CHANGE ORDER CAUSES, EFFECTS, CONTROLS AND THEIR IMPACT ON PROJECT COST IN ALBANIAN INFRASTRUCTURE PROJECTS.

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CHANGE ORDER CAUSES, EFFECTS, CONTROLS AND THEIR IMPACT ON PROJECT COST IN ALBANIAN INFRASTRUCTURE PROJECTS.

Submitted by Erjon SADRIJA in partial fulfillment of the requirements for the degree of **Master of Science in Department of Civil Engineering, Epoka University** by,

Assoc.Prof. Dr. Huseyin Bilgin _____
Dean, Faculty of Architecture and Engineering

Assoc.Prof. Dr. Miriam Ndini _____
Head of Department, **Civil Engineering, EPOKA University**

Assoc.Prof. Dr. Elfrida Shehu _____
Supervisor, **Civil Engineering, EPOKA University**

Examining Committee Members:

Assoc. Prof. Dr. …… _____
……Epoka University

Assoc. Prof. Dr. ……..... _____
……..…… Epoka University

Assoc. Prof. Dr. ……..... _____
……... Epoka University

Date: / /2016

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: ERJON SADRIJA

Signature:

ABSTRACT

CHANGE ORDER CAUSES, EFFECTS, CONTROLS AND THEIR IMPACT ON PROJECT COST IN ALBANIAN INFRASTRUCTURE PROJECTS.

Sadrija, Erjon

M.Sc., Department of Civil Engineering

Supervisor: Assoc.Prof. Dr.Elfrida Shehu

Change orders are part of construction industry as they are part of life. Change orders are defined as changes that are done to the projects in different phase of construction as a result of different factors such as design changes, unepredicted issues and other factors, causing different effects to the project like changes in cost, completion schedule and other effects. The change orders causes, effects, controls and their impact on project cost for the Albania infrastructure projects is the subject of this thesis. The scope and objectives of this thesis are to carry out the causes, effects, controls and their impact on project cost for the Albanian infrastructure project found in different regions of Albania. The objectives will be carried out using a survey questionnaire distributed to professionals and using real case studies which were part of the execution of change orders. The survey questionnaire results were analyzed using the Relative Importance Index II method and the case studies using simple probability and statistics formulas and concepts. As a result was found out that the main cause of the change order is siginificant changes in the quantities of work, the main effect was found to be increase in the cost of the project and the main control that must be taken in consideration was found to be use of work breakdown structure. Based on the impact on project cost was found out that the change order totally affect the cost of the Albanian infrastructure project by 1.11% and the cost was miany impacted by substitution of materials or procedures cause.

Keywords: Change Order; Causes, Effects, Controls, Cost Impact,

ABSTRAKT

SHKAQET, EFEKTET, KONTROLLET E NDRYSHIMEVE NE PROJEKT DHE IMPAKTI I TYRE NE KOSTO PER PROJEKTET E INFRASTRUKTURES NE SHQIPERI.

Sadrija, Erjon

Master Shkencor, Departamenti i Inxhinierisë Ndertimit

Udhëheqësi: Assoc.Prof. Dr.Elfrida Shehu

Ndryshimet janë pjesë e industrisë së ndërtimit sic janë pjesë e jetës. Ndryshimet në projekt definohen si ndryshime të bëra në projekt në faza të ndryshme të ndërtimit si rezultat i ndryshimve në dizajn, punimeve të paparashikuara dhe faktorëve të tjerë duke shkaktuar efekte të ndryshme në projekt si ndryshime në kosto, kohën e realizimit dhe efekte të tjera.Shkaqet e ndryshimeve, efektet, kontrollet dhe impakti i tyre në koston e projekteve të infrastrukturës në Shqipëri janë subjekti i kësaj teze. Qëllimi dhe objektivat e kësaj teze janë nxjerrja e shkaqeve, efekteve, kontrolleve dhe impaktin e tyre në koston e projekteve të infrastrukturës në Shqipëri të lokalizuara në pjesë të ndryshme të Shqipërise. Objektivat e kësaj teze janë arritur duke shperndarë një formular tek profesionistët e fushave të ndryshme të ndërtimit dhe duke përdorur projektet reale që kanë qënë pjesë e ekzekutimit të ndryshimeve në projekt.Analiza bazuar në të dhënat e formularit u realizua duke përdorur metodën e indeksit relativ RII ndërsa analizimi i projekte reale u arrit duke përdorur koncepte dhe formula të thjeshta të probabilitetit dhe statistikës. Si rezultat u konkludua se shkaku kryesor i ndryshimeve të projektit janë ndryshimet në sasitë e punës, efekti kryesor u nxorr të jetë rritja në koston e projektit dhe kontrolli kryesor i këtyre ndryshimeve që duhen marrë në konsideratë u nxorr të jetë përdorimi i ndarjes së punës në copëza me të vogla. Bazuar në impaktin në koston e projektit u konkludua se ndryshimet kanë një efekt total në koston e projekteve të infrastrukturës në Shqipëri me 1.11% dhe efekti kryesor në kosto shkaktohej nga zevendësimi i materialeve ose procedurave.

Fjalët kyçe: Ndryshimet; Shkaqet, Efektet, Kontrollet, Impakti ne Kosto

Dedicated to my parents and wife

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

RII	Relative Importance Index
VO	Variation Order/Change Order

CHAPTER 1

INTRODUCTION

1.1. General

Change orders are part of the daily life. They affect every aspect in the human life herein including even construction. Change order in construction are the changes that happens in different phases of the project as a result of different factors causing different impact in the construction up to the failure of the project. Like in every country even the Albania change orders are part of the construction industry causing different impacts on the construction projects. The impacts are different such as cost impact, schedule impact, productivity impact, HSE impact, quality impact and other impacts. Since change orders have such impacts on construction projects they play a significant role in the project performance. In Albania almost all projects have delays in completion and cost impacts as a result of the change order which are not well managed. Because of that this research intends to give to the construction industry the change order causes, effects, controls and their impact on cost for Albanian construction industry by taking in consideration the survey questionnaire done to the professionals and case studies to identify the impact on cost.

1.2. Albanian Construction Environment

Albania has its own environment different or similar to different countries. Every study for the change orders in the construction industry is based on that country environment which is composed of different climate, social-cultural impact, material and equipment availability, manpower availability, codes and standards usage and different financial

investments. These factors have great impact on the change orders so for the Albanian environment these will be taken in consideration.

The Albania climate is composed of all seasons. The temperatures reach up to the 40 degree Celsius in the summer and up to -5 during the winter period. The humidity is within the normality similar to the other Balkan countries. Albanian climate is composed of good weather which does not produce any problem for the contractors except some days where is located the peak hot and the peak cold. But even in those days cases can be worked using different methods. Albania is located in the middle of Balkan and it is a strategic point for the connection to the east countries and European countries. Being in such position there are invested some projects in Albania related to the gas transportation and infrastructure projects. In Albania are found most of the required materials and equipment required to perform the work. About the materials and equipment that are not found in Albania there is a positive fact that those can be found in the nearby countries by avoiding the delays and big cost increases for the provision of those material and equipment making this one just a small problem for contractors that can be solve by good planning and avoiding changes. Manpower is an important factor for performing the work activities and in this case are used the local staff since the quality of the manpower in Albania is mostly composed of semi-qualified manpower making this a problem for contractors for the execution of the works since they can be executed wrongly and causing changes to the project. In Albania there are used different codes like ASTM, Euro Codes, British Standards, ASCI and other codes and standards. Except those codes Albania has its own codes and standards for construction projects that are even used in design. This is another problem for the contractors since more than one code can be used and provide inadequate design resulting then in changes. Another factor in the Albania construction industry is the financial in this sector which is mostly depending on the payment of the executed works by the government which most of the time are not done on time. This results into delays, cost increase and different changes in the project causing difficulties for the contractor.

1.3. Significance of the study

Albania is a country that has been increased in the construction industry the last decade. Since it is located in a strategic point there are many projects invested in Albania which attracts different contractors to execute them. Being a country that is invested in it the standards and quality of the construction industry have been increased and European standards have been started to be followed for different construction disciplines. This makes the terrain of the construction easier for the foreign contractors in Albania but again with lack of understanding of the social, cultural and physical environment of Albania, problem that result in many changes on the project causing delays and cost increases. The change orders con not be evitable in the construction industry. There are different factors which cause changes orders such as error and omissions in design, technology changes, and improvement of the construction method, market conditions and other factors. All those factors cause in the project delays and cost increases. Taking in consideration the above factors the change order must be included as a clause on the contract and must include a process from initiation phase up to the implementation in order to be well managed.

The aim of this paper is to find out the main causes, effects and controls in the construction industry in Albania based on a survey questionnaire and case studies. The case studies then will be used to carry out the effect of the change orders in the project cost. This research should serve as passage for the future research on the change orders in construction industry and how to manage well these changes by reducing or avoiding their impact on project cost.

1.4. Problem Statement

Change orders have many definitions depending on different researches one of which is that the change order is a written order to the contractor, signed by the owner, and issued after execution of the contract, authorizing a change in the work or an adjustment in the contract sum or the contract time. Every change that is done to the project leads to the

impact on time and cost of the project. Change order bring problem to all parties included in the project and in most of the cases are causes of the contractual disputes. There are many reasons that a change order can be issued such as errors and omissions on design, market conditions, slow delivery of the required material and other similar factors.

The aim of this study is to carry out the causes, effects and controls of the change orders on the construction industry in Albania based on the questionnaire and case studies which will be even used to find out the impact of the change order on project cost.

This study will assist in the identification of the factors of the change orders, their effect and how they can be controlled by minimizing or avoiding their impact on the project cost. It lays the foundation for further studies in the future.

1.5. Objectives of the Study

The main objectives of this study are:

- Identification of the causes and factors influencing the change orders based on questionnaire and case studies
- Determination of the effects of the change orders.
- Determination of the controls for the change orders
- Determination of the impact of the change order on the project cost.

1.6. Scope and Limitations

This study will be limited on the infrastructure projects composed of roads and bridge projects with budget up to the 50 million Euros located in different parts of Albania executed by contractors classified as Grade 1 and Grade 2 contractors.

1.7. Key Questions

There are many key questions that will be answered after the accomplishment of this study as given below:

- Which are the causes and factor that influences the change orders?
- What are the effects of the change orders?
- What controls can be taken in order to minimize or avoid the effects of the change orders?
- Is there any impact of the change order on project cost?
- What is the impact of the change orders on project cost?
- How much is the impact of the change orders on the project cost?
- How can the other researchers and professional benefit from this study?

1.8. Research Outline

In order to reach the objectives of this study that are identification of the causes of the change orders, effects, and controls of change orders and finally their impact on project cost a structure is used which is composed of six main chapters each composed of its sub-chapter.

The first chapter is the Introduction chapter. This chapter starts with general sub chapter in which is introduced generally the change orders in construction. This chapter is followed by Albania environment sub chapter where is explained the climate of Albania, socio-cultural impact, material and equipment availability, manpower and the finance in the construction industry all important factor that may influence the change orders .In this chapter is introduced the significance of the study, the problem statement, objectives of the studies together with the scope and limitation of the study. Part of this chapter is also the key questions that will be answered at the end of this study followe by the research outline describing generally each chapter composition and structure .

The second chapter is the literature review chapter. In order to understand better the objectives of this study and to reach at the desired objectives a comprehensive literature review was conducted in order to get the change order definition, change order types, change order legal aspects composed of the contract types, change order policy, change order content, change order typical flow and change order problems. The literature review was used even to identify the possible causes of the change orders, their occurrence and their impact on the project cost. Since the causes of the change orders have effects on the project they need to be controlled and in literature review is conducted a detailed study for the change order control on the design stage, construction stage and design-construction stage. In order to be controlled the change order need to be well managed and as a reason of this another study was done for the change order management for the process that must be followed in order that the change orders to be effectively management by decreasing or even avoiding their effect on construction projects. All the above information was taken from the conducted literature review.

In this chapter is introduced the literature review that is required to perform the study which is composed of the change order definition, change order types, legal aspects of change orders introducing the contract types, change order policy, change order content, typical change order flow and problems of the change orders, factors influencing the change orders and their impact on the cost and the change order controls on design stage, construction stage and design construction stage, change order management procedure composed of change control and change administration and lastly literature review critics.

The third chapter is the questionnaire survey chapter. This chapter introduces the questionnaire survey that is used in this study with its components, the statistical samples, gathering of the data from the professionals and lastly the evaluation of those change orders based on the results of the questionnaire survey. The questionnaire is prepared and is submitted to the professionals in order to be filled according to the instructions. The survey questionnaire is composed of five sections each containing its

information. The first section is composed of general information, second section composed of company information, third section composed of causes of the change orders, fourth section composed of effects of the change orders and fifth section composed of controls of the change orders. These questionnaires will be gathered and will be evaluated based on the scoring done by the professionals to who were submitted. The evaluation of this survey will be carried out using the Relative importance index method. The survey questionnaire survey process will be executed as given in the *Figure 1*:

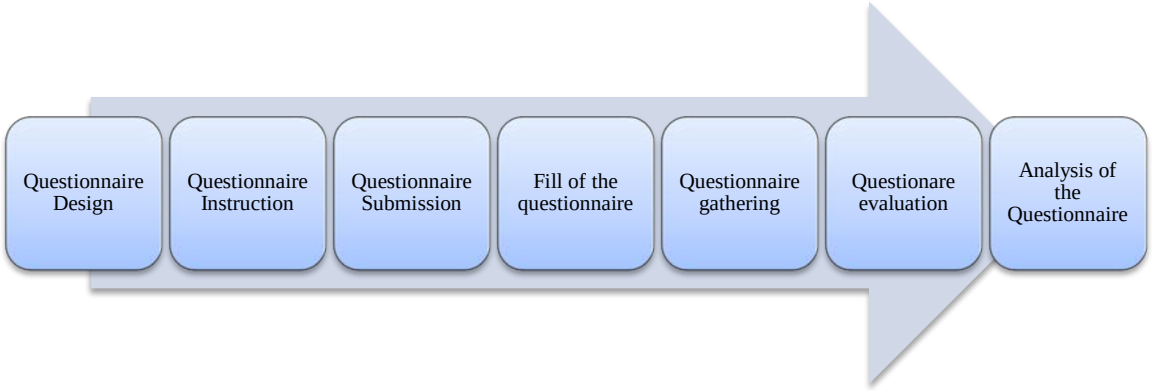

Figure 1. Questionnaire Survey Procedure

The fourth chapter is the case studies chapter. In this study will be used some case studies based on the infrastructure sector and in this chapter will be introduced this cases studies description the change order causes and their occurrence together with their impact on the project cost. Firstly the case studies documents such as variation order, reports, bill of quantity, contract and other documents were collected. The data collected are described in details for every project. After the case studies description the determination of the factors that caused the change order was achieved. Then based on the information of the variation orders documents collected from case studies the impact on cost of the project is carried out. Lastly all the information is collected in the table which then will be used for the analysis process. The main purpose of using the case studies is usage of the real document obtained from real construction projects. Almost

all of the case studies are finished road projects and one of them is ongoing project. The main range that is followed from the case studies is explained in the *Figure 2*:

Figure 2. Case Studies Procedure

The fifth chapter is arranged with the analysis of the questionnaire survey results using the relative index method RII and the case studies information using simple probability and statistical formulas. After the evaluation of the survey questionnaire based on relative importance index and case studies evaluation based on the collected document and the above equation of the Ibss 2003 the analysis and results are carried out. From the analysis of the questionnaire survey the causes, effects and controls of the change orders were evaluated based on the gathered data from the professionals and collected in the table in order to be listed from the most effective one to the less effective one by ending in the answering of the question such what are the main causes for causing the change order, what are the effects of the those change orders and what are the controls of the change orders. All the causes, effects and elements are listed in the table based on the Relative importance index results and standard deviation calculation results. From the analysis of the case studies based on the data gathered from the documents the causes of the change orders were classified based on their happening on the projects. The impact of the variation order on cost aspects was classified based on the results of the equations above classifying them from the causes that impact mostly the cost up to the ones that have less impact.

The last and sixth chapter is the conclusion and recommendation chapter which is composed of the conclusion part and recommendations for those types of studies.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

Change order is a wide spread word and problem all over the worlds construction industry. Changes are necessity for modifying the contract as a result of the construction circumstances. The change orders are included in every stage of the project causing different impacts on cost, time, productivity and other fields of engineering. Change order can be small and well managed as a result of which may have little effect on the project but the changes can be even large and poor managed resulting in high negative impacts on the project time and cost. For this reason the change order management is very important in the construction industry in order to avoid those problems. There are many articles and researchers dealing with the change order management starting from the cause of the change orders, effects of the change orders, controls of the change orders, impact of the change orders using different methods in order to provide a better procedure for the effective management of project changes. In this study the literature review is used for identification of causes of the change orders, their effect, controls and impacts of those changes on project cost based in previous studies by different researchers.

