

MODELING TO REDUCE VARIATION ORDER IN CONSTRUCTION PROJECTS IN EGYPT

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Abstract

Variation order is common phenomena in the construction field all over the world. These phenomena usually happen during any construction project which leads to dispute between the parties which are involved in the construction project. Also, the construction field is one of the main creations of any nation's wealth as it is the backbone of most industries for developing economics. Variation in many cases causes problems and disputes among the parties which are involved in construction projects. Thus, it is very important to study the main causes of variation order and to figure out and control variation. As if no agreement is reached between the parties of the project, it turns into a claim and dispute that may negatively affect the progress of the project and reduce its ability to be successfully completed in time within the project budget. Variation order is mainly caused due to unavailability of equipment, poor workmanship, design complexity and changing project scope etc. Variation order mainly effects on increasing project cost and delay in completion time.

The aim of this research is to produce a software modeling to help in reducing vary of variation orders causes and effects in construction projects. So, modeling eases the job and helps reducing the troubles that come along and solving problems. Modeling in the construction engineering field will act like a simulator which will help in solving that kind of variations that might be found in the construction projects. This model will act as a tool, which can show how to avoid variation or how to solve variation to minimizing the variation order causes in the construction field. As a fact variation order is unwanted as if we dream to have the construction field free of variations, but it is impossible to have a construction field free from variation order in reality, but it can be developing tools to assist in reduce and solve variations and this was the main aim of this research.

Keywords:—Variation Order, Time Delay, Cost Overruns, Construction Projects

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1. INTRODUCTION

A study conducted that all parties involved in the construction project have a direct proportion benefits, as if the owner wants to operate his project to start gaining profit, the consultant want to finish the project within the specification of the owner and the contractor wants to execute the project within time and budget. So, they all have to work and collaborate together to achieve a successes project. A successful project is the project which can be executed as planned on time and within budget while obtaining the required objectives and quality of the project. In a perfect construction world, there would be no variation orders, but there is no perfect construction world. Variation order is all about time overrun and cost overrun in construction projects (Arian and Pheng 2006) ^[1].

Time overruns is the delay in the planned schedule that can happen and it could be defined as finishing after completion date which is known in a term, or after the due date for submitting the project that the parties were agreeing on. Also, controlling time is really very important because time and cost are direct proportion where if the time increased the cost increased as well and this what can be called parallel relationship.

Cost overrun is one of the most serious problems in construction field and it could be defined as finishing the project with more cost than the planned cost or not within the budget. Cost is mainly one of the important aspects within the project management execution cycle and it is also the driving force which leads to a success project, so it is an important parameter of a project cycle. Regardless its proven importance, usually it is the one of the main reasons of failing the project from achieving its specification within the budget.

2. METHODOLOGY

To develop amodel there are too many methods to model there are a verity available nowadays in the world due to the new technology methods found as well as the research method. Different modeling types have also different type of methods from programming and designing as well as different research types have also different type of methods from collecting and analyzing data. The method used in modeling was in form of a website to be used by easily in any place worldwide without needing source, permission or something from the author to use it, while the research method used was reading more than eighty-five paper from articles or case studies and by collecting data from a

designed questionnaire, this questionnaire was designed and published and have been send to respondents from engineers and non-engineers working in the construction field organization such as contractor, consultant and owner. Most data were collected from this questionnaire. Using website questionnaire method made the results more accurate as it never allows the respondents to skip any of the questions and beside this method the author made interviews with the respondents to introduce the questionnaire were easily understood and well defined, so this method gives the author more accurate results so the research methodology depended on: literature review, interviews, questionnaire to develop a modeling software to assist in reducing variation order.

2.1 Modeling Design

The model was designed to be a guide for all parties involved in the construction field by presenting the factors leads to variation order in construction projects and to achieve mainly the objectives in Egypt, but it can be used worldwide If more researches don on the different factors due to the location of the project. The domain which is the website link of the model is been bought for three years and will be extended. The model was designed by using WordPress to build the website in shape of model. All data and results in the model was obtained from the research method.

