ASSESSING THE IMPACTS OF VARIATION ORDERS ON BUILDING COST AND SCHEDULE OVERRUN

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Abstract: It is common in all type of construction labor and it determines the time limit and anticipated budget of the task. Variation order is observed as one of the most frequently occurring issues in construction labor in India. Like other regions of the country, construction project in Vadodara are excruciation from variation procedure. This bailiwick assessed the encroachment of mutant orderliness on edifice projects that resultant price and schedule overrun in Vadodara edifice projects. The objectives of the study were firstly to determine the causes of variation order; secondly to identify the impacts of variation order; and lastly to recommend strategies to minimize variation orders. Through the study of literature review, resulted in identification of 40 common causes of variation orders, 15 impacts of variation orders and 16 recommended strategies to minimize variation orders and this variable were mapped in frequency tabular array. The questionnaire survey was carryout to identify the causes of variation orders, their impacts on building projects and to find the recommended strategies to minimize variation orders. The questionnaire responses were analyzed using the mean score method. Based on the analysis done conclusion and recommendation was done. The outcome indicated that errors and omission in design, lack of contractors involvement in design, Change in design were the most causes of variation orders. The results also showed that completion schedule delay, increase in project cost, and additional payments for contractor were the most impact of variation orders. The findings also suggested the most recommended strategies to minimize variation orders. These strategies were to produce a concluding design and contract document, to complete drawing at attender stage, and to supervise the industrial plant with experienced and dedicated supervisor to minimize variation orders.

IndexTerms **-** *variation order, causes, impact, Building project*

I. INTRODUCTION

Construction project is one of the biggest manufactures in the world, with members who are expert in planning, design, construction operation, and administration. It display considerable role in socio economic elaboration of any nation, largely for developing countries through creating the necessary physical base ; deficit improvement via immediate possibilities and sustainable employment creation and mixer resource maturation; technological development through knowledge transfer and providing memory access to education services; and politico legal development through distribution of physical infrastructure to satisfy all societies to confirm service through decentralization and right hand, obligations and remedial rights. Construction projections are long process having more complicated small bodily process involved in it. For acquisition of big twist undertaking we have to complete small construction tasks in regular manner. For that mess of efforts are taken. But sometimes quite unfortunate conditions cause the movement of construction activity. Construction Manufacturing has become known as adversarial and problem-prone, with claims and disputes on construction undertaking frequently the regulation instead of exemption [1]. These projects are intrinsically complicated, hazardous and at the mercifulness of the unpredictable weather and also the most difficult of human enterprises. Hence, it is perhaps not astonishing that something often goes wrong [2]. For this reason, no construction project is free people from trouble such as delay, unexpected additional or extra study, defective work, cost overruns, structural failure and accidents. The incorporation of construction knowledge and skill at the early design phase provides the best chance to improve overall project routine in the construction diligence [3]. To comprehend this combining, it is not only essential to provide a structured and systematic way to economic aid the transfer and utilization of construction industry [3]. To comprehend this combination, it is not only necessary to provide a structured and systematic way to economic aid the transferee and employment of grammatical construction discernment and acquirement during the first plan decision making process, but also to establish these discernment and skill in a controllable data format so that they can be entered successfully and competently into the process. Variation is mutual in all types of construction tasks the origin and frequency of variations occurrence different from one project to another depending on different factors [4]. If one was to extremely deliberate ways to reduce trouble on site, an obvious lieu to Begin with is to focus on what the project team can do to eliminate this trouble at the intent stage [5]. Variations in construction projects can bring considerable modification to the arrangement period, total direct and indirect monetary value, or both. Consequently, project management bunch must have the capability to reply to change successfully in order to diminish their opposing influence to the project [6].

II. Research methods

Methodological is a plan of action which must be developed that show how the problems will be investigated, what information will be collected using which methods, and how this information will be analysed in decree to arrive at conclusions and develop recommendations. Research undertaking synthesises and analyse existing theory, ideas, and findings of other research, in quest to solvent a particular dubiousness or to provide new insights. The problem investigated in this field was the causes and impact of magnetic variation Orders on building projects that brought cost and schedule overrun. The responses to the questionnaire was based on Likert's scale of five ordinal measures which was from one to five 5 arranged in ascending order according to the degree of contribution to each question. The main approach path used to analyze the data was by using the Mean score method. The responses are analyzed using the Microsoft Excel software. The mean score (Ms) for each variables causes and impacts of variation order was computed by using the following formula;

$$\boldsymbol{MS} = \frac{\sum \mathrm{F} \times \mathrm{S}}{\mathrm{N}}$$

Where:

MS – Mean Score
F – Frequency of responses for each score
S – Scores given to each variable (from 0 to 5)
N – Total number of responses concerning each variable.