2.2. Change Order Definition

Change order definition is a wide definition given differently by many researchers. Some of the definitions for the change orders are given below. According to the Gallow 2007 change order is defined as transformation or modification, a variation or deviation, the substitution of one thing for another and a replacement or substitution (Galloway.P,

2007). Change order is defined as "an action that specifies and justifies a change to the scope of a construction contract that alters the original time of completion or the project total cost, or both" according to the Mokbel 2003 (Mokbel.H, 2003). A change is any modification to the contractual guidance provided to the contractor by the owner, owners agent, or design engineer a definition by CII, 2000 (CII, 2000). According to the Lee 2001 any event, which results in a modification of the original scope, execution time or cost of work is called as change order (Lee.M, 2001). A change order is a legally binding document used to make changes to the contract is another definition of the change orders by CALTRANS 2014 (Caltrans, 2014).

2.3. Change Order Types

Change orders can be classified into different types depending on the basis and purpose classification. According to the procedure used to introduce them there exist three main types of change orders (Hanna, 2002).

- Formal changes otherwise called as directed changes is the type of the change order which arises as a result of the direct order for changing the plan and specification and/or acknowledge that change are being made directed by the owner or owners representative.
- Constructive change is the type of change which arises in the circumstances when the owner by his action and/or inaction changes the scope of work but does not recognize a change. This type includes changes as a result of design problems, interface with the contractor’s responsibilities, clarifications and failure to provide owner furnished items.
- Cardinal changes are changes that arise as a result of the long time recognition in the federal sector of contracting and changes that are beyond the scope of work in other words scope change that can be caused by differing site conditions.

Based on the effect of the change orders are classified into four main types:

- Additive changes are changes that are added to the original scope of work.
- Deductive changes are changes that deleted from the original scope of work.
- Reworks are changes done due to quality deficiencies.
- Force Majeure changes are changes done as a result of the weather conditions which can impact the schedule and cost of the project.

According to the CSU 2007 there exists two types of change orders normal change orders and emergency change orders.

2.4. Change Order Legal Aspects

2.4.1. Contract Types

Change orders are changes done to the project which cause great impact on the performance of that project so they must be managed carefully in contract clause. In most of the construction projects the site engineer has the authority to approve those changes according to the terms of the contract but in some cases the change order are being approved between the owner and contractor by agreeing for the price and change is schedule. The parties may have a direct impact on the change orders based on their responsibilities. The owner cause bad impact on the project by not understanding the objectives, scope and program of work changes which can cause even the disruption of the project. The contractor can cause bad impact by doing installing nonconforming work while the architect can cause a bad impact on design errors groups. As can be observed on the above effects of the change orders and parties, the change orders must be managed effectively and this may be accomplished by taking in consideration the following legal aspects (CEII, 1990):

- Selecting the best delivery system (contract format)
- Drafting and interpreting change clauses
- Documenting change orders to be ready in case of litigation

In order to take in consideration the above factors contract must be carefully prepared. There exist three main types of contracts (Halpin, 2009):

- Competitive Bidding Contract

It includes all types of contracts in which the contractor must submit a financial offer based on the quantity of the work. These types of contract are based on the lowest responsible bidder. The competitive bidding contract is divided into two other subdivisions composed of:

  - Lump-Sum contract is a type of contract from which the contractor quotes a price by including all the services and works that are required to finish the project based on the plan a specification, otherwise called as fixed fee inside which the contractor will perform the work according to the plan and specification. This type of contract is used mainly on building projects.
  - Unit price contract is a type of contract from which the contract quotes a price based on the estimated quantities of the project given in the bill of quantities document. This type of contract is used mainly in heavy projects.

In those types of contracts it is included high risk to the contractor and low risk to the owner.

- Negotiated Cost Plus Contract

In those types of contract the contractor is invited to review the project documentation at the time of negotiation based on which he presents the qualifications to perform the work and the project cost and a fee to perform the works. This type of contract is called as a plus fee contract and is used mainly in the projects that the owner wants to start quickly or the project design in not completed. Based on this type of contract the risk is shared but the mostly the risk is taken by the owner since the cost of the project may increase. These types of contracts are

used mainly in the tunnel projects, power plants projects, process plant and other complex projects. It is divided into four subdivisions:

- Cost plus percentage of Cost

This type of contract includes a cost to complete the project a percentage based on the total project cost.

- Cost plus Fixed Fee

This type of contract includes a cost to complete the project a fixed fee that is percentage of the original estimated total.

- Cost plus Fee plus Profit Sharing

This type of contract rewards contractors who minimize cost and percentage of cost under GMP is considered profit and shared with the contractor.

- Cost plus Sliding Fee
- Cost plus Guaranteed Maximum Price

In this type of contract the contractor is reimbursed at cost with an agreed-upon fee up to the GMP, which is essentially a cap; beyond this point the contractor is responsible for covering any additional costs within the original project scope

- Combination

These are new innovation types of contract which may include combination of contract types in a single project or team works and will be CM administered.

All types of contract must include the following documents:

- Invitation to bid/ Notice to bidders
- Instructions to bidders
- General Conditions

- Supplementary Conditions
- Technical Specifications
- Drawings
- Addenda
- Change Orders
- Proposals
- Bid Bond
- Agreement
- Performance bond
- Payment bond

2.4.2. Change Order Policy

According to CALTRANS when the works are outside the scope of works a new contact must be signed except special situation that can be added to the existing contract if (Caltrans, 2014):

- A director's order has been approved for the new work in accordance with Deputy Directive 26-R2, "Use of Director's Orders", dated July 31, 2009.
- The Division of Construction chief concurs with adding new work to the existing contract by co-signing the director's order,
- On all federal-aid projects, the Federal Highway Administration (FHWA) transportation engineer approves the change as outlined in Section 5-308, "Federal Highway Administration Change Order Requirements," of this manual,
- On locally funded state highway projects, the contributing agency agrees to the change as outlined in Section 5-310, "Locally Funded State Highway Projects," of this manual, and
- The contractor agrees to the change.

In Albania the change order policy changes from the CALTRANS procedure. In Albania is followed the FIDIC red book contract type which is used in most of the projects. According to the red book type of contract the change order policy is as given below (FIDIC, 1999):

- Variations may be intended by the engineer prior issuing the takeover certificate for the works either by being instructed or requested by the contractor.
- Each variation may include:
    - Changes in the quantities of any work activity included in the contract.
    - Changes into quality or other characteristics of any item of work
    - Changes to the levels, positions and/or dimensions of any part of the work.
    - Omissions of any work unless has to be carried out by the others.
    - Any additional work, material, plant or service necessary for permanents works including the required test on completion.
    - Changes to the sequence or timing of the execution of the works.
- The contractor is not allowed to make any change to the permanent works until the Engineer instructs or approves the variation order.
- The contractor may at any time submit to the Engineer a written proposal which according to the contractor may:
    - Accelerate completion
    - Reduce the cost to the employer of executing, maintaining or operating the works.
    - Improve the efficiency or value to the employer of the completed works.
    - Otherwise be of benefit to the employer.
- The proposal must include the cost according to the Contractor.
- If the proposal approved by the engineer include changes in permanent works design unless otherwise agreed between both parties:
    - The contractor shall design this part

    - Sub-paragraphs shall apply
    - If this change results in reduction of the contract price the Engineer shall proceed with accordance of sub-clause 3.5 determinations to agree or determine e new fee which shall be included in the contract price.
- If the Engineer requests for proposal before issuing a variation order the contractor must respond in writing as soon as possible by giving reason why he cannot comply or by submitting:
    - A description of the work that needs to be performed and a programme for the execution.
    - The contractors proposal for any necessary modification to the programme according to sub-clause 8.1 (Programme) and to the time for completion
    - The contractor's proposal evaluation.
- The Engineer immediately after this should responds with approval, disapproval or comments
- If the contracts provide more than one currency for payment after the agreement, approve or determination of the amount the currency shall be specified.
- The provisional sum shall only be used in whole or in part in accordance with the Engineers instructions and the contract price accordingly and must include the amount for the work, supplies and services to which the sum relates. For each provisional sum the Engineer may instruct:
    - The actual amount paid by the contractor.
    - A sum for overhead charges and profit calculated as percentage.
- For works related as minor of incidental nature a variation based on day work basis may be instructed by the engineer (only if this day work schedule is included in the contract) and for each day work the contractor must submit to the engineer:
    - The names, occupations and the Contractors personnel

    - The identification, type and time of Contractors equipment and temporary works.
    - The quantities, material and plants used.
- One copy of the signed and agreed statement will be returned to the contractor.
- The contract price shall be adjusted to take into account changes in the cost as a result of changes in the Laws of the Country or in the judicial or official government interpretation of this Laws made after the Base Date. The contractor shall notice the Engineer for extension of time of such delay and for payment of any such cost.
- Adjustments for changes in cost must be taken in consideration only if the y are part of the Appendix to Tender and the contractors cost must change for any change in the labor cost.

2.4.3. Change Order Content

Change order must be clear and concise and must include the following (Caltrans, 2014):

- Description of the work

In this step must explained what is required to be done by describing added work or the contract change herein including references to the special provisions, contract plans, standard plans or any other documentation required to perform the work. Then the contractor produces the method statement how is going to perform the work and submits to the resident engineer for approval. The detail drawings must be prepared carefully by taking in consideration even the small details like dimensions or if they are not going to be prepared the differences must be clearly identified from the original plans then in both cases must be submitted for approval. Each of the submitted documents must be signed and stamped and dated in each sign and stamp.

- Specifications

If for the change order that are part of the bid item are used in the change order it is not necessary to be repeated while if extra work takes place it is necessary to be a reference for the specifications that are going to be used which will be even mentioned in the supplementary condition in the contract that will be executed for change order.

- Methods of Payment.

The payment method for the change order is determined by the resident engineer and is some types that can be used for this purpose as given below:

- Bid Item Unit Price
- Bid item unit prices with a payment adjustment at agreed unit price or lump sum.
- Payment adjustment at agreed unit price or lump sum.
- Force account.
    - Payment adjustment.
    - Extra work.

Changes in planned work or addition or removal of work results in increases or decreases in the bid item quantities. All the increases or decreases must be indicated since they have an effect on the payment quantities which must be even mentioned as the bid item quantities. Payment adjustments are estimations that are done to the quantities or cost which represents the quantities of the changes. Extra is also part of the changes that can happen in a project. In this case the extra work will be paid independent of the bid item quantities. This extra work can be paid in an agreed price to perform the work according to the changes or by force account in the cases when the work cannot be estimated within reasonable limits of accuracy, when the resident engineer does not agree with the contractor for the unit or lump-sum price and when a contractor refuse to sign a change order.

- Adjustments to time of completion

A change order may have a positive, negative or may not have any effect on the completion time of the project. When the effect on time for completion can be estimated reasonable this adjustment will be mentioned in the change order together with the file of contract records and calculations used for this purpose. If the time adjustment cannot be estimated in the initial change order defer of the adjustment can be done while if the approval with the contractor cannot be realized a a unilaterally approved supplemental change order adjusting time will be issued. The resident engineer cannot decrease the time unless it is stated in the specifications or an agreement with the contractor is reached otherwise the recommendation for the approval must not be done if from this change orders are not benefits but if substantial benefits exist a unilaterally approved change order with no time adjustment will be issued.

- Change order standard clauses

These are specific situations for various types of change orders.

- Work Designated as Extra Work in the Specifications.

In this case the standard specifications and special provisions describe certain work and specify that it is to be paid for as extra work.

- Change Order Format

This is the format that is used to issue e change order.

2.4.4. Change Order Flow Chart

- ✓ The need for a change arises.
- ✓ A change is identified and all options are evaluated.
- ✓ The project Engineer obtains all change concept approvals required by the Change Order Checklist.

- ✓ The Project Engineer prepares Plans Specifications and Estimates (PS & E) type documentation for the change, including an independent estimate to justify the cost, and any new or revised plan sheets required to detail and describe the work.
- ✓ The Project Engineer meets with the Contractor to discuss the terms of the change and to negotiate agreed pricing and time.
- ✓ The change is formalized with a written change order.
- ✓ The change order is submitted to the Region Construction for review and/or execution.
- ✓ Region sends the change order to the State Construction Office for review and/or execution.
- ✓ The change order is executed, sent to the Contractor, and the Contractor proceeds with the change work.

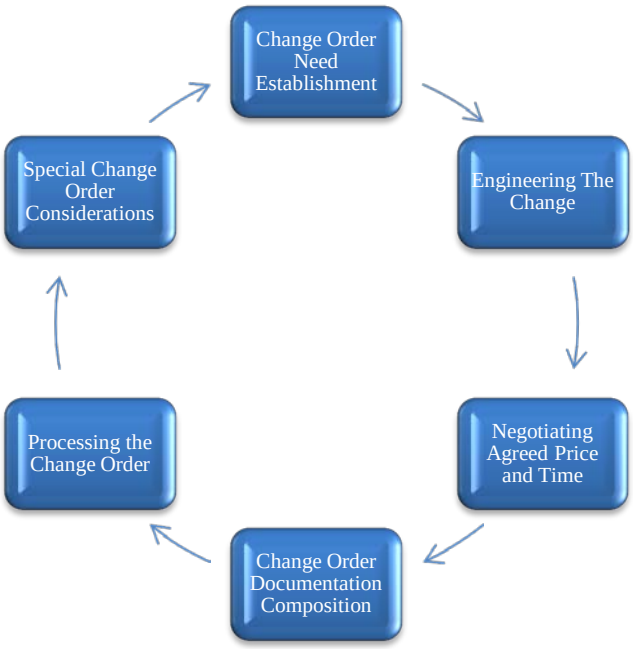

Figure 3. Change order Flow

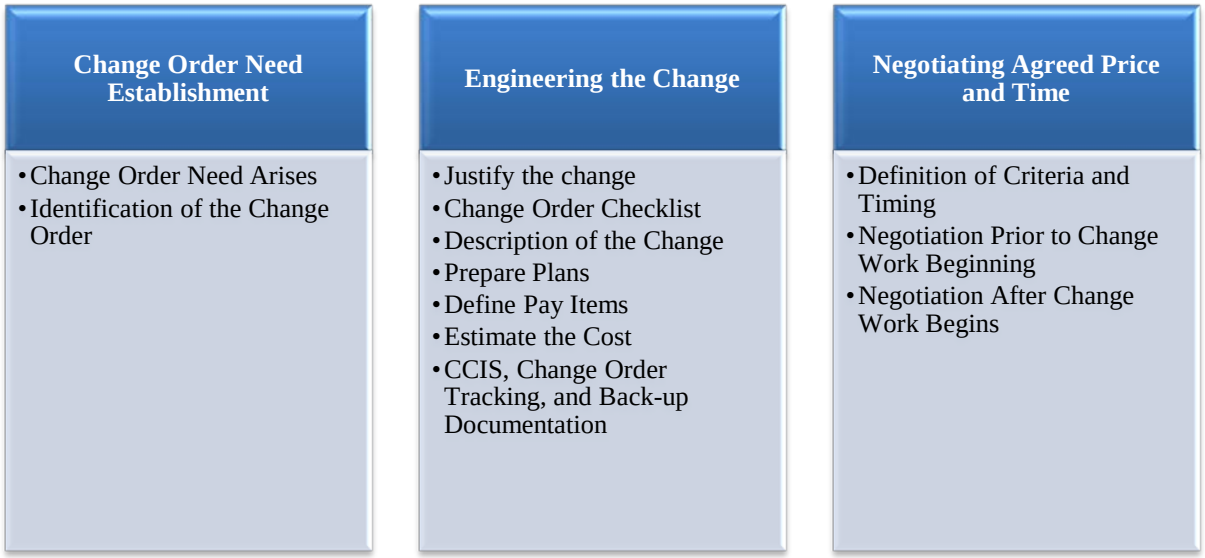

Figure 4. Change Order Flow Chart Description

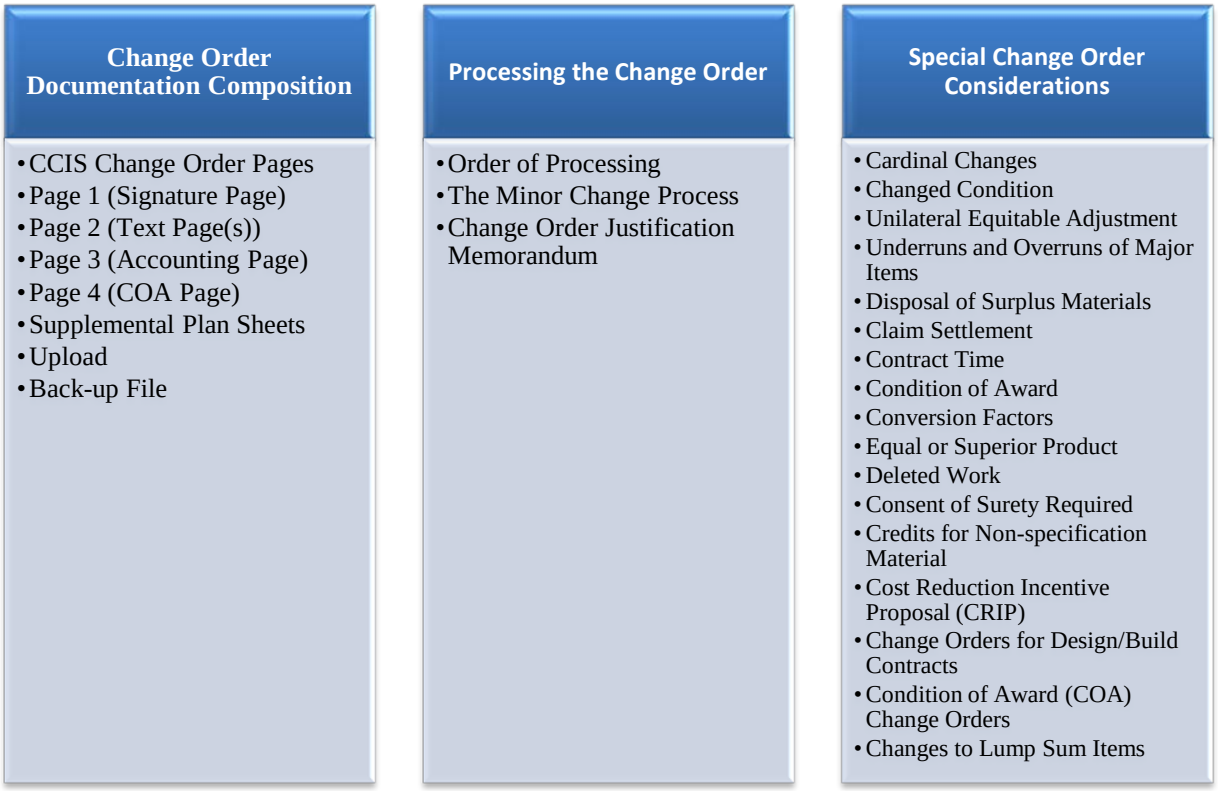

Figure 5. Change Order Flow Chart Description (cont)