2.2 Research Design

This research was designed and made to figure out the factors which lead to variation order for construction projects and to fulfill all the objectives and requirements in the Egyptian construction industry. The research was settled in a logical sequence to be simple, specific on its aims and to avoid any kind of misunderstanding. In order to be sure of the research aim, objective and stating the problem for a clear perspective about the factors causing variation order were stated in the outset problem statement, aims and objectives of the research were therefore stated at the outset of the research. So, the study was designed to undertake four stages. The first stage was a global literature review. This stage was parallel to all other stages as it was an important stage to provide the newest information on the research subject. Second stage was data collection which was collected through questionnaire surveys which was published online on the model website and throughout meetings, while the third stage was the results obtained from data analysis of the collected data, finally was the data entry stage by inserting the results, which was obtained from the previous stages, so the users can easily use the model.

3. LITERATURE REVIEWED

The variation order in constructing any kind of projects is usually linked to the performance of quality, time, and cost. Overrun in time and cost is a common issue that is happening every day in the construction field worldwide and the percentage of time overruns is higher compared with

percentage of cost overruns but both of them facing overrun more than 50%. For the public sector, only 20.5% of the projects completed within stipulated time and 46.8% of projects completed within the budget (Ismail, Abdul Rahman and Memon 2013) ^[2].

Variation order is a result from the lack of management system and lack of ability to prevent time and cost overruns or to control time and costs which makes the construction companies to fail.

3.1 Time

Time delay is defined to be the finishing of the project after the planned time schedule and can be defined also as finishing the project beyond its completion date, which is known in the contract terms and conditions or after the agreed time of submitting the project which the parties were agreeing on.

Time delay in the construction projects are usually expensive for example if there is a construction loan involved which charges interest, staff which are involved into the project such as managers, engineers and labor all of this are costs which is time dependent, and ongoing inflation in wage and materials prices. And also, time delay has a negative effect on clients, contractors, and consultants in terms of, claims, adjudication, cash flow inflations, and some irritation feelings between each other. A questionnaire to investigated the top ten causes of delays to investigate what are the factors that causes delays in time from which could be related to owner, consultant, contractor, material, labor, equipment or project. The researcher used three method severity Index, frequency index and importance index to analyze the questionnaire results. Severity Index analyzes shows that low productivity level of labors, shortage of construction materials in market, difficulties in financing project by contractor, fluctuations in cost/currency, unqualified workforce, during construction, finance and payments of completed work by owner, inadequate experience of consultant, effects of subsurface conditions, shortage of labors and changes of scope by owner. While, frequency index shows that the top ten factors that causes delay are slow in decision making, changes of scope by owner during execution, ineffective planning and scheduling of project, late in revising and approving design documents or finance and payments of completed work by owner, poor site management and supervision, low productivity level of labors, difficulties in financing project by contractor, effects of subsurface conditions (e.g., soil, high water table, etc.) and type of project bidding and award (negotiation, lowest bidder) (Marzouk 2014) ^[3].

Another study carried out the causes of delay in executing construction projects in Ghana to figure out the most important and critical cause of time overrun related to each of the parties involved in the project; owners, consultants, and contractors. The study identified thirty-two likely factors of causing time overrun can be categorized into nine important groups. The questionnaire was distributed on 130 respondents, which were 37 owners, 54

consultants and 39 contractors. The groups were calculated and evaluated by their relative importance of the individual causes. An importance index was the method used in analyzing the questionnaire results. The majority of the results indicate that the respondents are generally agreeing that the highest ranked group is financial group factors among the other groups causing delay or time overrun in construction field in Ghana. The financial group factors contain delay and disrespecting for payment conditions, difficulty in financing the project due to the turning in prices. The second ranked group is the materials group factors contains shortage of materials and late deliveries of materials, then followed by the third ranked group which is scheduling and controlling factors which contains poor supervision, accidents during construction, poor site management, lack of programming of works, construction methods, underestimation of costs of projects, underestimation of complexity of projects and underestimation of time of completion. Fourth ranked group is contractual relationship factors such as poor professional management, legal disputes, insufficient communication between parties, delay in instructions from consultants and delay by subcontractors. Changes occupy the fifth ranked group such as owner-initiated variations, necessary variations, and mistakes with soil investigations, foundation conditions encountered on site and poor design. Equipment group is the sixth group with unskilled equipment operators and breakdown of equipment. Environment group comes in the seventh place; this group contains bad weather conditions and unfavorable site conditions. The eighth group is the government factors, which are obtaining permit from municipality, discrepancy between design specification and building code and public holiday. Manpower group is the least ranked group its factors are shortage of skilled labor and shortage of unskilled labor (Frank et al. 2007)^[4].

