, 38 number of participants on rating average is 1. 74 for " Designers poorly designed at the design and planning stage", mostly 2. 24 rating average for " Errors of instructions by the engineer during construction period", for " At the briefing stage client had not given proper briefing/incomplete information" on1. 82 rating average, and for " Incomplete Contract documents is1. 95 rating average. Also for " Unacceptable natural surface features" is 2. 16 rating average as well. Thus mostly provide significant facts as Designers, engineer, client and natural surface features are specific causes for occurrence of variations and project delays respectively.

## Identified effects of variations in a project

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

### As of identified effects of variations occurred in a project;

#### Answer Options

**Strongly affected**

**Affected**

**Neutral**

#### Rating Average

#### Response Count

• Cost Overruns182001. 5338• Time Overruns211701. 4538• Dispute between parties62662. 0038• Increase Overhead Expenses92721. 8238• Delay in Payment523102. 1338• Procurement Delay62392. 0838•

Completion Schedule Delay122241. 7938answered question38skipped

question3Figure 6. 1. 6: How important is it to study of construction project delays in UAE? When study through the participants responds on above table and chart show 2. 50 ranking average of participants respond for Cost and Time overrun. And also show as other effects of dispute between parties, increased over head, delay in payment, procurement are 1. 80 rating average. Thus variation arise to project is inherent effect as project cost overrun and delay of completion.

## **Mitigation actions for minimize of variations in construction industry**

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

### **In your past experiences what are the appropriate mitigation actions to minimize of occurrence of variations in construction industry**

#### **Answer Options**

**Agree**

**Disagree**

**Rating Average**

**Response Count**

- Continuous coordination and direct communication will not only eliminate design discrepancies and errors. 3701. 0037
- Clear and comprehensive project brief would assist in eliminate variations arising. 20171. 4637
- The Contract document must clearly define the task and works that need to be done by the contractor especially in bills of quantities. 3431. 0837
- The involvement of the professionals in the design phase. 3701. 0037
- Local Authority involved in the construction. 3251. 1437
- More comprehensive detailing in design, detail design at the pre- contract stage. 2981. 2237
- To conduct/ organize the design workshop involving all parties, i. e. client, user and consultant. 3421. 0636
- To get first hand information and comment from the user before finalize the design. 3521. 0537

## **answered question**

**37**

## **skipped question**

**4**

Figure 6. 1. 6: How important is it to study of construction project delays in UAE? As per above table highest rating average is 1. 46 for " Clear and comprehensive project brief would assist in eliminate variations arising". As second rating average is 1. 22 for " More comprehensive detailing in design, detail design at the pre- contract stage." And other facts average ratings are very close to 1. 00. Although as a result of participant responds for mitigation action are essential process for avoid project delay due to variations.

## **Research finding 03 – Opinion of participants about " Necessity for minimizing of variations to avoid project delay"**

Figure 6. 1. 6: How important is it to study of construction project delays in UAE?

## **As your experience; do you agree with the necessity for minimize variations to avoid project delay and for completion of project successfully?**

### **Answer Options**

### **Response Percent**

### **Response Count**

Disagree 0.0% 0 Neutral 5.4% 2 Agree 40.5% 15 Strongly agree 54.1% 20

answered question 37 skipped question 4

Figure 6.1.6: How important is it to study of construction project delays in UAE? According to the primary data collections as final Question, majority of participants (54.1%) were responded for "necessity for minimizing of variations to avoid project delays in a Construction industry", and 40.5% of participants are responds for agree, although both answer option derive in same view of point, thus this issue can be consider as total of 94.6% of participant are agree for "necessity for minimizing of variations to avoid project delays in a Construction industry" likewise,

## **Chapter -04 Summary**

The comprehensive study through the case study and Questioner gives ultimately most important findings to this research. Variations are much common in construction industry; due to significant changes arise to project time to time by client or designers, engineer it may lead to variations. Therefore as inherent effects due to variations finally project estimated cost overrun and scheduled project completion date will delay. Sequences of explanation are completely described within each research analysis and research findings sections. The clarity of amplification is further enhanced by

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the diagrammatic illustration of bar chart, pie chart and tables. The findings data in this chapter are then brought forward to the next chapter of conclusion and recommendation

## **CHAPTER -05**

### **CONCLUSION AND RECOMANDATION**

#### **Introduction**

This is the last chapter of the study and it contains the conclusion and recommendations based on the findings through above study of literature review, cash study and Questioner surveyor. The main objective of the study is to explore the type of variations in constructions projects and identify key elements that cause to occurrences of project delays that incurred due to variations in the construction Projects. Also investigate how to mitigate/ avoid the variations in construction projects.

