

## Causes of Variation Orders in the Egyptian Construction Industry: Time and Cost Impacts

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**Abstract :** Variation orders are of great importance in any construction project. Variation orders are defined as any change in the scope of works of a project that can be an addition omission, or even modification. This paper investigates the variation orders that occur during construction projects in Egypt. The literature review represents a comparison of causes of variation orders among Egypt, Tanzania, Nigeria, Malaysia and the United Kingdom. A classification of occurrence of variation orders due to owner related factors, consultant related factors and other factors are signified in the literature review. These classified events that lead to variation orders were introduced in a survey with 19 events to observe their frequency of occurrence, and their time and cost impacts. The survey data was obtained from 87 participants that included clients, consultants, and contractors and a database of 42 scenarios was created. A model is then developed to help assist project managers in predicting the frequency of variations and account for a budget for any additional costs and minimize any delays that can take place. Two experts with more than 25 years of experience were given the model to verify that the model was working effectively. The model was then validated on a residential compound that was completed in July 2016 to prove that the model actually produces acceptable results.

**Keywords :** construction, cost impact, Egypt, time impact, variation orders

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