3.2 Cost

Throughout history, construction companies have failed to neither deliver its services nor complete its assigned engagements after falling in the cost overrun trap. Giant construction projects for example Highway constructions have been exponentially exposed to major cost overruns, the phenomena when planned costs exceeded the actual costs disbursed which leads to surpassing the settled budget for the project. Detailed Analysis conducted for cost variation indicated that, approximately 95% of constructions projects are subject to overruns and estimated the ratio of actual to planned costs to not exceed 2.00 (Bhargava et al.2010)^[5].

However, further research proved that cost overruns is not the only sole element effecting the construction process and slaying its budgets, time delays has always been a fundamental element accompanying cost overruns and in other cases its significant cause. After decades of researching and despite the efforts exerted to prevent these overruns, time and cost overruns have been officially marked as a common issue in construction field worldwide with frequency of both factors to occur exceeding 50%

when measured upon the Public Sector scoring 20.5% of its projects accomplished within time while 46.8% of projects completed within its budget (Ismail, Abdul Rahman and Memon 2013)^[2].

In an article that carried that with the lack of effective management programs to address this issue, organizations found themselves in constant challenge to deliver its projects within budget over the settled time span from initiation till completion. This issue has been widely known as Cost variation. Despite the complexity of Cost Variation issue, it has been introduced with three major factors that overlap with each other to impact the overall performance. These Factors are Time, Cost and Quality. These primary factors are constantly escalating from sub-factors that hinder performance such as projects complexity, vagueness of scope, inaccessible technology requirements, team requirements and others (Memon and Abdul Rahman 2011)^[6].

Furthermore, a study carried the factors affecting the construction process either being avoidable or not are numerous and are derived from different sources. These sources include financial and managerial issues, resources unavailability, outer conditions and performance of construction parties (Mahamid, Dmaid 2013)^[7].

More examples of economies profit margins have slowed down due to cost variation such as Vietnam, India, The United Kingdom (UK), Egypt and Uganda. The economy of Uganda Faced a constant problem of failing to deliver projects on time due to delays in completion and overruns that raised a lot of concern. It was also noted that Uganda's Problems mainly were centralized in the Implementation phase of the project. While on the other hand, the Vietnamese, Indian, Egyptian and British economies faced no different challenges from Uganda during its journey for Urbanization and Developing Infrastructure. For the above-mentioned economies, the end result for both lead to reduction in profit margins, project failure and Citizen's Faith in Governments has been jeopardized.

Study carried out the scored that, 70% of the Indian contracts faced overruns, while 25% of British contracts have been extended (Patil, Ullagaddi and Jugati 2011)^[8]. As for Egypt, shows that 45% of the Government's national Funds were allocated for the construction sector (Abd El-Razek, Bassioni and Mobarak 2008)^[9].

A study carried out cost overruns and failure of project management despite the complexity of cost variation issue; it has been introduced with three major factors that overlap with each other to impact the overall performance. These factors are time, cost and quality. These primary factors are constantly escalating from sub-factors that hinder performance such as projects complexity, vagueness of scope, inaccessible technology requirements, team requirements and others (Doloi 2013)^[10].

4. COLLECTING AND ANALYZING DATA

In this research, the questionnaire contains two main sectors: The first sector covers some personal information about the respondents to identify himself/herself like asking about their names, emails, engineers or not, kind of organization whether it was owner, contractor or consultant, job title, and years of experience which is a general details or background information about the respondents.

The second sector was divided and categorized into three sections by each organization: owner section, consultant section and contractor section. The participants were gently requested to choose one choice for each cause of variation order which is very low, low, moderate, high and very high and the choices were numbered from 1 to 5 respectively.

At the end of the questionnaire, a submission message pop up to ask to the participant if there was any variation order factor missing or to clarify the issues related to the study and any information needed so a contact information of the website and developer is provided that the respondents can interact to send an email that was written in the submission message.