#### **Conclusion**

Conclusion for this study will be based from the objective as mentioned in chapter 03. All three main objectives of this study have been achieved successfully. The conclusions are as follows

#### **Objective-01; Explore the type of variations in constructions projects**

The first objective is to study explore the type of variations based on literature review considerably achieved. Variations are additions, omissions, substitutions, alterations, changes in quality, form, character, kind, position, dimension, level or line, and changes in any specified sequence, method or timing of construction. In a Construction project, Variations are much

common in most Contracts due to incomplete Drawings, Specifications, Bill of Quantities and other Contract Documents. And also due to lack of information from the Client to the Consultant with regards to the Project, lead to Variations. This situation inevitably generates unnecessary project delays and disputes.

## **Objective-02; Identify key elements that cause to occurrences of project delays that incurred due to variations in the construction Projects**

The most frequently causes of variations are Owner Related Variations such as Changes of plans or scope, Changes of schedule, Owner's financial problems, Inadequate project objectives, Replacement of materials or procedures, Impediment in prompt decision making process, determined nature of owner, change in specifications by owner. The owner is the main source of variations in construction projects. Change of plans by owner is the main cause of variations as per above study findings refer to literature, document study and questioner surveyor. Consultant is the second major contributor to variations by generating conflicting design documents or through change in design after award. Another source is errors and omissions in design. As extracts of consultant Related Variations are Change in design by consultant, Errors and omissions in design, Conflicts between contract documents, inadequate scope of work for contractor, Technology change and as other Variations unforeseen problems, etc; Mostly variations comprehensively involved with entire project time and cost. It is an extension of time or cost overrun to complete variation work, and by the given time extension; project is delayed related to original completion date.

It means essential requirement for minimize variations to avoid project delays.

### **Objective-03; Investigate how to mitigate/ avoid the variations in construction projects**

The following points are critically important in order to minimize and control of variations to avoid project delay in construction projects according to the literature review and questioner surveyor provided, those are as follows; The involvement of contractor's during the design phase. Regular coordination and direct communication among the project team. Proper management of variation orders or project planning. Use of proper site investigations and feasibility studies reports at the design and planning stage. (Unacceptable natural surface features such as, boulders, unsuitable sub base( plasticity or filled), existing utility service lines, water table, flood effect or any natural disasters )Designers poorly designed at the design and planning stage since involvement of inexperience designers, falier of foundation, insufficient storm water and drainage designs, obstruct column placed in common areas. Unnecessary instructions by the engineer during construction period hence contractor will claim them as variations such as, level change without proper idea of the requirement or without surveyor report therefore earthwork item might be increased or arise as additional items in original contract, At the briefing stage client representatives had not given proper briefing/incomplete information this leads to misunderstanding of client actual requirement such as, Client instruct to install a elevator in retail area without idea of existing condition about already casted staircase in that place, it is not in original scope of work, Arise in completed drawings,



specifications, BOQ, Use Standard method of measurements, such as SAMM7, CECEM3, and PROMIPoor contract administration which should have been easily avoided. Select reputed consultant firms with similar project experienceMake sure well coordination at the design stage with relative client management persons/ or teams (End users) as per them satisfaction at the end.

## **Recommendations**

Based on the findings of this research discussed in chapters three with main conclusion listed above and the referring to findings of previous studies discussed in the literature review, the following recommendation are made for minimize variations to avoid project delays significantly: The research point out that owner is the main source of variations in building construction projects. Even though the research showed that the owner get involved during the design phase of the project, this is not enough for minimizing problems associated with variations and project delays due to variations. As per general point view also, the owner usually lack the ability to read design documents prepared by the engineer. Many professionals suggested that owners, in many case, get surprised that what is being constructed is not what they have anticipated or imagined. Owners of building projects are usually businessmen who have a good level of education and with extra effort and visual aids they should be able to imagine the design. As the research showed that most variations are client and design related, thus this extra effort in understanding the design would minimize variations made by the owner. Also it will directly effect to project success without any delays due to variations. In additions within researcher experiences, The following

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factors are highly recommended for avoiding and minimising occurrence of variations and obtain project successfully completion without any delays due to variations. Use of standard condition of contract, Such as FIDIC Condition of contract, ICTAD, JCT and individual Project condition of contract. At the project inception stage, preparation of proper site investigations and feasibility studies reports. Use of Standard method of measurements, such as SAMM7, CECM3, and PROMI. Selecting a reputed consultant firms with similar project experience. Identify the incompleting drawings, specifications, BOQ, and other contract drawings as soon as drawing receive by the contractor due to lack of information from client to the consultant. Make sure well coordination at the design stage with relative client management persons/ or teams (End users) as per them satisfaction at the end. Client/client team must have a good knowledge of the project. It is advisable to select a suitable procurement method considering the prevailing economic situation in the country. For research end, Due to un-necessary variation directly affect with entire project time and cost. It is an extension of time to complete variation work, and by the given time extension project will be delay. Thus, through the whole study of research is appearing significant requirement as " Necessity for minimizes variations to avoid project delays" accordingly.