2.4.5. Change Order Typical Problems

- After the fact change orders

In this case the after fact change order is compounded by the fact that the price is unsupported or the change should not have been allowed causing even strained relationships between the Contractor and Project Engineer, Project Engineer and the Region and the Region and the Headquarters.

- Unjustified need

In this case the change must be clearly described that even the persons that are not inside the project to understand the changes. If this change is not clearly justified may not be approved.

- Unacceptable Credit or Substitution

In normal case the contractor includes a credit for the equal products but may be even product that will benefit from state which does not include cost.

- Inappropriate No Cost Change Orders

If no costs are proposed from the contractor may fail to report the equal or superior product situation so in many cases the contractor is proposing the changes because of some benefits that he is going to have. But in the case that the change does not provide a bonus for the contractor a no-cost change order may be used.

- Failure to Follow Guidelines

Like each process the change has its own guidelines that must be followed otherwise errors such as lacking of approval, missing documentation order or signing by wrong person may be mentioned.

- No Prior Approval to Proceed

A construction must be executed in writing by the executing authority before the change works are performed. This approval must be signed and documented before starting the works together with the change order package and submitted to the necessary authority.

- Failure to Follow Through

Sometimes the approval is given before the change order credibility systems meaning that the change order need to be executed immediately and will follow as soon as possible.

- Incorrectly Marked

In the cases the change order does not give credit to the state should be marked so the proposed changes must be carefully marked according the state benefits.

- Insufficient Detail

The information of the change order must be well justified and cleared in order to be understood by the non-engineers and should include a cost estimation.

- Inadequate Description

The change order must be carefully described including the method of measurement and payment in the change order text.

- Lack of Entitlement

When the change order provides additional moneys or time to the contract the entitlement must be established in the justification memo together the documents which include independent cost estimation.

- Surplus Material

The items deleted from the project must be documented and kept carefully.

- No Approval

The Project engineer is not approving the changes without the passing them to the region or State construction office and without having a written change order. But the Project engineer is placed in awkward position where the approval from the state construction office has not been done.

- Inappropriate Approval

Sometimes the changes are not coming with the correct approval documentation to the state construction office. They may have the marked approved by the Region that has structural changes but they do not have approval from the State Construction office which may cause problems.

- Time

The time impact on the project must be addressed and resolved from the change order. Sometimes the Project engineer may not come to an agreement to the time extension. The best solution is that at the very end an agreement should be made to address the time as soon as the change order is finished in order to calculate and resolve the time impact.

- Incidental Work

Incidental works must be included into special provisions, amendments, or Standard Specifications during the change order process and if it is not clearly processed may result in double payment that is not allowed.

- Actual Vs Prior Approval Types or Quantities

If the quantities calculated in the change order does not agree with the quantities that will be executed specific items and quantities may be executed and approved while if they change during process a new approval may be warranted.

- Structural Change

Each of the changes should be checked and evaluated if it is a structural change or not and if it's a structural change the determination and approval from the state construction office must be required.

- Incorrect Item or Group

Change orders often are represented by items and groups by the Region and the State Construction Office which may have incorporated them wrongly. So the project office should check if the item and groups affected by the change order are correctly represented in the change order document.

- Constructive Changes

Constructive changes are changes happening to the project during the execution and are not recognized as a change order at the moment. In case of disputed the construction changes must be mentioned in the daily reports and other field documentation must be mentioned if they did occur and what impact they had.

- Condition of Award not coded.

Condition of the Award must be coded in order to mention the changes

2.5. Change order Influencing Factors

Some of the factors that influences and causes change orders collected from previous similar studies are listed in the *Table 1* below:

Table 1. Change Order Influencing Factors

No.	Groups	Factors	References
1	Design Errors	Inadequate Design	(Arain, 2005)
		Inadequate Shop Drawing Details	(Arain and Pheng, 2005)
		Inadequate Working Drawing Details	(Arain and Pheng, 2005)
		Consultant Lack of Required data	(Arain and Pheng, 2005)
		Change in Specification by Consultant	(Arain and Pheng, 2005)
		Design Criteria Changes	(WSDOT, 2007)
		Changes in Design by Consultant	(Arain and Pheng, 2005)
		Non-compliance of Design with Owner's Requirements	(Arain and Pheng, 2005)
		Change In Design	Al-Dubaisi (2000)
		Errors and Ommissions in Design	Al-Dubaisi (2000)
2	Changes in Market Conditions	Specified Item Became Unavailable	(Hunt, 2005)
		New products became available cheaper, more efficient	(Hunt, 2005)
		The required tools and equipment are not available	Halwatura and Ranasinghe (2013)
		Substitution of Materials or Procedures.	Halwatura and Ranasinghe (2013)

3	Scope and Quantities of Work	Significant changes in the quantities of the work	(Ohio Department of Transportation, 1998)
		Construction method	(Ohio Department of Transportation, 1998)
		Plan Errors	(Ohio Department of Transportation, 1998)
		Material Plan Errors	(Ohio Department of Transportation, 1998)
		Change of Plans by Owner	(Arain and Pheng, 2005)
		Change of Scope by Owner	(Arain and Pheng, 2005)
		Changes in Specification by Owner	(Arain and Pheng, 2005)
		Contractor financial difficulties	Al-Dubaisi (2000)
		Change of schedule by owner	Al-Dubaisi (2000)
		Inadequate project objectives	(Arain and Pheng, 2005)
		Owner Financial Difficulties	Desai, Pitroda and Bhavasar (2015)
		Contractor Desire to Improve his Financial Conditions	Al-Dubaisi (2000)
		Inadequate Planning	Halwatura and Ranasinghe (2013)
		Poor Estimation	Halwatura and Ranasinghe (2013)
4	External Conditions	Uncovering Disclosed Exisitng Conditions	(Hunt, 2005)
		Extreme Weather Conditions	Al-Dubaisi (2000)
		Moterial Non-Availability	Desai, Pitroda and Bhavasar (2015)
		Unforeseen Site Conditions	Halwatura and Ranasinghe (2013)
		Poor Investigation	Halwatura and Ranasinghe (2013)
5	Differing Site Conditions	Differing Site Conditions	Al-Dubaisi (2000)
		Safety Considerations	Al-Dubaisi (2000)
		Differing Subsurface Conditions	(Ohio Department of Transportation, 1998)
6	Suggestion to Initiate Better	Suggestion to Initiate Better	(Hunt, 2005)
		Suggestion to Initiate more Economical Construction	(Hunt, 2005)
		Value Engineering	Al-Dubaisi (2000)

7	Changes in Design Preference	Non Performance of a Team Member	(Boot, 2005)
		Delays in the project	(Boot, 2005)
		Delays in the Approval	Halwatura and Ranasinghe (2013)
		Defective Workmanship	Al-Dubaisi (2000)
		Unavailability of Skills	Al-Dubaisi (2000)
		Unavailability of Equipment	Al-Dubaisi (2000)
		Poor Procurement Process	(Arain and Pheng, 2005)
		Long Procurement Process	(Arain and Pheng, 2005)
		Poor Performance of Contractors	Halwatura and Ranasinghe (2013)
		Additional Pre-eliminaries due to Time Extension	Halwatura and Ranasinghe (2013)
8	Contract Conditions	Contract Conditions	(Boot, 2005)
		Size of the Project	(George, 1982)
		Contract Type	(George, 1982)
		Owner's Project Budget	(George, 1982)
		Consultant’s lack of judgment and experience.	(Arain and Pheng, 2005)
		Lack of consultant’s knowledge of available materials.	(Arain and Pheng, 2005)
		Contractor’s lack of judgment and experience.	(Arain and Pheng, 2005)
		Contractor’s lack of required data.	(Arain and Pheng, 2005)
		Lack of a specialized construction manager.	(Arain and Pheng, 2005)
		Fast track construction.	(Arain and Pheng, 2005)
		Contractor’s desired profitability.	(Arain and Pheng, 2005)
		Mathematically unbalanced Bid.	(Manzo, 1998)
		Material unbalanced Bid.	(Manzo, 1998)
		Conflicts Between Contract Documents	Al-Dubaisi (2000)
9	Actions by Other	Utility Companies	(Ohio Department of Transportation, 1998)
		Regulatory Agencies	(Ohio Department of Transportation, 1998)

9	Actions by Other	Local Governments	(Ohio Department of Transportation, 1998)
		New Government Regulation	Al-Dubaisi (2000)
		Political Pressure	Halwatura and Ranasinghe (2013)
		Change in Economic Conditions	Halwatura and Ranasinghe (2013)
		Local Residents	Halwatura and Ranasinghe (2013)
		Suspension Of Works	(Ohio Department of Transportation, 1998)
		Socio-Cultural Factors	(Arain and Pheng, 2005)
		Addition or Deletion of the Work	(Ohio Department of Transportation, 1998)
		Building Codes/Inspectors	(Hunt, 2005)
		User Needs	(Hunt, 2005)
10	Final Coordination	Scope	(Arain and Pheng, 2005)
		Mechanical and Electrical Provision	(Arain and Pheng, 2005)
		Lack of Coordination	(Arain and Pheng, 2005)
		Technology Changes	Al-Dubaisi (2000)

2.6. Change Order Impact on Project Cots

One of the impacts of the change orders is in cost aspects. Cost includes items such as home-office overhead, increased labor costs, equipment and material costs, financing costs, and overhead which are very difficult to be calculated according to the change order impact. The cost impact is calculated as the difference between the end cost and the original budget (Al-Hams, 2010). There exist different models in order to measure the cost impact of the change order. One of the models is the Ibbs et al, 2003 model which calculated the cost impact based on the equation below (Ibbs, 2003):

$$Change\ In\ Cost\ (\%) = \frac{Final\ Cost - Original\ Budget}{Original\ Budget}\ x\ 100$$

Another model for calculation of the cost impact was built by Serag and Oloufa (2007) based on the equation below (Al-Dubaisi, 2000):

$$\%\ inc.\ due\ to\ change = \frac{Cumulative\ Cost\ of\ the\ Change\ Order\ to\ date\ x\ 100}{Original\ Cost\ of\ the\ Project}$$

In both case the calculation of the cost impact is based on the original cost/budget of the project.

2.7. Change Order Control Measures

The controls for the change orders are required to be based on three different stages with its elements as given in the diagram below:

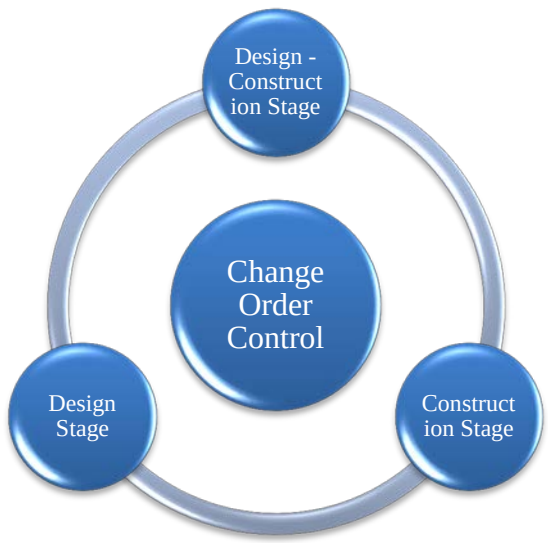

Figure 6. Change Order Management Stages

Each of the stages is composed of its own elements as given in the diagrams below:

Design Stage	Review Of Contract Documents
	Freezing Design
	Value engineering at conceptual phase
	Involvement of professionals at initial stages of project
	Owners involvement at planning and design phase
	Contractor's involvement at planning and scheduling process
	Thorough detailing of design
	Clear and thorough project brief
	Reducing contingency sum

Figure 7. Change Order Management Design Stage

Construction Stage	Clarity of change order procedures
	Written approvals
	Change order scope
	Change logic and justification
	Project manager from an independent firm to manage the project
	Restricted pre-qualification system for awarding projects
	Owners involvement during construction phase
	Avoidance of use of open tendering
	Use of project scheduling/management techniques
	Comprehensive documentation of change order

Figure 8. Change Order Management Construction Stage

Design-Construction Interface Stage	Prompt approval procedures
	Ability to negotiate change
	Valuation of indirect effects
	Team effort to control change orders and coordination
	Utilize work breakdown structure
	Control the potential for change orders arising through contractual clauses
	Comprehensive site investigation
	Use of collected and data compiled by owner, consultant and contractor
	Knowledge-base of previous similar projects

Figure 9. Change Order Management Design-Construction Interface Stage

The above stages and its element will be described briefly in the below sub-sections:

2.7.1. Design Stage

This stage is composed of nine control tools which must be taken in consideration as given below (Al-Dubaisi, 2000):

1. Review of contract documents

The contract documents include plans which are followed from the project works so they must contain comprehensive and balance changes in order to improve the coordination and communication.

2. Freezing design

There are numerous change orders that are born from the owners and users desires. Therefore, closing the door for changes after the completion of the design freezes the design in a strong control method.

3. Value engineering at conceptual phase

Value engineering is the process that helps in decreasing the cost by increasing the quality and it is a factor must be taken in consideration in design phase since it defines even better the project objectives and reduces the design interventions.

4. Involvement of professionals at initial stages of project

If at initial stages are involved professional the chances to make changes in the later stages will decrease since the professional ones take in consideration some of the changes that can happen before execution stage.

5. Owner’s involvement at planning and design phase

Owner must be included in the planning and design stage since by involving him in these phase helps to understand better what he wants from the project, objectives of the project, specifications and requirements so the chances to plan and design are more accurately done causing even decreasing or avoiding the changes as a result of owner.

6. Contractor's involvement at planning and scheduling process

If the contractor is involved in the planning and scheduling process by his experience can help to initiate better and reduce or avoid the changes.

7. Thorough detailing of design

Thorough detailing of design helps for identification of the design errors and omissions in the early stages.

8. Clear and thorough project brief

This step is a good tool to describe the objectives and scope of the project to all participants by reducing and avoiding the changes in early stage.

9. Reducing contingency sum

By including a large contingency sum gives the designer the idea not to provide a detailed design which can cause in the later stages change orders as a result of missing details.

2.7.2. Construction Stage

This stage is composed of ten control tools that must be taken in consideration as follow (Al-Dubaisi, 2000):

1. Clarity of change order procedures

In the construction stage is very important to be clarified to all parties the change order procedures which may lead in reducing the processing time and avoiding other issues.

2. Written approvals

It is very important to be taken in consideration the written approval for change orders before they are being executed by the owner or an authorized person in order to avoid missing of the changes in the price of the project.