4.1 Questionnaire Section Selection

The questionnaire sections were divided and categorized to allocate and figure out the variation order factors that cause variation order in the construction projects in Egypt, so it was necessary to divide the factors by each organization to collect the data from different parties which are involved in the construction field to make the study more accurate and precise. By covering the most important and critical factors which affect the project life cycle.

4.2 Variation Order Factors Categorization

The research factors that were identified and obtained from the second chapter which was the literature review chapter, which was probable to be relative in studying factors causing variation order is the main objective. So, in order to obtain that objective, the organized literature review was made. The objective was to:

- Clarify and define the aim of the research.
- Historical perspective should be taken in the study consideration.
- Recognize the research design and methodology.
- Presents the upcoming direction of the study in the future.

More than thirty main factors of causing variation order in the construction field were conducted and obtained from different sources such as journal articles, researches magazines and internet, which are gained from literature review are classified by each party as contractor, consultant and owner. Contractor factors were complex design and technology, unavailability of equipment, difficulties in financing project by contractor, delay in site mobilization due to unfamiliarity with local conditions, rework due to errors during construction, unqualified workforce,

unavailability of skills, shortage of labors, differing site conditions, frequent change of sub-contractors because of their inefficient work, poor site management and supervision, poor workmanship, shortage of material and high cost of skilled labor. Consultant factors were inadequate working drawing details, inadequate design, design complexity, delays in producing design documents, conflicts among contract documents, change in specification by the consultant, errors and omissions in design, change in design by the consultant, un-use of advanced engineering design software, poor knowledge of available materials and equipment, quality assurance/control, delay in performing inspection and testing by consultant and delays in approving shop drawings. While, change of scope obstinate nature of owner, inadequate project objectives, owner's financial problems, change in specifications by the owner, interference of employer, impediment to prompt decision-making process replacement of materials or procedures, poor communication and coordination by owner and other parties and unrealistic contract duration.

5. DATA ANALYSIS

Two methods were used to analyze the data, Descartes equation and the SPSS. The SPSS program is statistics analysis software that is well known for all researchers, health researchers, survey companies, government, education researchers, marketing organizations, data miners and others. SPSS is widely used program due to its easily interference and its user friendly. SPSS calculate and plot graphs for the analysis results by showing mean, median, mode, standard deviation and other parameters by using excel spreadsheet and SPSS program to represent the collected data in table, to calculate and to conduct graphs and figures.

- The Mean is the average, which is the sum of total choices and divided by their numbers.
- The Median is the choice number, which comes in the middle of the total choices.
- The Mode is the choice number, which is most repeated.
- Standard deviation represents the allowances and whether there is a gap between the participants choice or not.

Descartes Equation Method

$$W\% = (A+2B+3C+4D+5E)/5$$

Where:

A = total of choice of (1) "very low"

B = total of choice of (2) "low"

C = total of choice of (3) "moderate"

D = total of choice of (4) "high"

E = total of choice of (5) "very high"

5.1 Participants' General Information

A hundred participant have done the questionnaire 92 was accepted and 8 was rejected. The rejected questionnaire was figured that 5 were spam due to incorrect personal information such as name, email, job title or major by writing non-readable words, while the other 3 were choosing more than one choice for each factor.

The participants were 92 all of them was working in the construction field 63 were males and 29 females as shown in (Figure 1). They were about 78 engineers and 14 non-engineer such as accountant, supervisors etc. as shown in (Figure 2). Also, there were different majors such as 61 civil engineering, 13 architecture engineering, 9 management such as account and finance and 9 were named as others such as politics, institutes and mass com as shown in (Figure 3). There was a verity in their experience 52 were from 1 to 5 years, 15 were from 6 to 10 years, 11 were from 11 to 15 years and 14 were more than 15 years as shown in (Figure 4). Last the participants were asked what type of organization they are related to as shown in (Figure 5) 50 were working in a contractor organization, 17 were working in consultant organization, 15 were working in owner organization and 10 were located as others such as working in academic field, government or anther organization related to the construction field.