III. Analysis of the Findings

In the structured part of the questionnaire, the respondents were asked to rate the degree of contribution of the variables drawn from the literature review. Furthermore, the respondents were also asked to add other variables or factors that contributed to the causes and impacts as well as recommendations that they perceived as being necessary. Forty (40) causes of variation orders identified from the literatures, fifteen (15) impacts of variation orders and sixteen (16) strategies to minimize variation orders on building projects were used in questionnaire survey.

a) Causes of variation orders on building projects

According to analysis result of the questionnaire survey shown, Errors and omissions in design is identified as the first **highly ranked causes** of variation order with highest mean score. The subsequent causes of variation orders were errors and omissions in design, change in design by the consultants, inadequate working drawing details; lack of contractor's involvement in design and ambiguous design details

The following are the **sometimes causes** identified from the questionnaire survey were:

- ✓ Change in design,
- ✓ Inadequate working drawing details,
- ✓ Lack of communication between contractors and consultants and
- ✓ Lack of coordination between consultant and contractor or subcontractors.
- ✓ Design complexity
- ✓ Design discrepancy
- ✓ Lack of coordination
- ✓ Conflict between contract documents

Other challenges mentioned by Respondents were:

As a **seldom causes** of variation order

- ✓ Inadequate shop drawing detail
- ✓ Change of schedule
- ✓ Defective workmanship
- ✓ owner changes, additional work and modification to prior work
- ✓ Technology change;
- ✓ Lack of a specialized construction manager
- ✓ Inadequate scope of work for contractor;
- ✓ Lack of involvement in design of one or more parties to contract
- ✓ Change in economic conditions
- ✓ Complex design and technology;
- ✓ Lack of strategic planning;
- ✓ Lack of coordination

As a **never causes** of variation orders

- ✓ Change in economic conditions
- ✓ Unavailability of equipment
- ✓ Long lead procurement
- ✓ Socio-cultural factors

- ✓ Weather conditions

Below figure shows percentage causes of variation orders based on variables identified from literature review.

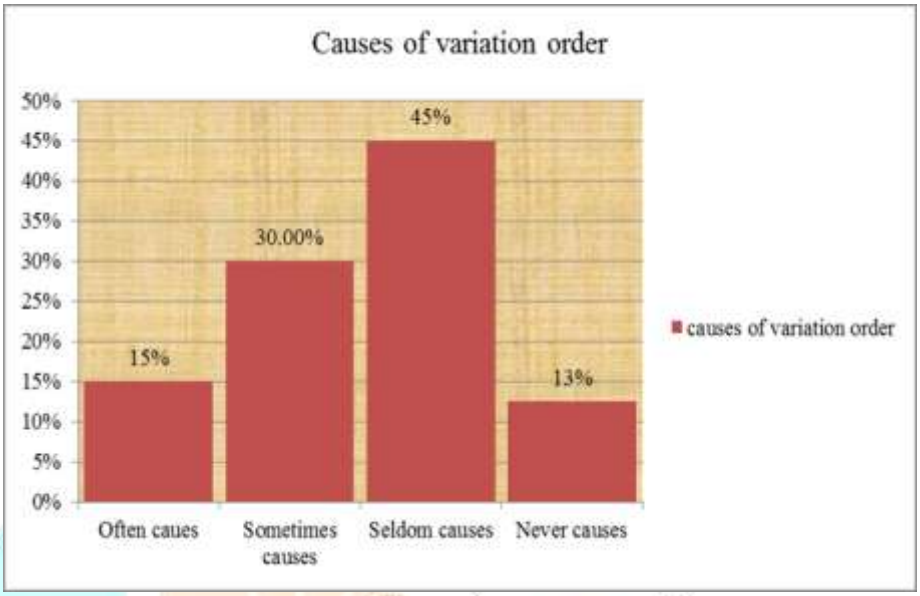

Figure 1- shows percentage for causes of variation order

b) Impacts of variation orders on building projects

According to the analysis result of the questionnaires survey increase in project cost was the identified as highest ranked impact of variation orders with the maximum average mean score were increase project and complete schedule delay. The subsequent very high impacts of variation orders were increase in overhead cost and affecting progress of work. The following are the **high impacts of variation** orders identified from the questionnaire survey were:

- ✓ Disputes among professionals
- ✓ Productivity degradations
- ✓ Rework and demolition
- ✓ Additional payment for contractors
- ✓ Quality degradation

As **medium impact of variation** order

- ✓ Poor professional relations
- ✓ Delay in payment
- ✓ Blemish firm's reputation

As **low impacts** of variation orders

- ✓ Poor safety conditions

As **no impacts** of variation orders

- ✓ Procurement delay

Below figure shows percentage impact of variation orders based on variables identified from literature review.

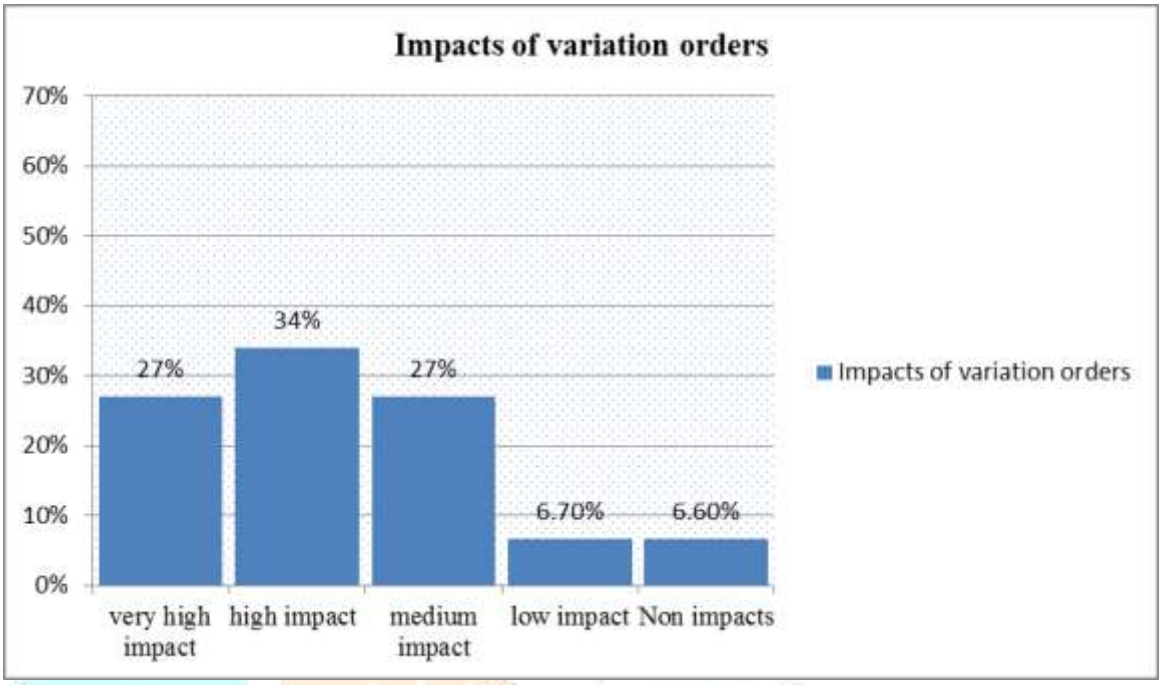

Figure 2- shows percentage of the impact of variation orders

c) Recommended strategies to minimize variation orders on building projects.

According to the this survey, the most ranked recommended strategy was adequate planning is required by all involved parties before work starts on site, followed by consultant should ensure that the design or specification fall with approved budget, and place experienced and knowledgeable executive in the engineering department. The following are the highly important recommended strategies of variation orders identified from the questionnaire survey were:

- Drawing should be complete at tender stage
- Work should be supervised with an experienced and dedicated supervisor
- Adequate time should be spent on a pretender planning stage
- The consultant should produce a concluded design and contract
- Carry out detail site investigation including detail soil investigations
- Close consultant coordination is required at design stage
- All parties should forecast to overview unforeseen condition
- Enhance communication and all parties should proactive all times
- Get accurate information and research with regard to procurement procedure
- Once the tender is awarded there should be no changes to the specification.