3. Change order scope

The first step in order manage effectively and avoid the conflicts between the parties is definition of the change order scope. By defining the scope the change orders process will be easily managed and approved even by knowing briefly the change orders effects.

4. Change logic and justification

Change logic and justification is one of the principles for effective change management. Change can be classified as required changes which are the changes which verified the original objectives of the project, and elective changes which are additional features that enhance the project. The logic and justification of the changes helps to understand better the change by knowing its advantages and disadvantages.

5. Project manager from an independent firm to manage the project

This step is important for the changes in order to avoid the lack of coordination between the professionals.

6. Restricted pre-qualification system for awarding projects.

In the phase of choosing the contractor that will execute the works ,in the bidding process it is very important that the bids to pass over a restricted prequalification system in order to award the project to the lowest responsible bidder which is the ones which is able to perform the work within the specifications and drawings by the lowest cost.

7. Owner’s involvement during construction phase

The involvement of the Owner in the construction phase supports in the identification of the works that are not under the requirements, approving of the changes and keeps him within ongoing activities by helping him in the decision making.

8. Avoidance of use of open tendering

In order to avoid the selection of the wrong contractor for the execution of the works it is better that every contractor follows step number 6 in the construction stage for the selection of the responsible contractor. If the open tendering is avoided the very low process and claims from the contractor are even avoided.

9. Use of project scheduling/management techniques

Since the change order have impact on the project time it is important to decide a flexible schedule where can be included this impact by using different scheduling techniques such as CPM or PERT.

10. Comprehensive documentation of change order

This step is important in order to keep the change orders and claims in tracking the effects of the change and claim events on time and cost.

2.7.3. Design – Construction Interface Stage

This stage is composed of nine control tools that must be taken in consideration as given below (Al-Dubaisi, 2000):

1. Prompt approval procedures

Every change order has its steps from the proposed change up to the rejection or approval of this change. These steps include a period of time between them which causes increase in cost by increasing this period. In order to avoid this problem it is better to have approval procedures for the change orders.

2. Ability to negotiate change

If the person that is dealing with the change has skills and ability to negotiate the change to the professional team helps in reducing or avoiding the negative impacts of the changes.

3. Valuation of indirect effects

The change orders have direct and indirect affect. It is important to identify and evaluate even the indirect effects since they start to be appeared later in the downstream phases of a project. By taking in consideration both effects the total effect of the change order can be calculated.

4. Team effort to control change orders and coordination

The good coordination of the main team parties herein including the owner, consultant and contract help in identifying and managing effectively the change order since the impact can be identified and evaluated easily.

5. Utilize work breakdown structure

The work breakdown structure it is an important tool in order to classify the work. In this case even if the activity is a new one can be added to the work breakdown structure and linked to the other activities.

6. Control the potential for change orders arising through contractual clauses

In order to control the change order arising the appropriate contract form selection is one of the best steps since in the contract form can be mentioned the change order clauses helping in effective management of the changes.

7. Comprehensive site investigation

A detailed and clear site investigation should be done in the design stage otherwise if problems are observed during the construction phase cause the differing site condition changes cause which has a great impact on the project time and cost.

8. Use of collected and data compiled by owner, consultant and contractor

The importance of this step is in development of a database where the change orders are entered in order to show the change order and their impact even to the other team that they need it.

9. Knowledge-base of previous similar projects

The experience gained from the other similar project is another important step since it helps in avoiding the same changes in the project.

2.8. Change Order Management

The change order management process is as given in the diagram below, *Figure 10*:

Figure 10. Change Order Management Process

For an effective change management there are some management aspects that must be taken in consideration. In its special publication 43-1 (1994), the CII Project Change Management Research Team recognized five principles for effective change management as given in *Figure 11* (Al-Dubaisi, 2000):

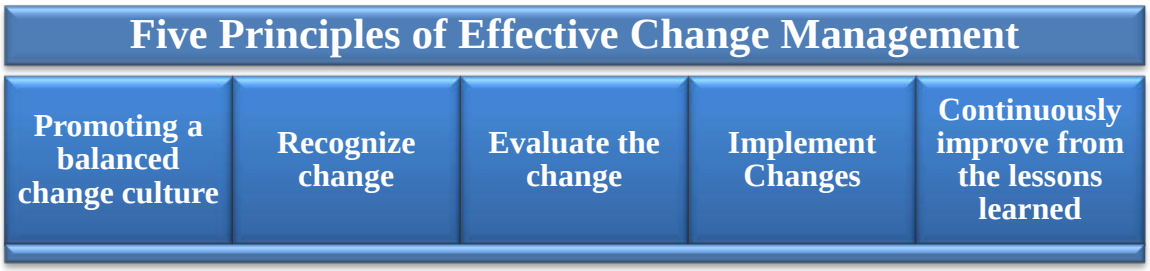

Figure 11. Principles of Effective Change Order Management

- Promoting a balanced change culture

Herein is included the allowance for beneficial changes which are termed from the team the changes that have potential long-term problems while are not included and prevented the changes that are called as detrimental changes which are the changes that have a negative impact on the owner value and causes bad impact on project. In order to prevent the detrimental changes the research team recommended value engineering, understanding the basis of evaluation, financial justification for elective changes, and maintaining accountability.

- Recognize change

Herein is included the environment that allows the parties to agree or disagree for the following change by communicating openly between them. For this step research team recommended some ways to enhance the changes by training team members, flowcharting change management process, devoting specific meetings for change identification, and the regular examination of the total number and value of changes.

- Evaluate change

In this step stage is included the classification of changes as a required change which are changes that are required to meet original objectives of the project and elective change which are additional features that enhance the project. The research team recommended warns against quick judgment in favor of implementing elective changes.

- Implement changes

Herein is included the flexibility of the team members to implement changes on any point in the schedule. Procedure must be established for the changes by authorization which ensures that the changes have been communicated to all parties and documentation. The research team recommended that the implementation process should contain a documentation system to follow up on the overall impact of the changes.

- Continuously improve from the lessons learned

In this step is described the importance of the lesson learned from the past projects in order to improve the changes by avoiding the same mistakes.

As a conclusion the research team concluded that significant savings in total installed costs of construction projects are achievable by improving management of changes

In order to manage effectively a change the need for a well-developed program is established composed of the change control and change administration.

2.8.1. Change Order Control

An important step in the effective change management is the control procedure for the change order which is executed as given in the *Figure 12* below (PRINCE, 2009):

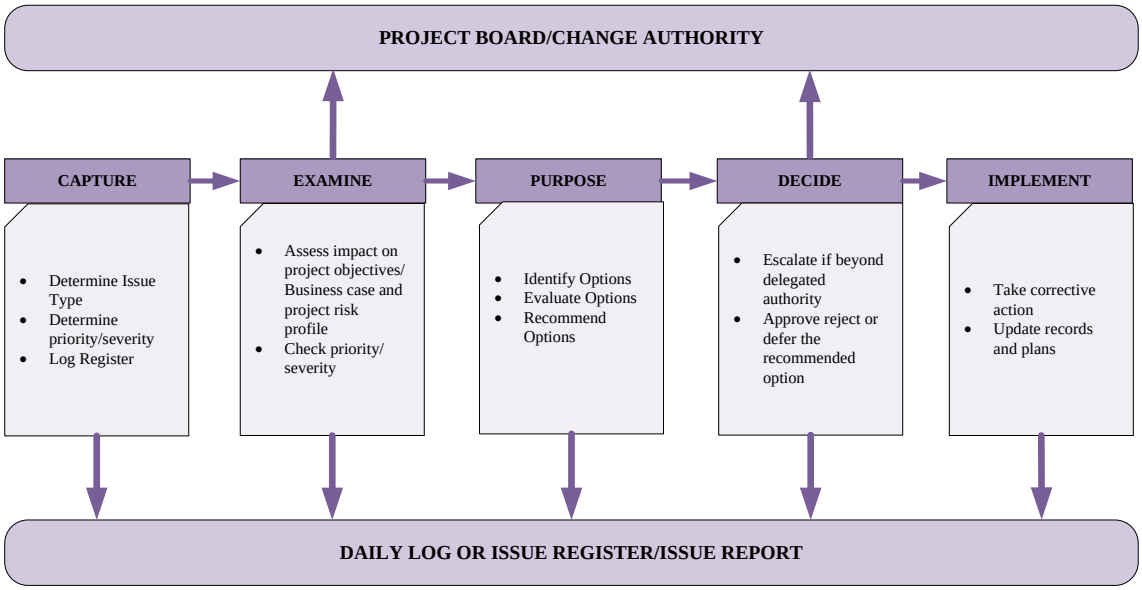

Figure 12. Change Order Control ***(PRINCE, 2009)***

2.8.2. Change Order Administration

Change order administration in the other key after the change control for the effective change management. The procedures and documentation which are part of the change order administration are vital elements in any change order. The process for the change order is long processes which start from the initiation of the change up to the implementation during which a number of formats and guidelines need to be followed.

There are some fundamental elements that are taken in consideration in this phase as given in *Figure 13* below (Al-Dubaisi, 2000):

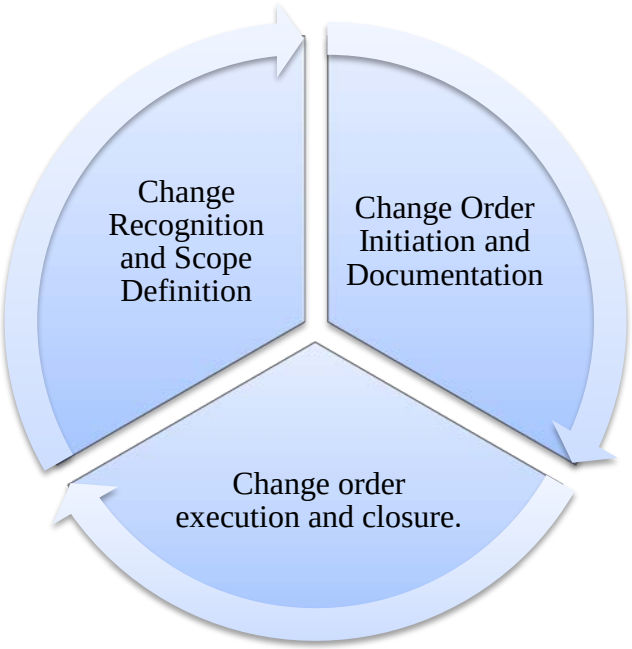

Figure 13. Change Order Administration

Many researcher conducted different researches based on the current procedures that are used for the change order administration. Lidholt (1977) came up with five recommendations as given below (Al-Dubaisi, 2000):

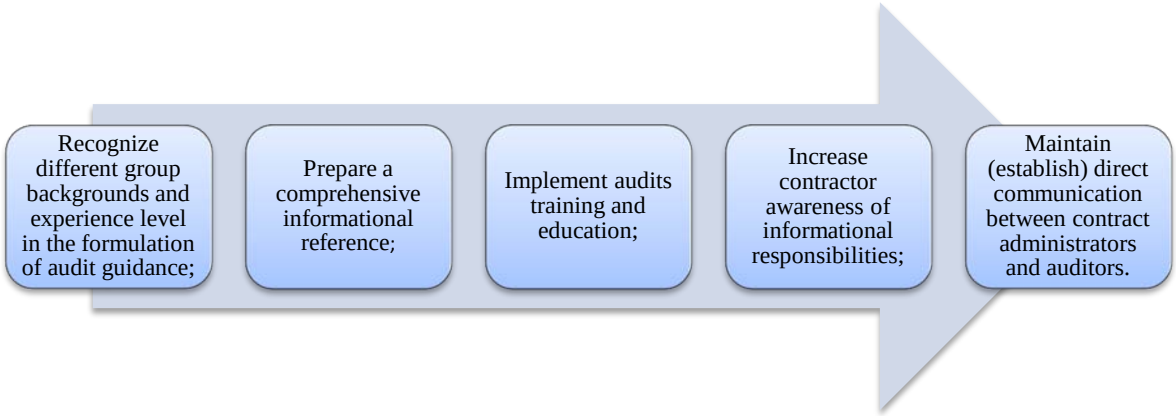

Figure 14. Change Order Administration Process

Parts of the change order administration are the change order scope definition and the change order documentation.

2.9. Literature Review Critics

For the literature review section have been taken in consideration eight different studies performed by different authors from different countries on the world based on the change orders of their construction industry. The first study was completed by Jadhav Onkar Uttam and Prof.Abhijit .N. Bhirud in April 2015 titled "Review Analysis on Causes and Effects of Change Orders on Construction Projects" (Bhirud, 2015). The objectives of this paper were identification of the causes of the change orders, identification of the effects of the causes of the change orders, identification of control measures for the effects of the change orders and provision of the solutions and recommendation for these issues. For the methodology the literature review, survey questionnaire together with discussions and case studies were used. For the analysis the Relative Importance Index method was used and as a conclusion was found out that the changes in design and schedule by the owner is the main cause of the change order, from which the main effect was the increase in the project cost and the control for this change

order was incorporation of the consultant from the pre-eliminary stage and selection of experienced contractor.

The second study was titled “Cost and Time Overruns in Highway Construction” prepared by S. M. Vidalis and F.T. Najafi (S. M. VidalisA, 2002). The objectives of this study were determination of the cost and time overruns in the Florida Department of Transportation finished projects. The methodology was performed using the literature review contents and the finished project documentation while as per the analysis the probability method was used. As a conclusion was carried out that the factors causing cost and time overruns were the plans modifications, changed conditions, lack of project coordination, and design related problems. As per control of those changes was carried out that the contract must be analyzed and pre-eliminary research and investigation must be done.

The third study is titled “Change Orders in Public Construction Projects in Nigeria and Oman” prepared by Ijaola, I.A and Iyagba R.O in 2012 (Ijaola, 2012). The objectives of this paper were identification of the effects of the change orders, parties benefiting from the causes of the change orders, remedies of the effects of the change orders and then comparing to the construction industry change orders in Oman. The methodology used was the previous literature review content and the survey questionnaire. The analysis was performed using the relative importance index method. As a conclusion was carried out that the main effect of the change order was Variations would result in claims and disputes in Nigeria while delay in completion of date of project in Oman. As for the parties benefiting from the causes was the same in Nigeria and Oman the contractor would benefit the most from variations and for remedies in Nigeria was s specialized quantity surveyor/cost controller and project manager should be assigned to large construction projects while in Oman registration of the consultant company should be reviewed to reflect its technical capabilities.

The fourth study was performed by Jaydeep N. Desai, Prof. Jayeshkumar Pitroda and Prof. Jaydev J. Bhavasar in 2015 titled as the “Analyzing of Factors Affecting the

Change Orders on Construction Industry using the Relative Importance Index method" (Jaydeep N. Desai, 2015). The objectives of this study were to develop foundation for this type of study that will be even used in the future and to bring a way how to identify the causes, effects and the proper controls for those change order in order to minimize or avoid their effect on construction project time and cost. The methodology used included the literature review content and survey questionnaire. The analysis was done using the relative importance index method. As per conclusion was found out that the main cause of the change order was owner's financial problem, the main effect of the change order was increase of the cost of the project and the main control for the effects of those change orders was review of grey areas in contract document.

The fifth study was titled "Causes of the Variation Orders in Road Construction Projects in Sri Lanka" prepared by R. U. Halwatura and N. P. N. P. Ranasinghe in 2013 (Ranasinghe, 2013). The main objectives of this study were to found out the causes of the change orders in the road construction projects. The methodology included the literature review, survey questionnaire and case studies. The analysis was performed using the relative importance index method and the statistical analysis for case studies. As a conclusion was carried out that the main cause of the change orders based on the questionnaire was poor estimation while based on the case studies was poor investigation.

The sixth study was titled "Change Management and Change Process Model for the Iranian Construction Industry" prepared by A. Gharaee Moghaddam in 2012 (Moghaddam, 2012). The objectives of this paper were investigation of the existence of the practical change management procedure, analyzing of available change management procedures and adapt to the Iranian Construction Industry and researching and pointing out of the critical factors and requirement regarding the implementation of the change management system. The methodology and analysis included the literature review, quantitative methodology performed by questions and quantitative methodology used to measure tangible features of the concepts, find facts about them and collect these factual

evidences. As per conclusion was carried out that implementing a practical and standard procedure for change management is very important for the Iranian construction industry even approved by the construction leaders of this country.