Major

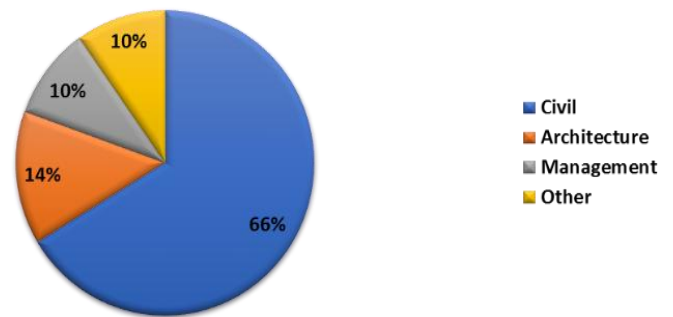


Fig 3: Participant's Major Percentage

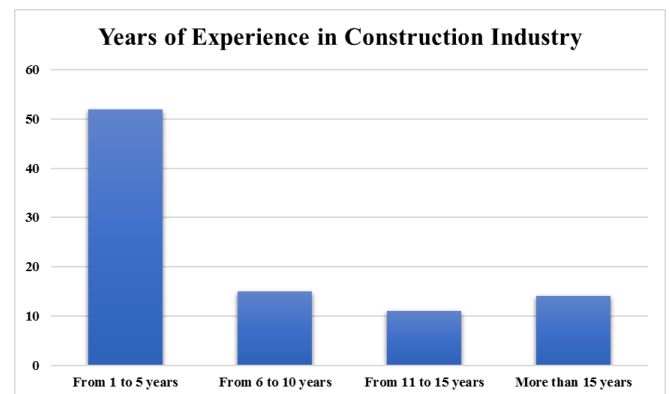


Fig 4: Participant's Years of Experience in Construction Industry

Gender

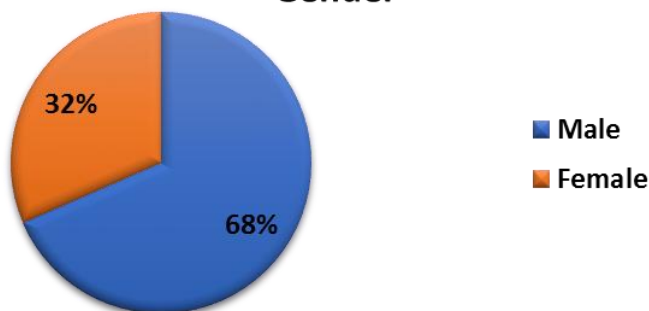


Fig 1: Participant's Gender Percentage

Engineer and Non-Engineer

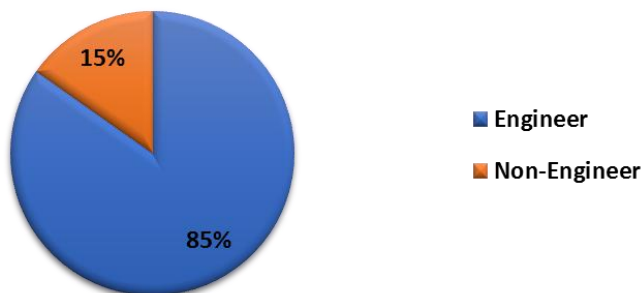


Fig 2: Participant's Engineer and Non-Engineer Percentage

Type of Organization

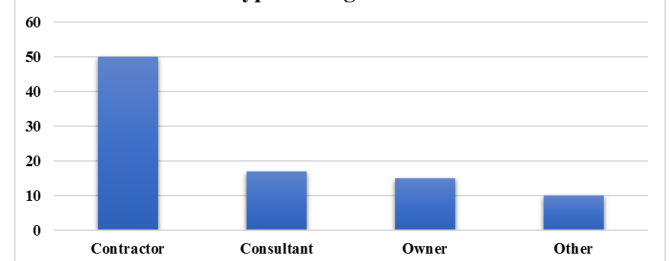


Fig 5: Participant's Type of Organization Working in

5.2 Owner Section Results

The result that obtained from the owner section by using Descartes equation and SPSS program showed that the top ranked factor is owner's financial problems by weight of 70.4 %, while the lowest factor was unrealistic contract duration by weight of 53.8 % and in between impediment to prompt decision-making process by weight of 69.2%, change of scope by weight of 69 %, change in specifications by the owner by weight of 64.8 %, inadequate project objectives by weight of 63.8 %, replacement of materials or procedures and interference of employer are in the same rank by weight of 59.6 %, obstinate nature of owner by weight of 58.8 % and poor communication and coordination by owner and other parties by weight of 58.2 % respectively from high to low ranked factor as shown in (Table 1).