As **important** recommended strategies to minimize variation orders

- Enhance communication and all parties should be proactive all times;
- Have the underground cable route confirm by the local authorities;
- Clients should provide a clear brief of the scope of works;

As **Less important** recommended strategies to minimize variation orders

- ✓ All involving must prediction to overview unexpected circumstances;
- ✓ Carry out detail site investigation including detail soil investigations
- ✓ Get accurate information and research with regard to procurement procedure
- ✓ Once the tender is awarded, there should be no changes to the specifications; and

As **unimportant** recommended strategies to minimize variation orders

- Have the land application or land purchase completed before awarding contracts;

Below figure shows percentage recommended strategies to minimize variation orders based on variables identified from literature review.

Figure 3- Percentage of recommended strategies to minimize variation orders

I. Conclusions

The first objective of the study was to analyze the causes of variation orders on building projects in Vadodara city. Among 40 causes of variation orders, the responses received from the respondents showed that errors and omission of design, change in design by consultant, inadequate working drawing details, lack of contractor's involvement in design and ambiguous design details were the top five most frequent causes of variation orders on building projects.

The second objective was to identify the various impacts of variation orders on building projects in Vadodara city. The study found that variation orders had an impact on building projects. From the 15 impacts of variation orders increase in project cost, completion schedule delay, additional payments for contractor, increase in overhead expenses and progress of work is affected.

The third objective was to suggest recommendations to minimize variation orders on building projects in Vadodara city. From the literatures, fifteen (16) strategies to minimize variation orders on building projects were identified. The overall responses received were therefore concluded that the following best five strategies were recommended to minimize variation

orders on building projects: Adequate planning is required by all involved parties before works start on site; drawings should be complete at tender stage; Works should be supervised with an experienced and dedicated supervisor, consultant should ensure that the design/specifications fall within the approved budget , the consultant should produce a concluded design and contract; adequate time should be spent on pre-tender planning phase.

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References

[1] Steen, H.R. Alternative Dispute Resolution in the Construction Industry, provided under the auspices of the New Jersey State Bar Association's Dispute Resolution Section, 2002.

[2] Love, P.E.D. & Li, H. 2000, 'Quantifying the Causes and Costs of Rework in Construction', Construction Management and Economics, 18, 479-490.

[3] Arain, F.M., Assaf, S. and Low, S.P. (2004) Causes of discrepancies between Design and Construction, Architectural Science Review, 47(3), 237-249.

[4] Bower, D. 2000, 'A Systematic Approach to the Evaluation of Indirect Costs of Contract Variations', Construction Management and Economics, 18, 263-268.

[5] Arain, F.M., Assaf, S. and Low, S.P. (2004) Causes of discrepancies between Design and Construction, Architectural Science Review, 47(3), 237-249.
[6] Finsen, E. 2005, 'The Building Contract - A Commentary on the JBCC Agreements', 2nd ed., Kenwyn: Juta & Co, Ltd. 14-28.
[7] Arain, F.M. & Pheng, L.S. 2005b, 'How Design Consultants Perceive Causes of Variation Orders for Institutional Buildings in Singapore', Architectural Engineering and Design Management, vol. 1, no. 3, 181-196.
[8] Amiruddin Ismail,Towhid Pourrostam, Amir Soleymanzadeh and Majid Ghouyounchizad, Factors Causing Variation Orders and their Effects in Roadway Construction Projects, Research Journal of Applied Sciences, Engineering and Technology, Shoushtar, Iran, 4, 4669-4972, 2012.
[9] Burati, J.L., Farrington, J.J. & Ledbetter, W.B. 1992, 'Causes of Quality Deviations in Design and Construction', Journal of Construction Engineering and Management, vol. 118, 34-49
[10] Arain F.M. and Phen L.S. (2005): The Potential Effects of Variation Orders on Institutional Building Projects, Journal of Facilities, Vol 23 No 11/12, 2005, 496-510.
[11] Chan, A.P.C. & Yeong, C.M. 1995, 'A Comparison of Strategies for Reducing Variations', Construction Management and Economics,13, 467-473
[12] Motawa, I., Anumba, C., Lee, S., Peña-Mora, F. (2007). An integrated system for change management in construction. Automation in Construction, 16, 368-377.