The seventh study has been performed by Abdulghafoor Habib Al-Dubaisi in 2010 titled as “Change Orders in Construction Projects in Saudi Arabia” (Al-Dubaisi, 2000). The objectives of this study were identification of the main causes, effects and controls of the change order in the construction industry in Saudi Arabia according to contractors and consultants and combined together, finding the severity if those change orders and then testing the hypothesis that the contractors and consultants disagree on the severity of the causes. The methodology included the literature review and questionnaire survey done to a list of contractors and consultant together with the testing of the hypothesis. The analysis used for this study was done according to the statistical analysis, the relative importance index and sample sizes were calculated following farooq 1997 sample formula. As conclusion was found out that the owner is the main source of change orders and change of plans by owner is the main cause of change orders, substituting materials and or procedures is the second source of change orders generated by owner again, followed by the consultant as the second major source to the change orders by generating conflicting design documents, changes in design and/or errors and omissions in design. Three other factors composed of differing site conditions, value engineering and technology changes were resulted as the lowest causes of the change orders. Some other conclusions carried out from this study was that the increase in the project cost and duration are the two main effects of the causes of the change orders and clarity of the scope of the change was ranked as the first control in order to manage the change orders effects. Finally the test results agreed that the contractors and consultants agree on the causes of the change orders.

The last and eight study was prepared by Mohammed F. Al-Hams in 2010 titled “Simulation Model of Change Orders and Their Impact on Building Project Performance in Gaza strip” (Al-Hams, 2010). The main objectives of this study were determination of

the main causes or factors influencing the change orders in building project in Gaza strip together with their frequency, impact of those change orders on the cost, time and productivity of the project and building of a simulation model. The methodology used the literature review content, interviews and case studies. The analyses were performed by the statistical analysis in order to found probability and percentage of occurrence and for simulation model was used Arena program. As a conclusion was found out that the inadequate design was the main factor for causing the change order, followed by change of plans or scope by owner for causing the most impact on the cost of the project and Israeli closure causing the most impact on the project time.

Table 2. Literature Review Critics Summary

No	Title	Author	Year	Objectives	Data Collection	Type Of Analysis	Main Cause	Main Effect	Main Control	Cost Impact	Time Impact	Critics
1	Simulation model of change orders and their impact on building project performance in Gaza strip	Mohammed F. Al-Hams	2010	Determination of the main causes or factors influencing the change orders in building project in Gaza strip	Literature Review	Statistical Analysis & Simulation Analysis	Inadequate Design	Impact on project time and cost	-	X	X	Restricted to projects (200000$ or more), to contractors (Class A and B). to building projects (education buildings, health buildings, and residential buildings).
				Frequency of those factors	Questionnaire Survey							
				Impact of project cost	Interviews							
				Impact of project time	Case Studies							
				Impact of project productivity								
				Building simulation model								
2	Change Orders in Construction Projects in Saudi Arabia	Abdulghafoor Habib Al-Dubaisi	2010	Identification of the causes	Literature Review	Relative Importance Index (RII) & Statistical Analysis	Change of plans by owner	Increase in the project cost and duration	Clarity of the scope of the change	X	X	Limited to large building construction projects (projects costing over 20 million Saudi Riyals , SR. 3.75 = $1) in the Eastern Province of Saudi Arabia executed by building contractors Grade 1 and 2 as classified by the Chamber of Commerce in Dammam
				Identification of the effects	Questionnaire Survey							
				Identification of the control								
				Determination of severity of each cause								
				Testing the hypothesis that the contractors and consultants disagree on the severity of the causes								
3	Change orders in public construction projects in Nigeria and Oman	Ijaola, I.A & Iyagba R.O	2012	Identification of the effects	Literature Review	Relative Importance Index (RII)	-	Variations would result in claims and disputes	Specialized quantity surveyor/cost controller and project manager should be assigned to large construction projects	X	X	Limited on literature review and questionnaire survey
				Benefiting parties	Questionnaire Survey							
				Identification of the control								
				Compare to the Oman construction industry								
4	Analyzing of factors affecting the change orders on construction industry using the relative importance index method	Jaydeep N. Desai, Prof. Jayeshkumar Pitroda & Prof. Jaydev J. Bhavasar	2015	Development of foundation for identifying causes	Literature Review	Relative Importance Index (RII)	Owner's financial problem	increase of the cost of the project	Review of grey areas in contract document	X	X	Limited on literature review and questionnaire survey
				Development of foundation for identifying effects	Survey Questionnaire							
				Development of foundation for identifying controls								
5	Causes of the variation orders in road construction projects in Sri Lanka	R. U. Halwatura & N. P. N. P. Ranasinghe	2013	Identification of change orders on road construction projects	Literature Review	Relative Importance Index (RII) & Statistical Analysis	poor estimation & poor investigation	-	-	X	X	Limited on literature review, on questionnaire survey and case studies
					Survey Questionnaire							
					Case Studies							

6	Review analysis on causes and effects of change orders on construction projects	Jadhav Onkar Uttam & Prof.Abhijit .N. Bhirud	2015	Identification of the causes	Literature Review	Relative Importance Index (RII)	Changes in design plan and schedule by owner	Increase in project cost	Review capabilities of the consultant, Qualified and experienced contractor	X	X	Limited on literature review, on questionnaire survey and case studies
				Identification of the effects	Discussions with site personnel							
				Identification of the control	Questionnaire Survey							
				Provision of solution	Case Studies							
				Provision of recommendation								
7	Cost and time overruns in highway construction	S. M. Vidalis & F.T. Najafi	2002	Determination of the cost overruns in FDOT projects	Literature Review	Statistical Analysis	Plan modifications	Time and Cost overruns	Contract pre-eliminary research and investigation	X	X	Limited in the FDOT projects
				Determination of the time overruns in FDOT projects	Finished projects documentation							
8	Change management and change process model for the Iranian construction industry	A. Gharaee Moghaddam	2012	Investigation of the existence of the practical change management procedure	Literature Review	Qualitative Analysis and Quantitave Analysis	-	-	-	-	-	Limited on the questionnaire survey accurate results based on interviews questionnaire survey.
				Analyzing of available change management procedures	Questinnaire Survey							
				Adapt to the Iranian Construction Industry and researching and pointing out of the critical factors and requirement regarding the implementation of the change management system	Personnal Interviews							

CHAPTER 3

QUESTIONNAIRE SURVEY

3.1. Questionnaire Survey

The questionnaire design is prepared based on the objectives of this study in order to get the answers of the key question found in chapter I section 1.7. The questionnaire design is prepared taking in consideration the construction managers idea, project managers idea, engineering managers idea, project controls and planning ideas and other professionals ideas and their experience in construction in order to conclude in this survey all the required data to perform an effective survey. Taking in consideration their idea and experience in combination with the objectives of this study and literature review part e questionnaire design was prepared in the English language. In order to help to answer to the person that does not know fluently English an Albanian version was even prepared. The questionnaire survey is prepared with detailed understandable question in order to create an easily answered survey for the respondents.

3.1.1. Questionnaire Content

After the summarize of the literature review on causes, effects and controls of the change orders in this chapter the definition of our targets for the accomplishment of this study are achieved. The focused areas are the causes, effect and controls of the change order upon which will be formulated even the questionnaire survey which is composed of below sections:

The first section of the questionnaire survey is composed of the general information of the respondent herein including name, surname, address, university degree and contact information such as email.

The second section is composed of the company and respondent experience information which describes the company name he is working for, the position held at the company and its experience with the construction projects.

The third section is composed of the causes of the change orders. The causes of the change order used in the questionnaire survey and their description are given below:

1. Inadequate Design

This cause includes the designs that are not properly prepared from the designer after which they will be executed. Parts of this section are the inadequate shop drawings and inadequate working drawings which does not contain the necessary details to be executed and because of that change orders are produced.

2. Changes in Design

Change in design in one of the other causes of the change orders. Those changes can come as a result when the project starts without finalizing the design and the design needs to change during the execution leading to changes in design. Those changes can even come as a result of the revised design by the consultant which can change the opinion of the designer.

3. Errors and Omissions in Design

None of the produced documents from design are 100% error free design. At the design package may be found different errors or omissions such as deleted notes, miss-referenced designs and other similar errors. The contractor will try to deviate from the extra cost caused by those errors and omissions and delegate those one to the owner. The main problem here is to minimize the effect of this cause by quality assurance process.

4. Substitution of materials or procedures.

Albania market is composed of all kinds of material. The construction industry does not have a standardization for the materials so because of that the material are chosen during construction process making the material selection difficult and as a reason of this changes may occur in the material type substituting the first planned material with another one while as per procedures it the change that will occur in the execution of different construction activities.

5. Significant changes in the quantities of the work

Since the planning phase is inadequate and the design is inadequate and changes those factor bring to significant changes on the quantities of the work that will be performed. This is one of the cases for issuing a change order.

6. Contractor financial difficulties

In Albanian construction industry there are found many contractors that are responsible for execution of different activities such as excavations, road layer, bituminous surfacing and other activities. Sometimes the contractors are not being paid regularly causing to them financial difficulties which even causes difficulties to finish the works on time withput delaying them making this factor a responsible factor for change order.

7. Owner financial difficulties

The owner like the contractor may have financial difficulties and as a reason of this he will try to reduce the cost. Sometimes even the owner in public construction projects is not paid regularly by the investor causing to him difficulties to finish the works on time causing the change orders. This can be eliminated by adequate planning and cash flow.

8. Inadequate planning

Inadequate planning is on the causes of the change orders. Since the design is inadequate and changes most of the time causes inadequate planning of the activities. By making the inadequate planning the problem to rise a change order is born.

9. Poor estimation

After the design process an estimation process is done in order to plan effectively the construction. But most of the time this estimation is very poor rising the problem for issuing extra estimation from which is needed an extra change order in order to execute the next estimation.

10. Material non-availability

Many of the times the construction project are composed of different materials which can no found inside the country. As a result of the material non-availability is rise the problem for issuing a change order in order to substitute the material, extra time in order to bring from the nearby countries and other similar issues that can be required.

11. Unforeseen Site Conditions.

Before starting the construction phase during the design phase are executed different studies such as geological report, survey report, seismological report and other required reports. But when the construction is starting to be executed problem in the survey, geological conditions may be found causing the interruption of the work. This is unforeseen site conditions which cause change orders.

12. Differing site conditions

This is seen more in the excavation process and geological process when the site condition is assumed to be soft soil but after starting is seen to be hard rock. As a result of this extra cost and time is required by issuing a change order.

13. Safety consideration

If the safety considerations are not taken in detailed consideration during the design phase then in the construction phase the owner may issue some safety actions to be executed casuing change orders.

14. Delays in the approval

Delays in approval are part of the change orders in construction industry in Albania. Following the hierarchical level most of the time is causing delays in approval since the approval process passes into too many persons. In order to approve this delay change order must be issued.

15. Defective workmanship

Workmanship is executing many activities in the construction process. Some persons from workmanship are unskilled workers and as a result of this the work is performed with defects by requiring the demolition of reworking for that activity casing the problem for issuing a change order.

16. Poor procurement process

Procurement process is the main process for the choosing the best bid offer and for furniture of the construction with the required materials. If the procurement process is poor results into delays for the material delivery or choosing of the worst contractor to execute the work resulting later in different problem from which arises the problem of change orders.

17. Long procurement process

Many times the procurement process is longer than must be causing delays in the material delivery or delays in choosing a responsible contractor which affects directly the project by causing delays and extra cost. All those issues bring to the change order arising.

18. Unavailability of skills

Some time in construction project the activities require the specialized group of workers which may not be found in Albania. As a result of this the owner or consultant is required to change the construction method which issues a change order.

19. Unavailability of equipment

The equipment are wide spread types. They are required to perform different work activities from which some time special work activities which need special equipment to be executed. This special equipment may not be found in the country so as a result the construction method must be change by issuing a change order.

20. Poor performance of contractors

Contractors are the main team for the execution of the construction phase activities. As a result of this a poor performance contractor may bring delays in the project, extra cost and other effects causing the problem of the change order.

21. Conflicts between contract documents

Many of the cases the contractor is signing the contract without knowing what it contains and what is composed of. As a result of this at the moment the contractors are being paid are issued different problem from the contract clauses. This brings into delays and extra cost to the project casing the necessity to issue a change order.

22. Weather Conditions

Weather is an unexpected even that can happen at any moment. Force majeure are part of the weather conditions and as a result of those condition the construction works cannot be executed causing the necessity for issuing the change order for extra time and cost. This problem may be solving by an adequate planning phase by taking the weather conditions in consideration.

The fourth section is composed of the effects of the change orders which are listed as given below:

1. Increase in the project cost.

This is one of the main effects foe each if the causes that effects the project as it can be mentioned even from the literature review.

2. Delays in completion schedule

Change orders mostly results into time extension which even results into extra cost. In order to avoid these extra costs the owner is pushing the contractor to follow the original schedule.

3. Increase in each activity duration

By increasing the total duration the each activity duration is increased as a result of this time extension caused by changes.

4. Decrease in productivity

Decrease in productivity is one of the effects of the change orders. By repeating the same change the productivity of the workers is decreased by increasing the time for completion of activity even resulting into project cost increase.

5. Decrease in quality

Decrease in quality is impacted since by changing the activity may result into mismatch to the other area and since the workers are touched from those changes and their productivity is decreased affects even the quality if the work they are performing.

6. Delay in Payment

The payments may be delayed if they are based on milestones and since the time is extended the time to be paid the contractor is even extended.

7. Demolition & Rework

This is an impact of the defective workmanship since their work is not within the requirements and standards and as a result of this the demolition of the executed work is done and rework takes place. This effect is mainly in special required works that cannot be found specialized workmanship.

8. Dispute between owner and contractor

Changes are the main reasons for the claims and disputes between the owner and contractor. The contract conditions are applied but for changes estimation, evaluation and negotiation must be done leading most of the time in problems between parties. These issue can go to arbitration and up the courts and legal aspects from which can be suspended even the project.

9. Increase in Overhead expenses

By increasing in the time extension and the project cost during this period even the overhead expenses are increased in the project based on time extension.

10. Work on hold

Changes in different work activities can put on hold the upcoming activities. This can be seen especially when the activities are independent. Speed and quick change order procedure helps to minimize these effect.

The fifth section is composed of the controls of the change orders which are listed as below:

1. Negotiation of change order

This is one of the controls for the change orders and in order to use this control some skills such knowledge of the contract term, project details, and technical background and

negotiation skills must be present. Otherwise the change can bring disputes, delays and wrong decisions.

2. Clarity of change order procedures

This control is used to clarify the procedures for change orders to all parties, form and instructions must be ready and the responsible persons must be identified. If the steps are followed an effective change order control will be provided.

3. Change order scope

Change order scope is one of the basics for the control process. Like in original design the change order scope must be well defined and the effect of the change must be reviewed in different documents to identify the changes.

4. Approval in writing

If a change order is issued must be written and approved in writing otherwise is difficult to prove the change order in order to get back the financial impact.

5. Justification of changes

When a change order is requested the material that are part of the change order documentation must be clearly described in order to be understandable for the person that is going to control it. The financial impact, change in scope must be determined to examine the effect of the change order.

6. Review of contract documents

The contract documents must be reviewed from the contractors and the owner in order to be updated. Special attention must be given to the grey areas from which can arise different issues. Clarification must be done to earlier stages at different parts of the contract in order to avoid change orders.

7. Freezing design

This control is used in large multi department owner organization. This control provides time for each department to modify its scope something that will result in avoidance of the change orders.

8. Team effort

If all the parties work together as a team to identify and implement project changes an effective change order management.

9. Use of Work Breakdown Structure (WBS)

The work breakdown structure is the breaking down of the activities into small pieces up to which the change orders can be identified and cost tracked forming an effective change order management.

10. Early setting of change order handling procedures

In order to minimize or avoid the change order in the early stages must be provided the process that will be followed for the change order and the person that will be responsible for the change orders.

Below is given a summary of the causes, effects and change orders that are used in the questionnaire survey:

Causes of Change Orders	Effects of Change Orders	Controls of Change Orders
• Inadequate Design • Changes in Design • Errors and Omissions in Design • Substitution of materials or procedures. • Significant changes in the quantities of the work • Contractor financial difficulties • Owner financial difficulties • Inadequate planning • Poor estimation • Material non-availability • Unforeseen Site Conditions. • Differing site conditions • Safety consideration • Delays in the approval • Defective workmanship • Poor procurement process • Long procurement process • Unavailability of skills • Unavailability of equipment • Poor performance of contractors • Conflicts between contract documents • Weather Conditions	• Increase in the project cost. • Delays in completion schedule • Increase in each activity duration • Decrease in productivity • Decrease in quality • Delay in Payment • Demolition & Rework • Dispute between owner and contractor • Increase in Overhead expenses • Work on hold	• Negotiation of change order • Clarity of change order procedures • Change order scope • Approval in writing • Justification of changes • Review of contract documents • Freezing design • Team effort • Use of Work Breakdown Structure (WBS) • Early setting of change order handling procedures

Figure 15. Causes, Effects and Controls Summary

3.1.2. Data Gathering and Evaluation

The questionnaire survey was prepared and distributed to professional personnel which has dealt with project changes in their profession experience. The survey was distributed to 40 people with different professions from which 95 % distributed to the civil engineers of different profiles and different years of experience and 5% was distributed to the financial, environmental dealing persons. From the 40 surveys 26 surveys were returned back completed meaning that 65 % of the people which were part of this survey answered.