Table 1: Result of Owner's Section

Owner's Factors	Weight %	Mean	Median	Mode	Std. Deviation
Owner's financial problems	70.4	3.826	4	5	1.4343
Impediment to prompt decision-making process	69.2	3.760	4	4	1.0521
Change of scope	69	3.75	4	5	1.3637
Change in specifications by the owner	64.8	3.521	4	4	1.0942
Inadequate project objectives	63.8	3.467	4	4	1.1430
Interference of employer	59.6	3.239	3	3	1.1326
Replacement of materials or procedures	59.6	3.239	3	3	0.9419
Obstinate nature of owner	58.8	3.195	3	4	1.1601
Poor communication and coordination by owner and other parties	58.2	3.163	3	4	1.1509
Unrealistic contract duration	53.8	2.923	3	4	1.3443

5.3 Consultant Section Results

The result that obtained from the consultant section by using Descartes equation and SPSS showed that the highest ranked factor is delays in approving shop drawings with weight of 68.4 % and the lowest ranked factor was design complexity with weight of 55.8 %. While in between comes respectively as shown in (Table 2) delays in producing design documents with weight of 68 %, conflicts among contract documents and errors and omissions in design have the same rank with weight of 67.4, change in design by the consultant and inadequate design have the same rank with weight of 67.2 %, then comes change in specification by the consultant and inadequate working drawing details with weight of 64.6 %, quality assurance/control comes with weight of 64.4%, delay in performing inspection and testing

by consultant with weight of 64.2 %, poor knowledge of available materials and equipment with weight of 61.6 % and un-use of advanced engineering design software comes with weight of 58.4 %.

Table 2: Result of Consultant's Section

Consultant's Factors	Weight %	Mean	Median	Mode	Std. Deviation
Delays in approving shop drawings	68.4	3.717	4	4	1.12246
Delays in producing design documents.	68	3.695	4	4	1.06636
Conflicts among contract documents	67.4	3.663	4	4	1.01934
Errors and omissions in design	67.4	3.663	4	4	1.19777
Change in design by the consultant	67.2	3.652	4	4	1.12352
Inadequate design	67.2	3.652	4	4	1.2876
Change in specification by the consultant	64.6	3.510	4	4	1.15306
Inadequate working drawing details	64.6	3.510	4	4	1.03238
Quality assurance/control.	64.4	3.5	4	4	1.18136
Delay in performing inspection and testing by consultant	64.2	3.489	4	4	0.96641
Poor knowledge of available materials and equipment	61.6	3.347	4	4	1.19922
Un-use of advanced engineering design software	58.4	3.173	3	5	1.37168
Design complexity	55.8	3.032	3	3	1.27055

5.4 Contractor Section Results

The result that obtained from the contractor section by using Descartes equation and SPSS showed that the highest ranked factor is difficulties in financing project by contractor with a weight of 71.6 % and the lowest ranked factor is complex design and technology with weight of 55.8 %. While in between comes respectively as shown in (Table 3) rework due to errors during construction with weight of 71.4 %, poor site management and supervision with weight of 69.6 %, unavailability of skills with weight of 65.8 %, poor workmanship with weight of 64.6 %, shortage of material with weight of 64 %, delay in site mobilization due to unfamiliarity with local conditions with weight of 63.8 %, frequent change of sub-contractors because of their inefficient work with weight of 63 %, unqualified workforce with weight of 62.4 %, shortage of labors and differing site conditions share the same rank with weight of 60.8 %, unavailability of equipment with weight of 60.2 % and high cost of skilled labor scored weight of 57.4%.