A ranking procedure is used for the above causes, effects and controls starting from one which the one that produces most of change orders up to the five which is the one that

produces less the change orders. Otherwise they can be classified from 1-5 as very often up to the never. The detailed classification for the ranking is given in *Figure 16* below:

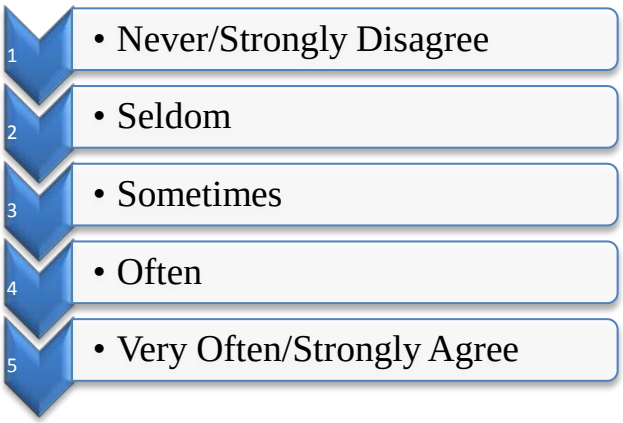

Figure 16. Questionnaire Survey Ranking

According to the answered survey the gathered data is summarized and given at the table below while as per questionnaire survey completed are found in the Appendix A of this thesis. As per below is found the summarizing table of the gathering data of the survey:

Table 3. Data Gathering and Evaluation Of Causes, Effects and Controls of Change Orders

CAUSES OF CHANGE ORDERS																											
Inadequate Design	3.00	2.00	2.00	2.00	1.00	2.00	3.00	5.00	3.00	5.00	5.00	4.00	3.00	5.00	4.00	4.00	5.00	2.00	5.00	1.00	2.00	3.00	4.00	5.00	3.00	4.00	**87.00**
Changes in Design	4.00	2.00	1.00	2.00	1.00	2.00	2.00	3.00	3.00	4.00	5.00	5.00	4.00	5.00	5.00	5.00	4.00	3.00	4.00	4.00	4.00	3.00	5.00	4.00	4.00	4.00	**92.00**
Errors and Omissions in Design	2.00	3.00	4.00	3.00	2.00	3.00	1.00	2.00	2.00	3.00	4.00	4.00	3.00	5.00	4.00	5.00	3.00	3.00	4.00	3.00	2.00	4.00	3.00	4.00	2.00	3.00	**81.00**
Substitution of materials or procedures.	2.00	1.00	1.00	1.00	3.00	1.00	4.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	2.00	2.00	4.00	1.00	3.00	4.00	4.00	3.00	2.00	**74.00**
Significant changes in the quantities of the work	4.00	5.00	4.00	5.00	3.00	5.00	2.00	2.00	5.00	2.00	5.00	5.00	4.00	3.00	4.00	4.00	5.00	2.00	4.00	2.00	1.00	4.00	5.00	3.00	4.00	4.00	**96.00**
Contractor financial difficulties	3.00	1.00	1.00	1.00	3.00	1.00	5.00	1.00	3.00	2.00	2.00	1.00	2.00	1.00	1.00	3.00	1.00	1.00	3.00	1.00	2.00	3.00	2.00	2.00	1.00	3.00	**50.00**
Owner financial difficulties	5.00	1.00	1.00	1.00	3.00	1.00	5.00	1.00	3.00	2.00	2.00	1.00	2.00	1.00	2.00	4.00	3.00	3.00	3.00	1.00	1.00	3.00	2.00	2.00	3.00	3.00	**59.00**
Inadequate planning	3.00	2.00	3.00	3.00	2.00	2.00	5.00	1.00	4.00	4.00	1.00	1.00	5.00	2.00	3.00	3.00	1.00	2.00	3.00	3.00	4.00	4.00	3.00	5.00	2.00	5.00	**76.00**
Poor estimation	3.00	4.00	3.00	4.00	2.00	3.00	4.00	3.00	4.00	4.00	4.00	1.00	4.00	2.00	1.00	3.00	2.00	2.00	4.00	2.00	2.00	4.00	1.00	5.00	2.00	5.00	**78.00**
Material non-availability	2.00	4.00	3.00	4.00	5.00	3.00	4.00	5.00	3.00	5.00	4.00	1.00	3.00	3.00	1.00	4.00	3.00	2.00	3.00	2.00	1.00	4.00	4.00	3.00	3.00	2.00	**81.00**
Unforeseen Site Conditions.	2.00	5.00	5.00	5.00	4.00	4.00	2.00	5.00	3.00	5.00	4.00	1.00	3.00	4.00	2.00	3.00	2.00	3.00	4.00	4.00	2.00	3.00	2.00	3.00	5.00	4.00	**89.00**
Differing site conditions	2.00	4.00	5.00	4.00	3.00	4.00	3.00	3.00	3.00	3.00	2.00	4.00	3.00	4.00	1.00	2.00	2.00	3.00	4.00	3.00	2.00	4.00	1.00	3.00	2.00	3.00	**77.00**
Safety consideration	2.00	3.00	2.00	3.00	2.00	4.00	1.00	2.00	1.00	3.00	2.00	1.00	1.00	3.00	1.00	1.00	1.00	3.00	3.00	1.00	2.00	3.00	2.00	3.00	1.00	2.00	**53.00**
Delays in the approval	3.00	2.00	1.00	2.00	2.00	3.00	4.00	1.00	2.00	1.00	1.00	5.00	1.00	1.00	3.00	2.00	3.00	3.00	2.00	4.00	5.00	3.00	1.00	2.00	5.00	2.00	**64.00**
Defective workmanship	3.00	3.00	3.00	3.00	4.00	2.00	5.00	1.00	1.00	2.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	3.00	3.00	3.00	3.00	3.00	1.00	4.00	1.00	2.00	**59.00**
Poor procurement process	2.00	5.00	4.00	5.00	3.00	4.00	3.00	2.00	3.00	1.00	1.00	1.00	2.00	2.00	1.00	3.00	1.00	2.00	4.00	3.00	3.00	3.00	1.00	2.00	2.00	2.00	**65.00**
Long procurement process	2.00	2.00	3.00	3.00	2.00	1.00	3.00	2.00	3.00	1.00	1.00	1.00	2.00	2.00	1.00	3.00	1.00	3.00	3.00	3.00	3.00	4.00	2.00	2.00	1.00	3.00	**57.00**
Unavailability of skills	2.00	1.00	1.00	1.00	2.00	1.00	2.00	4.00	1.00	2.00	1.00	1.00	3.00	3.00	2.00	2.00	1.00	2.00	2.00	4.00	2.00	4.00	2.00	4.00	1.00	4.00	**55.00**
Unavailability of equipment	2.00	1.00	1.00	1.00	2.00	1.00	2.00	4.00	1.00	3.00	1.00	1.00	3.00	3.00	2.00	2.00	1.00	2.00	3.00	4.00	2.00	4.00	2.00	2.00	2.00	3.00	**55.00**
Poor performance of contractors	3.00	1.00	1.00	2.00	2.00	1.00	5.00	4.00	4.00	3.00	4.00	1.00	3.00	3.00	3.00	2.00	1.00	3.00	5.00	1.00	3.00	3.00	2.00	5.00	4.00	5.00	**74.00**
Conflicts between contract documents	3.00	5.00	4.00	4.00	4.00	5.00	3.00	2.00	3.00	3.00	4.00	1.00	4.00	4.00	1.00	2.00	1.00	2.00	4.00	2.00	3.00	3.00	2.00	5.00	5.00	3.00	**82.00**
Weather Conditions	2.00	3.00	2.00	4.00	4.00	3.00	1.00	1.00	2.00	2.00	1.00	1.00	1.00	3.00	4.00	2.00	2.00	3.00	2.00	2.00	2.00	3.00	2.00	3.00	3.00	3.00	**61.00**
Force Majeure	1.00									2.00							2.00										**5.00**
Suspensions	3.00																										**3.00**
New Items Of Works																	5.00										**5.00**
Construction Delays																	2.00										**2.00**
Subcontractor Claims	4.00									4.00																	**8.00**
EFFECTS OF CHANGE ORDERS																											
Increase in the project cost.	5.00	5.00	4.00	5.00	5.00	5.00	1.00	3.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	4.00	5.00	3.00	4.00	5.00	4.00	4.00	5.00	3.00	5.00	4.00	**113.00**
Delays in completion schedule	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	4.00	3.00	4.00	2.00	3.00	5.00	3.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	5.00	**103.00**
Increase in each activity duration	4.00	2.00	3.00	3.00	1.00	2.00	5.00	3.00	4.00	3.00	4.00	2.00	4.00	5.00	5.00	5.00	4.00	4.00	3.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	**94.00**
Decrease in productivity	3.00	2.00	3.00	3.00	5.00	2.00	3.00	3.00	3.00	2.00	1.00	1.00	2.00	3.00	1.00	3.00	2.00	3.00	4.00	2.00	5.00	4.00	2.00	3.00	2.00	4.00	**71.00**
Decrease in quality	1.00	1.00	2.00	2.00	2.00	1.00	5.00	3.00	3.00	2.00	1.00	1.00	3.00	1.00	1.00	3.00	1.00	3.00	2.00	2.00	2.00	4.00	1.00	2.00	3.00	4.00	**56.00**
Delay in Payment	3.00	5.00	4.00	4.00	5.00	5.00	5.00	3.00	5.00	4.00	3.00	1.00	4.00	1.00	1.00	4.00	2.00	3.00	3.00	2.00	5.00	4.00	2.00	2.00	3.00	4.00	**87.00**
Demolition & Rework	2.00	2.00	2.00	2.00	5.00	1.00	1.00	2.00	2.00	2.00	1.00	4.00	1.00	3.00	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	2.00	2.00	1.00	3.00	**61.00**
Dispute between owner and contractor	4.00	5.00	5.00	5.00	5.00	4.00	5.00	2.00	4.00	3.00	4.00	3.00	3.00	1.00	3.00	5.00	3.00	2.00	3.00	2.00	4.00	4.00	2.00	3.00	4.00	3.00	**91.00**
Increase in Overhead expenses	3.00	4.00	5.00	4.00	5.00	4.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	2.00	4.00	4.00	4.00	3.00	2.00	2.00	3.00	3.00	**91.00**
Work on hold	2.00	4.00	4.00	5.00	5.00	5.00	5.00	4.00	5.00	5.00	2.00	1.00	5.00	5.00	2.00	5.00	4.00	3.00	4.00	5.00	5.00	4.00	3.00	2.00	3.00	3.00	**100.00**
Suspension Of Works										3.00							4.00										**7.00**

CONTROLS OF CHANGE ORDER																											
Negotiation of change order	3.00	5.00	5.00	5.00	5.00	5.00	3.00	5.00	4.00	5.00	5.00	5.00	3.00	5.00	5.00	3.00	4.00	3.00	4.00	5.00	3.00	3.00	2.00	4.00	3.00	3.00	**105.00**
Clarity of change order procedures	2.00	5.00	5.00	5.00	5.00	5.00	2.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	3.00	3.00	5.00	5.00	3.00	3.00	2.00	4.00	2.00	3.00	**105.00**
Change order scope	3.00	1.00	2.00	1.00	5.00	5.00	3.00	4.00	2.00	5.00	5.00	5.00	2.00	5.00	2.00	2.00	4.00	3.00	4.00	5.00	2.00	4.00	1.00	4.00	2.00	3.00	**84.00**
Approval in writing	4.00	5.00	5.00	5.00	5.00	2.00	5.00	4.00	4.00	5.00	5.00	5.00	4.00	5.00	3.00	4.00	3.00	2.00	5.00	5.00	3.00	4.00	1.00	3.00	4.00	4.00	**104.00**
Justification of changes	5.00	5.00	4.00	5.00	5.00	2.00	5.00	5.00	3.00	5.00	5.00	5.00	4.00	4.00	4.00	3.00	4.00	2.00	5.00	5.00	3.00	4.00	2.00	4.00	4.00	3.00	**105.00**
Review of contract documents	5.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00	5.00	4.00	5.00	5.00	5.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00	4.00	3.00	4.00	3.00	3.00	**104.00**
Freezing design	5.00	1.00	1.00	1.00	5.00	5.00	5.00	5.00	2.00	2.00	1.00	1.00	3.00	3.00	4.00	4.00	3.00	2.00	3.00	2.00	3.00	4.00	4.00	3.00	4.00	4.00	**80.00**
Team effort	4.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00	2.00	3.00	5.00	3.00	2.00	5.00	1.00	2.00	2.00	2.00	2.00	2.00	3.00	3.00	2.00	4.00	2.00	4.00	**86.00**
Use of Work Breakdown Structure (WBS)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00	4.00	2.00	5.00	5.00	3.00	4.00	2.00	4.00	3.00	4.00	**113.00**
Early setting of change order handling procedures	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	1.00	5.00	5.00	5.00	2.00	4.00	3.00	2.00	5.00	3.00	3.00	3.00	2.00	4.00	2.00	4.00	**101.00**
Control of Design										5.00							-										**5.00**
Market Investigation										3.00							3.00										**6.00**

CHAPTER 4

CASE STUDIES

4.1. Case studies Background

The case studies chosen for achieving the result of this thesis are all part of infrastructure sector. This thesis is composed of four main projects as listed below:

- Project 1 is composed of the construction of highway located in the south of Albania. This project was constructed between 3 November 2008 and 25 February 2012. The project activities were included bill of quantity items such as general items, demolition and site clearance, earthworks and piling, road works and pavement, culverts and drainage, bridges, road furniture and miscellaneous, retaining walls, retaining walls in reinforced earth, nails walls and landslide treatment. Each of the bill of quantity was composed of its amount achieving a contract amount of 28 627 444.91 Euro.
- Project 2 is composed of construction of interchange located in the middle part of Albania. This project was constructed between 4 June 2007 and 11 April 2008. It was composed of bill of quantity items such as general items, demolition and site clearance, earthworks, in situ concrete, concrete ancillaries, pipe works, manholes and pipe work ancillaries, miscellaneous metal work, piles and ancillaries, roads and paving, electrical utilities and road lightening and miscellaneous works. The projects contract amount was 8 346 878.6 Euro.
- Project 3 is located in three different cities and is mainly located in the south part of Albania. It is one of the biggest projects in Albania. This project is constructed from April 2015 up to December 2016. It is separated into road construction part,

bridge rehabilitation part and new bridge construction part. The road construction was composed of construction of approximately 100 km road from which 30 km asphalt road while 70 km gravel paved road. It was composed of bill of quantity items such as general items, site and clearance, earthworks, subgrade, sub-base and base, bituminous surfacing, concrete channels and culverts, structures and slopes and embankments. The bridge section is composed of 39 bridge rehabilitation and 2 new bridge construction. The bridge rehabilitation is composed of the bill of quantity items such as general items, earthworks, works in the presence of water, demolition works, detour works, repair works, reinforced concrete works, structural steel works, pavement works, signage works, miscellaneous works and engineering works. The new bridge construction is composed of bill of quantity items such as general items, site clearance, earthworks, piling works, concrete works, pavement works and signage works. The contract amount of this project is 43 949 303.24.