Table 3: Result of Contractor's Section

Contractor's Factors	Weight %	Mean	Median	Mode	Std. Deviation
Difficulties in financing project by contractor	71.6	3.891	4	5	1.19022
Rework due to errors during construction	71.4	3.880	4	4	1.20295
Poor site management and supervision	69.6	3.782	4	4	1.22990
Unavailability of skills	65.8	3.576	4	4	1.07144
Poor workmanship	64.6	3.510	4	4	1.06384
Shortage of material	64	3.478	4	4	1.19042
Delay in site mobilization due to unfamiliarity with local conditions	63.8	3.467	4	4	1.12368
Frequent change of sub-contractors because of their inefficient work	63	3.423	3.5	4	1.05073
Unqualified workforce	62.4	3.391	4	4	1.23107

Shortage of labors	60.8	3.304	3.5	4	1.10681
Differing site conditions	60.8	3.304	3.5	4	1.19283
Unavailability of equipment	60.2	3.271	3	4	1.12028
High cost of skilled labor	57.4	3.119	3	3	1.24779
Complex design and technology	55.8	3.032	3	4	1.23547

6. THE MODEL

Variation Order reducing by solutions (VORS) is the model name. VORS was being chosen from a different types of software programming methods such as coding by java, c++ or any other coding language otherwise to be on a website form. A comparison was made between software programming and website form to obtain the best for the users. The comparison was revolving about four axes, which are independency, availability, integrity and be updated easily. Independency cannot be in software program because every operating system for any kind of devices from computers to smart phones has his own coding language, while for the website independency can be exist because it doesn't require specific operating system it can be accessed from any web browsing application. Availability is not found in a software program because a software program needs searching for getting the source then to be installed not easy such as a website form it is only about click and the user are in any time without suffering from non-working source or crashing while installing the software. Integrity in software program is not as in a website form because in a website form everyone using the VORS has the same information and the least update, rather than the software program if a user has an old version without knowing that a new version is out this user will not be up to date, while in the website form all users are seeing the same thing. Be updated easily is one of the important axes in the comparison in software program it will need more coding and complex languages to develop and update the software, while in the website is much easier it's all about data entry and sometimes it needs simple coding. So, the VORS was designed a guide for anyone involved in the construction field by presenting the factors and results that leads to variation order in construction projects and to achieve mainly the objectives in Egypt, but it can be used worldwide. The domain which is the website link of the VORS is been bought for three years and will be extended. The model was designed by using WordPress to build the website to develop VORS. All data and results in VORS is obtained from the research method. VORS link is www.variationorder.com.

6.1 How to Use the VORS

First Step:

Write the website domain URL in the URL place in any web browsing application (www.variationorder.com), then click on the double arrow facing down in the middle of the page

Second Step:

The page will move downward to introduce the model and to give a brief definition about variation order in the construction field, then to start the model click on start in the oval-shape.

Third Step:

The page will move to new page asking the user for what type of organization would like to see its factors, so just one click on the required organization, then a new page will open for the chosen organization.

Fourth Step:

A new page will open showing a table which presents the factors and analysis results for the chosen organization and the weight of Descartes equation, mean, median, mode and standard deviation.

Fifth Step:

Every page on the website contain a button " Contact" at the bottom of the page beside a sentence contain "Happy To Hear Any Suggestion, Missing Data Or Any Question!" by clicking on the button a new page will load with the author contact information to send any suggestion, point of view, rating, any question and if there any missing data.

7. CONCLUSION

- The main aim of this study is to produces a model to guide all partiesinvolved in the construction field by identifying the most important and common causes of variation order in the construction projects in Egypt.
- The thesis tried to analysis the causes of variation order with the help of reading old researches and by the help of the experts, where the expert's feedback and experience were obtained through questionnaire survey.
- Variation order affect the performance, time and cost of any construction project, so that the main causes of the variation order should be identified to achieve projects goals successfully.
- Descartes equation was used to obtain the weight of each cause and by getting the mean, median and standard deviation.
- The top three factors are difficulties in financing project by contractor, rework due to errors during construction and owner's financial problems with weight of 71.6, 71.4 and 70.4 respectively.
- The solutions for the top three factors was obtained from an academic research and from the participant of the questionnaire for the first factor difficulties in financing project by contractor the solution was to have a good budget planner to be avoid any financing problems as well as the third factor owner's financial problems, while for rework due to errors during

construction needs a correction action should be made as if crushing for the schedule if it needs to be crashed to avoid any type of variation order.

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