4.2. Data Collection

From the above projects are collected the variation order that are executed during the construction. The variation orders data for each of the projects is summarized and collected and presented in the tables below:

Table 4. Project 1 Variation Order Values

PROJECT 1			
VO - No.	**Date of Issue**	**Description of Variaton**	**Value of Variation (EURO)**
01	9-Apr-09	Design of New Road Alignment Between Km 13+500 and Km 17+750	290,000.00
02	20-May-09	Detailed Survey of the Landslide Zones between Ch. 12+900 and Ch. 13+425 and between Ch. 28+500 and Ch. 29+800	11,366.37
03	21-May-09	Additional Laboratory Equipment Necessary for Test on Site	5,213.60

04	22-Dec-10	Bridge 2.05 (Ali Pasha Bridge) at km 20+494; Replacing of "the Concrete Beams and Concrete Deck" with "Steel Beams and Concrete Deck" in a composite structure; and Replacing of "the Reinforced Earth Retaining Walls RW 2.14a and RW 2.14b" with "Concrete Retaining Walls laying on massive random rubble walling"	-
05	22-Dec-10	Replacing of Reinforced Earth Retaining Wall No. 2.15 by Embankment between Km 22+219 and Km 22+328	-
06	11-Feb-11	BR 2.08 "Luftinja Bridge"	470,784.49
07	21-Feb-11	Earthworks Details	1,086,497.00
08	4-Mar-11	"Vjossa Cliff" Between km 24+047 and km 24+850	2,183,562.86

Table 5. Project 2 Variation Order Values

PROJECT 2			
VO - No.	**Date of Issue**	**Description of Variaton**	**Value of Variation (EURO)**
01	13-Sep-07	Change of drainage pipes diameters (with no cost variation)	-
02	29-Sep-07	Demolition of old and construction of a new septic tank in garden city area.	8,203.78
03	29-Sep-07	New arrangement for outlet No.1	3,888.70
04	26-Oct-07	Relocation of underground electrical utilities	69,094.44
05	15-May-08	Relocation of underground fibre optical lines	29,702.00
06	18-Feb-08	Relocation of underground water supply lines	24,086.03
07	24-Mar-08	Removal of unsuitable ground and replacement with rockfill	126,974.04
08	21-Nov-07	Retaining Wall at DEC alignment	27,184.35
09	26-Nov-07	Precast retaining walls executed in accordance with terra armata technology	796,842.34
10	13-Dec-07	Additional drainage system works between manholes 01 & 02	9,261.00
11	30-Jan-08	Retaining Wall at Racc alignment	6,875.96
12	20-Mar-08	Modification of layers under and between new jersyes in AUTOSTRADA alignment	39,157.80
13	24-Mar-08	Modification of ramp 1 alignment and ramp 2 and Kamez drainage systems	-
14	15-May-08	Modification of pavement layer in footpath from asphalt to concrete	58,152.18

Table 6. Project 3 Variation Order Values

PROJECT 3			
VO - No.	**Date of Issue**	**Description of Variaton**	**Value of Variation (EURO)**
01	14-Aug-15	Rehabilitation of inaguration area	70,350.16
02	4-Sep-15	Revision of Scope of Work	2,124,141.88
03	10-Sep-15	Surveying of the road	Not Approved
04	4-Dec-15	Road Survey by Trailer	14,400.00
05	4-Dec-15	New Road feasibility study	92,976.00
06	10-Dec-15	Construction Of Bailey Bridges	(30,481.99)
07	17-Dec-15	Construction of Detour Road for Bridge	184,962.18
08	9-Jan-16	Construction of New Bridge km 4+260	132,849.27
09	19-Dec-15	Aplication of hydroseeding	27,754.44
10	6-Jan-16	Bridge Rehabilitation	36,099.02
11	10-Jan-16	Re-design of road 455	4,681.31
12	10-Jan-16	Bridge Testing	173,255.00

4.3. Change Order Causing Factors and Effects

All the above change order have happened as a result of different causes and has impact the project in different point of views. The main causes that have caused the above variation order together with their impact are listed in the tables below:

The project 1 variation orders are caused by the below causes and have the following main effects on project:

Table 7. Project 1 Variation Order Causes & Effects

PROJECT 1			
VO - No.	**Description of Variaton**	**Cause**	**Effect**
01	Design of New Road Alignment Between Km 13+500 and Km 17+750	Changes in Design	Increase in the Project Cost
02	Detailed Survey of the Landslide Zones between Ch. 12+900 and Ch. 13+425 and between Ch. 28+500 and Ch. 29+800	Inadequate Design & Unforeseen Site Conditions	Increase in the Project Cost

03	Additional Laboratory Equipment Necessary for Test on Site	Inadequate Planning	Increase in the Project Cost
04	Bridge 2.05 (Ali Pasha Bridge) at km 20+494; Replacing of "the Concrete Beams and Concrete Deck" with "Steel Beams and Concrete Deck" in a composite structure; and Replacing of "the Reinforced Earth Retaining Walls RW 2.14a and RW 2.14b" with "Concrete Retaining Walls laying on massive random rubble walling"	Substitution of Materials or Procedures	Delays in Completion Schedule
05	Replacing of Reinforced Earth Retaining Wall No. 2.15 by Embankment between Km 22+219 and Km 22+328	Substitution of Materials or Procedures	Delays In Completion Schedule
06	BR 2.08 "Luftinja Bridge"	Inadequate Design	Increase in the Project Cost
07	Earthworks Details	Differing Site Conditions	Increase in the Project Cost
08	"Vjossa Cliff" Between km 24+047 and km 24+850	Safety Considerations	Increase in the Project Cost

The project 2 variation orders are caused by the below causes and have the following main effects on project:

Table 8. Project 3 Variation Order Causes & Effects

PROJECT 2			
VO - No.	**Description of Variaton**	**Cause**	**Effect**
01	Change of drainage pipes diameters (with no cost variation)	Inadequate Design	Work on hold
02	Demolition of old and construction of a new septic tank in garden city area.	Safety & Environmental Consideration	Increase in the Project Cost
03	New arrangement for outlet No.1	Changes in design	Increase in the Project Cost
04	Relocation of underground electrical utilities	Inadequate Planning & Poor Estimation	Increase in the Project Cost
05	Relocation of underground fibre optical lines	Inadequate Planning & Poor Estimation	Increase in the Project Cost
06	Relocation of underground water supply lines	Inadequate Planning & Poor Estimation	Increase in the Project Cost
07	Removal of unsuitable ground and replacement with rockfill	Differing Site Conditions	Increase in the Project Cost

08	Retaining Wall at DEC alignment	Differing Site Conditions	Increase in the Project Cost
09	Precast retaining walls executed in accordance with terra armata technology	Substitution of Materials or Procedures	Increase in the Project Cost
10	Additional drainage system works between manholes 01 & 02	Inadequate Design	Increase in the Project Cost
11	Retaining Wall at Racc alignment	Differing Site Conditions	Increase in the Project Cost
12	Modification of layers under and between new jersyes in AUTOSTRADA alignment	Changes in design	Increase in the Project Cost
13	Modification of ramp 1 alignment and ramp 2 and Kamez drainage systems	Changes in design	Increase in Activity Duration
14	Modification of pavement layer in footpath from asphalt to concrete	Substitution of Materials or Procedures	Increase in the Project Cost

The project 3 variation orders are caused by the below causes and have the following main effects on project:

Table 9. Project 3 Variation Order Causes & Effects

PROJECT 3			
VO - No.	**Description of Variaton**	**Cause**	**Effect**
01	Rehabilitation of inaguration area	Changes in Design	Increase in the Project Cost
02	Revision of Scope of Work	Significant Changes in the Quantities of Work	Increase in the Project Cost
03	Surveying of the road	Significant Changes in the Quantities of Work	Work on Hold
04	Road Survey by Trailer	Changes in Design	Increase in the Project Cost
05	New Road feasibility study	Changes in Design	Increase in the Project Cost
06	Construction Of Bailey Bridges	Changes in Design	Increase in the Project Cost
07	Construction of Detour Road for Bridge	Changes in Design	Increase in the Project Cost
08	Construction of New Bridge km 4+260	Changes in Design	Increase in the Project Cost
09	Aplication of hydroseeding	Differing Site Conditions & Changes in Design	Increase in the Project Cost
10	Bridge Rehabilitation	Changes in Design	Increase in the Project Cost
11	Re-design of road 455	Changes in Design	Increase in the Project Cost
12	Bridge Testing	Inadequate Design	Increase in the Project Cost

CHAPTER 5

ANALYSIS AND RESULTS

5.1. General

Analysis and Result is the chapter from which will come out the answers of the key questions found in chapter 1, Introduction. Based on the collection data in both cases will be analyzed using different methods.

The survey questionnaire collected data and their evaluation found at chapter 3 section 3.1.2 Data gathering and Evaluation will be analyzed at this section using the Relative Index Method RII from which will come out the results for the main causes, effects and controls of the change orders in the Albanian infrastructure projects. The causes, effects and controls that will be analysed will be the same as those found at questionnaire survey.

In the same way the case studies will be analyzed using simple probability and statistics formulas and cost evaluation technique from the methodology section of chapter 1, Introduction from which will come out the percentage effects of the causes on the project cost together with the main causes and their main effects in the Albanian infrastructure projects.

5.2. Survey Questionnaire Analysis

For the analyzing of the survey questionnaire the relative importance index method will be used following the below formula:

$$RII = \frac{\sum W}{A * N} \quad (0 \leq RII \leq 1)$$

From which the characters have the below meaning:

$RII - Relative\ Importance\ Index\ RII$

$\sum W - Weight\ given\ to\ each\ factor\ by\ the\ reposndents\ and\ ranges\ from\ 1\ to\ 5$

$(A) - is\ the\ highest\ weight\ (in\ this\ case\ 5)$

$(N) - total\ number\ of\ respondents$

Based on the above calculation for each of the causes present in the questionnaire survey were achieved results as given in *Table 10*:

Table 10. Survey Questionnaire Change Order Causes Analysis

CAUSES OF CHANGE ORDERS	Σ W	A	N	A * N	RII
Inadequate Design	87.00	5.00	26.00	130.00	**0.67**
Changes in Design	92.00	5.00	26.00	130.00	**0.71**
Errors and Omissions in Design	81.00	5.00	26.00	130.00	**0.62**
Substitution of materials or procedures.	74.00	5.00	26.00	130.00	**0.57**
Significant changes in the quantities of the work	96.00	5.00	26.00	130.00	**0.74**
Contractor financial difficulties	50.00	5.00	26.00	130.00	**0.38**
Owner financial difficulties	59.00	5.00	26.00	130.00	**0.45**
Inadequate planning	76.00	5.00	26.00	130.00	**0.58**
Poor estimation	78.00	5.00	26.00	130.00	**0.60**
Material non-availability	81.00	5.00	26.00	130.00	**0.62**
Unforeseen Site Conditions.	89.00	5.00	26.00	130.00	**0.68**
Differing site conditions	77.00	5.00	26.00	130.00	**0.59**
Safety consideration	53.00	5.00	26.00	130.00	**0.41**
Delays in the approval	64.00	5.00	26.00	130.00	**0.49**
Defective workmanship	59.00	5.00	26.00	130.00	**0.45**
Poor procurement process	65.00	5.00	26.00	130.00	**0.50**
Long procurement process	57.00	5.00	26.00	130.00	**0.44**

Unavailability of skills	55.00	5.00	26.00	130.00	**0.42**
Unavailability of equipment	55.00	5.00	26.00	130.00	**0.42**
Poor performance of contractors	74.00	5.00	26.00	130.00	**0.57**
Conflicts between contract documents	82.00	5.00	26.00	130.00	**0.63**
Weather Conditions	61.00	5.00	26.00	130.00	**0.47**
Force Majeure	5.00	5.00	26.00	130.00	**0.04**
Suspensions	3.00	5.00	26.00	130.00	**0.02**
New Items Of Works	5.00	5.00	26.00	130.00	**0.04**
Construction Delays	2.00	5.00	26.00	130.00	**0.02**
Subcontractor Claims	8.00	5.00	26.00	130.00	**0.06**

As it was followed for the causes of the change orders the same procedure and the same method is used for the calculation of the RII coefficient of the effects and controls of change orders from which were achieved the below results as given in *Table 11* and *12*.

Table 11. Survey Questionnaire Change Order Effects Analysis

EFFECT OF CHANGE ORDERS	Σ W	A	N	A * N	RII
Increase in the project cost.	113.00	5.00	26.00	130.00	**0.87**
Delays in completion schedule	103.00	5.00	26.00	130.00	**0.79**
Increase in each activity duration	94.00	5.00	26.00	130.00	**0.72**
Decrease in productivity	71.00	5.00	26.00	130.00	**0.55**
Decrease in quality	56.00	5.00	26.00	130.00	**0.43**
Delay in Payment	87.00	5.00	26.00	130.00	**0.67**
Demolition & Rework	61.00	5.00	26.00	130.00	**0.47**
Dispute between owner and contractor	91.00	5.00	26.00	130.00	**0.70**
Increase in Overhead expenses	91.00	5.00	26.00	130.00	**0.70**
Work on hold	100.00	5.00	26.00	130.00	**0.77**
Suspension Of Works	7.00	5.00	26.00	130.00	**0.05**

Table 12. Survey Questionnaire Change Order Controls Analysis

CONTROLS OF CHANGE ORDERS	Σ W	A	N	A * N	RII
Negotiation of change order	105.00	5.00	26.00	130.00	**0.81**
Clarity of change order procedures	105.00	5.00	26.00	130.00	**0.81**
Change order scope	84.00	5.00	26.00	130.00	**0.65**
Approval in writing	104.00	5.00	26.00	130.00	**0.80**

Justification of changes	105.00	5.00	26.00	130.00	**0.81**
Review of contract documents	104.00	5.00	26.00	130.00	**0.80**
Freezing design	80.00	5.00	26.00	130.00	**0.62**
Team effort	86.00	5.00	26.00	130.00	**0.66**
Use of Work Breakdown Structure (WBS)	113.00	5.00	26.00	130.00	**0.87**
Early setting of change order handling procedures	101.00	5.00	26.00	130.00	**0.78**
Control of Design	5.00	5.00	26.00	130.00	**0.04**
Market Investigation	6.00	5.00	26.00	130.00	**0.05**

5.3. Case Study Analysis

For analyzing the causes and effects that are as a result of execution of real case studies the simple probability and statistical formulas were used.

Based on collected data on chapter 4, case studies sub section 4.3, Change Orders causing factors and effects and referring the following analysis were achieved:

Table 13. Project 1 Change Order Causes Analysis

	VARIATION ORDER CAUSES	SCORING	PERCENTAGE
PROJECT 1	**Change in Design**	**1.00**	**11.11%**
	Inadequate Design	**2.00**	**22.22%**
	Unforeseen site conditions	**1.00**	**11.11%**
	Inadequate Planning	**1.00**	**11.11%**
	Substitution of Materials or Procedures	**2.00**	**22.22%**
	Differing Site Conditions	**1.00**	**11.11%**
	Safety Consideration	**1.00**	**11.11%**

Table 14. Project 2 Change Order Causes Analysis

	VARIATION ORDER CAUSES	SCORING	PERCENTAGE
PROJECT 2	**Inadequate Design**	**2.00**	**11.76%**
	Safety Consideration	**1.00**	**5.88%**
	Changes in Design	**3.00**	**17.65%**

	Inadequate Planning	**3.00**	**17.65%**
	Poor Estimation	**3.00**	**17.65%**
	Differing Site Conditions	**3.00**	**17.65%**
	Substitution of Materials or Procedures	**2.00**	**11.76%**

Table 15. Project 3 Change Order Causes Analysis

	VARIATION ORDER CAUSES	SCORING	PERCENTAGE
PROJECT 3	**Changes in Design**	**9.00**	**69.23%**
	Inadequate Design	**1.00**	**7.69%**
	Significant Changes in the Quantities of Work	**2.00**	**15.38%**
	Differing Site Conditions	**1.00**	**7.69%**

The total scoring including all the case studies based on the above causes is as given in the *Table 16* below:

Table 16. Total Projects Change Order Causes Analysis

	VARIATION ORDER CAUSES	SCORING	PERCENTAGE
TOTAL	**Change in Design**	**13.00**	**33.33%**
	Inadequate Design	**5.00**	**12.82%**
	Unforeseen site conditions	**1.00**	**2.56%**
	Inadequate Planning	**4.00**	**10.26%**
	Substitution of Materials or Procedures	**4.00**	**10.26%**
	Differing Site Conditions	**5.00**	**12.82%**
	Poor Estimation	**3.00**	**7.69%**
	Significant Changes in the Quantities of Works	**2.00**	**5.13%**
	Safety Consideration	**2.00**	**5.13%**

The above scoring was calculated for the causes of the change orders while as per effects of the change orders for each project alone and combined is given in the tables below.

The first three tables show the scoring and the percentage for each of the projects of the case studies:

Table 17. Project 1 Change Order Effects Analysis

PROJECT 1	VARIATION ORDER EFFECTS	SCORING	PERCENTAGE
	Increase in the Project Cost	**6.00**	**75.00%**
	Delays in Completion Schedule	**2.00**	**25.00%**

Table 18. Project 2 Change Order Effects Analysis

PROJECT 2	VARIATION ORDER EFFECTS	SCORING	PERCENTAGE
	Increase in the Project Cost	**12.00**	**85.71%**
	Increase in the Activity Duration	**1.00**	**7.14%**
	Works on Hold	**1.00**	**7.14%**

Table 19. Project 3 Change Order Effects Analysis

PROJECT 3	VARIATION ORDER EFFECTS	SCORING	PERCENTAGE
	Increase in the Project Cost	**11.00**	**91.67%**
	Works on Hold	**1.00**	**8.33%**

While the last table (*Table 20*) is a summarizing table for the effects of the change orders including all project case studies.

Table 20. Total Projects Change Order Effects Analysis

	VARIATION ORDER EFFECTS	SCORING	PERCENTAGE
TOTAL	**Increase in the Project Cost**	**29.00**	**85.29%**
	Delays in Completion Schedule	**2.00**	**5.88%**
	Increase In the Activity Duration	**1.00**	**2.94%**
	Works on Hold	**2.00**	**5.88%**

For the analyzing of the case studies projects simple probability and statistics formulas area used in order to evaluate the cost impact of the change orders as it is given in the equation below:

$$Change\ In\ Cost\ (\%) = \frac{Final\ Cost - Original\ Budget}{Original\ Budget}\ x\ 100$$

Based on the gathered data chapter 4, case studies sub section 4.2, data collection and using the above equation was found the impact of each variation on total cost of the project. The analyses achieved are presented in the table below:

The project 1 is composed of 8 variation orders with the values and percentage cost impact as given in the *Table 21* below:

Table 21. Project 1 Variation Order Cost Impact Analysis

PROJECT 1					
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**VALUE OF VO (EURO)**	**CONTRACT VALUE (EURO)**	**PERCENTAGE**
01	9-Apr-09	Design of New Road Alignment Between Km 13+500 and Km 17+750	290,000.00	28,627,444.91	**1.01%**
02	20-May-09	Detailed Survey of the Landslide Zones between Ch. 12+900 and Ch. 13+425 and between Ch. 28+500 and Ch. 29+800	11,366.37	28,627,444.91	**0.04%**

03	21-May-09	Additional Laboratory Equipment Necessary for Test on Site	5,213.60	28,627,444.91	**0.02%**
04	22-Dec-10	Bridge 2.05 (Ali Pasha Bridge) at km 20+494; Replacing of "the Concrete Beams and Concrete Deck" with "Steel Beams and Concrete Deck" in a composite structure; and Replacing of "the Reinforced Earth Retaining Walls RW 2.14a and RW 2.14b" with "Concrete Retaining Walls laying on massive random rubble walling"	-	28,627,444.91	**0.00%**
05	22-Dec-10	Replacing of Reinforced Earth Retaining Wall No. 2.15 by Embankment between Km 22+219 and Km 22+328	-	28,627,444.91	**0.00%**
06	11-Feb-11	BR 2.08 "Luftinja Bridge"	470,784.49	28,627,444.91	**1.64%**
07	21-Feb-11	Earthworks Details	1,086,497.00	28,627,444.91	**3.80%**
08	4-Mar-11	"Vjossa Cliff" Between km 24+047 and km 24+850	2,183,562.86	28,627,444.91	**7.63%**

The project 2 is composed of 14 variation orders with the values and percentage cost impact as given in the *Table 22* below:

Table 22. Project 2 Variation Order Cost Impact Analysis

PROJECT 2					
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**VALUE OF VO**	**CONTRACT VALUE**	**PERCENTAGE**
			(EURO)	**(EURO)**	
01	13-Sep-07	Change of drainage pipes diameters (with no cost variation)	-	8,346,878.40	**0.00%**
02	29-Sep-07	Demolition of old and construction of a new septic tank in garden city area.	8,203.78	8,346,878.40	**0.10%**
03	29-Sep-07	New arrangement for outlet No.1	3,888.70	8,346,878.40	**0.05%**
04	26-Oct-07	Relocation of underground electrical utilities	69,094.44	8,346,878.40	**0.83%**
05	15-May-08	Relocation of underground fibre optical lines	29,702.00	8,346,878.40	**0.36%**
06	18-Feb-08	Relocation of underground water supply lines	24,086.03	8,346,878.40	**0.29%**
07	24-Mar-08	Removal of unsuitable ground and replacement with rockfill	126,974.04	8,346,878.40	**1.52%**
08	21-Nov-07	Retaining Wall at DEC alignment	27,184.35	8,346,878.40	**0.33%**
09	26-Nov-07	Precast retaining walls executed in accordance with terra armata technology	796,842.34	8,346,878.40	**9.55%**
10	13-Dec-07	Additional drainage system works between manholes 01 & 02	9,261.00	8,346,878.40	**0.11%**

11	30-Jan-08	Retaining Wall at Racc alignment	6,875.96	8,346,878.40	**0.08%**
12	20-Mar-08	Modification of layers under and between new jersyes in AUTOSTRADA alignment	39,157.80	8,346,878.40	**0.47%**
13	24-Mar-08	Modification of ramp 1 alignment and ramp 2 and Kamez drainage systems	-	8,346,878.40	**0.00%**
14	15-May-08	Modification of pavement layer in footpath from asphalt to concrete	58,152.18	8,346,878.40	**0.70%**

The project 3 is composed of 12 variation orders with the values and percentage cost impact as given in the *Table 23* below:

Table 23. Project 3 Variation Order Cost Impact Analysis

PROJECT 3					
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**VALUE OF VO**	**CONTRACT VALUE**	**PERCENTAGE**
			(EURO)	**(EURO)**	
01	14-Aug-15	Rehabilitation of inaguration area	70,350.16	43,949,303.24	**0.16%**
02	4-Sep-15	Revision of Scope of Work	2,124,141.88	43,949,303.24	**4.83%**
03	10-Sep-15	Surveying of the road	Not Approved	43,949,303.24	**0.00%**
04	4-Dec-15	Road Survey by Trailer	14,400.00	43,949,303.24	**0.03%**
05	4-Dec-15	New Road feasibility study	92,976.00	43,949,303.24	**0.21%**
06	10-Dec-15	Construction Of Bailey Bridges	(30,481.99)	43,949,303.24	**-0.07%**
07	17-Dec-15	Construction of Detour Road for Bridge	184,962.18	43,949,303.24	**0.42%**
08	9-Jan-16	Construction of New Bridge km 4+260	132,849.27	43,949,303.24	**0.30%**
09	19-Dec-15	Aplication of hydroseeding	27,754.44	43,949,303.24	**0.06%**
10	6-Jan-16	Bridge Rehabilitation	36,099.02	43,949,303.24	**0.08%**
11	10-Jan-16	Re-design of road 455	4,681.31	43,949,303.24	**0.01%**
12	10-Jan-16	Bridge Testing	173,255.00	43,949,303.24	**0.39%**

Except the effect that has in the project cost it is also important to identify how much impact has each cause on the project cost for each project and totally for each cause. Based on this one below is given e table based on the causes effect on project cost. The first one *Table 24* is project 1, second table, *Table 25* is project 2 and third table, *Table 26* is project 3.

Table 24. Project 1 Variation Order Causes Cost Impact Analysis

PROJECT 1						
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**CAUSES**	**VALUE OF VO (EURO)**	**CONTRACT VALUE (EURO)**	**%**
01	9-Apr-09	Design of New Road Alignment Between Km 13+500 and Km 17+750	Changes in Design	290,000.00	28,627,444.91	**1.01%**
02	20-May-09	Detailed Survey of the Landslide Zones between Ch. 12+900 and Ch. 13+425 and between Ch. 28+500 and Ch. 29+800	Inadequate Design & Unforeseen Site Conditions	11,366.37	28,627,444.91	**0.04%**
03	21-May-09	Additional Laboratory Equipment Necessary for Test on Site	Inadequate Planning	5,213.60	28,627,444.91	**0.02%**
04	22-Dec-10	Bridge 2.05 (Ali Pasha Bridge) at km 20+494; Replacing of "the Concrete Beams and Concrete Deck" with "Steel Beams and Concrete Deck" in a composite structure; and Replacing of "the Reinforced Earth Retaining Walls RW 2.14a and RW 2.14b" with "Concrete Retaining Walls laying on massive random rubble walling"	Substitution of Materials or Procedures	-	28,627,444.91	**0.00%**
05	22-Dec-10	Replacing of Reinforced Earth Retaining Wall No. 2.15 by Embankment between Km 22+219 and Km 22+328	Substitution of Materials or Procedures	-	28,627,444.91	**0.00%**
06	11-Feb-11	BR 2.08 "Luftinja Bridge"	Inadequate Design	470,784.49	28,627,444.91	**1.64%**
07	21-Feb-11	Earthworks Details	Differing Site Conditions	1,086,497.00	28,627,444.91	**3.80%**
08	4-Mar-11	"Vjossa Cliff" Between km 24+047 and km 24+850	Safety Considerations	2,183,562.86	28,627,444.91	**7.63%**

Table 25. Project 2 Variation Order Causes Cost Impact Analysis

PROJECT 2						
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**CAUSES**	**VALUE OF VO (EURO)**	**CONTRACT VALUE (EURO)**	**%**
01	13-Sep-07	Change of drainage pipes diameters (with no cost variation)	Inadequate Design	-	8,346,878.40	**0.00%**

02	29-Sep-07	Demolition of old and construction of a new septic tank in garden city area.	Safety & Environmental Consideration	8,203.78	8,346,878.40	**0.10%**
03	29-Sep-07	New arrangement for outlet No.1	Changes in design	3,888.70	8,346,878.40	**0.05%**
04	26-Oct-07	Relocation of underground electrical utilities	Inadequate Planning & Poor Estimation	69,094.44	8,346,878.40	**0.83%**
05	15-May-08	Relocation of underground fibre optical lines	Inadequate Planning & Poor Estimation	29,702.00	8,346,878.40	**0.36%**
06	18-Feb-08	Relocation of underground water supply lines	Inadequate Planning & Poor Estimation	24,086.03	8,346,878.40	**0.29%**
07	24-Mar-08	Removal of unsuitable ground and replacement with rockfill	Differing Site Conditions	126,974.04	8,346,878.40	**1.52%**
08	21-Nov-07	Retaining Wall at DEC alignment	Differing Site Conditions	27,184.35	8,346,878.40	**0.33%**
09	26-Nov-07	Precast retaining walls executed in accordance with terra armata technology	Substitution of Materials or Procedures	796,842.34	8,346,878.40	**9.55%**
10	13-Dec-07	Additional drainage system works between manholes 01 & 02	Inadequate Design	9,261.00	8,346,878.40	**0.11%**
11	30-Jan-08	Retaining Wall at Racc alignment	Differing Site Conditions	6,875.96	8,346,878.40	**0.08%**
12	20-Mar-08	Modification of layers under and between new jersyes in AUTOSTRADA alignment	Changes in design	39,157.80	8,346,878.40	**0.47%**
13	24-Mar-08	Modification of ramp 1 alignment and ramp 2 and Kamez drainage systems	Changes in design	-	8,346,878.40	**0.00%**
14	15-May-08	Modification of pavement layer in footpath from asphalt to concrete	Substitution of Materials or Procedures	58,152.18	8,346,878.40	**0.70%**

Table 26. Project 3 Variation Order Causes Cost Impact Analysis

PROJECT 3						
VO - No.	**DATE OF ISSUE**	**DESCRITPTION OF THE VARIATION**	**CAUSES**	**VALUE OF VO (EURO)**	**CONTRACT VALUE (EURO)**	**%**
01	14-Aug-15	Rehabilitation of inaguration area	Changes in Design	70,350.16	43,949,303.24	**0.16%**
02	4-Sep-15	Revision of Scope of Work	Significant Changes in the Quantities of Work	2,124,141.88	43,949,303.24	**4.83%**

03	10-Sep-15	Surveying of the road	Significant Changes in the Quantities of Work	Not Approved	43,949,303.24	**0.00%**
04	4-Dec-15	Road Survey by Trailer	Changes in Design	14,400.00	43,949,303.24	**0.03%**
05	4-Dec-15	New Road feasibility study	Changes in Design	92,976.00	43,949,303.24	**0.21%**
06	10-Dec-15	Construction Of Bailey Bridges	Changes in Design	(30,481.99)	43,949,303.24	**-0.07%**
07	17-Dec-15	Construction of Detour Road for Bridge	Changes in Design	184,962.18	43,949,303.24	**0.42%**
08	9-Jan-16	Construction of New Bridge km 4+260	Changes in Design	132,849.27	43,949,303.24	**0.30%**
09	19-Dec-15	Aplication of hydroseeding	Differing Site Conditions & Changes in Design	27,754.44	43,949,303.24	**0.06%**
10	6-Jan-16	Bridge Rehabilitation	Changes in Design	36,099.02	43,949,303.24	**0.08%**
11	10-Jan-16	Re-design of road 455	Changes in Design	4,681.31	43,949,303.24	**0.01%**
12	10-Jan-16	Bridge Testing	Inadequate Design	173,255.00	43,949,303.24	**0.39%**

Based on the Causes of the change orders the effect on cost of project is as given below:

Project 1 cost impact according to the causes is as given below in *Table 27*:

Table 27. Project 1 Causes Cost Impact

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 1	**Change in Design**	**290,000.00**	**28,627,444.91**	**1.01%**
	Inadequate Design	**482,150.86**	**28,627,444.91**	**1.68%**
	Unforeseen site conditions	**11,366.37**	**28,627,444.91**	**0.04%**
	Inadequate Planning	**5,213.60**	**28,627,444.91**	**0.02%**
	Substitution of Materials or Procedures	**-**	**28,627,444.91**	**0.00%**
	Differing Site Conditions	**1,086,497.00**	**28,627,444.91**	**3.80%**
	Safety Consideration	**2,183,562.86**	**28,627,444.91**	**7.63%**

Project 2 cost impact according to the causes is as given below in *Table 28*:

Table 28. Project 2 Causes Cost Impact

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 2	Inadequate Design	9,261.00	8,346,878.40	0.11%
	Safety Consideration	8,203.78	8,346,878.40	0.10%
	Changes in Design	43,046.50	8,346,878.40	0.52%
	Inadequate Planning	122,882.47	8,346,878.40	1.47%
	Poor Estimation	122,882.47	8,346,878.40	1.47%
	Differing Site Conditions	161,034.35	8,346,878.40	1.93%
	Substitution of Materials or Procedures	854,994.52	8,346,878.40	10.24%

Project 3 cost impact according to the causes is as given below in *Table 29*:

Table 29. Project 3 Causes Cost Impact

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 3	Changes in Design	533,590.39	43,949,303.24	1.21%
	Inadequate Design	173,255.00	43,949,303.24	0.39%
	Significant Changes in the Quantities of Work	2,124,141.88	43,949,303.24	4.83%
	Differing Site Conditions	27,754.44	43,949,303.24	0.06%

5.4. Survey Questionnaire Results

Based on the analysis performed for the survey questionnaire using the relative importance index method RII there has been a ranking for all the causes, effects and controls as given in the tables below. The first table is showing the ranking of all the causes based on RII coefficient:

Table 30. Survey Questionnaire Change Order Causes Results

CAUSES OF CHANGE ORDERS	RII
Significant changes in the quantities of the work	**0.74**
Changes in Design	**0.71**
Unforeseen Site Conditions.	**0.68**
Inadequate Design	**0.67**
Conflicts between contract documents	**0.63**
Errors and Omissions in Design	**0.62**
Material non-availability	**0.62**
Poor estimation	**0.60**
Differing site conditions	**0.59**
Inadequate planning	**0.58**
Substitution of materials or procedures.	**0.57**
Poor performance of contractors	**0.57**
Poor procurement process	**0.50**
Delays in the approval	**0.49**
Weather Conditions	**0.47**
Owner financial difficulties	**0.45**
Defective workmanship	**0.45**
Long procurement process	**0.44**
Unavailability of skills	**0.42**
Unavailability of equipment	**0.42**
Safety consideration	**0.41**
Contractor financial difficulties	**0.38**
Subcontractor Claims	**0.06**
Force Majeure	**0.04**
New Items Of Works	**0.04**
Suspensions	**0.02**
Construction Delays	**0.02**

According to the analysis result the ranking procedure for the causes of the change orders in Albania infrastructure projects seems to be significant changes in the quantities of the work as the main cause with a relative index coefficient of 0.74, followed by changes in design with relative index coefficient 0.71, unforeseen site condition with relative index coefficient 0.68. The fourth place is hold by inadequate design cause with

relative index coefficient 0.67 followed by the fifth place conflicts between contract documents with relative index coefficient 0.63. The other ranking together with their repsektive relative index coefficients is given in the *Table 31*.

The second table is showing the effects of the change order in the Albanian infrastructure projects based on relative index coefficient ranking as given in the table below.

Table 31. Survey Questionnaire Change Order Effects Results

EFFECT OF CHANGE ORDERS	RII
Increase in the project cost.	**0.87**
Delays in completion schedule	**0.79**
Work on hold	**0.77**
Increase in each activity duration	**0.72**
Dispute between owner and contractor	**0.70**
Increase in Overhead expenses	**0.70**
Delay in Payment	**0.67**
Decrease in productivity	**0.55**
Demolition & Rework	**0.47**
Decrease in quality	**0.43**
Suspension Of Works	**0.05**

According to the table ranking can be seen that the first effect by the causes of the change order in Albanian infrastructure projects is increasing of the project cost with a relative index coefficient 0.87, followed by delays in completion schedule with relative index coefficient 0.79 and work on hold with a relative index coefficient 0.77. In the fourth place is located increase in each activity duration with a relative index coefficient 0.72 followed by the fifth place location dispute between owner and contractor with a relative index coefficient 0.70 found in the same place and the same coefficient with increase in overhead expenses. The other effects with their respective relative index coefficient are given in the table 32.

The last table is the ranking of the controls of the change orders for the infrastructure Albanian projects in order to control the effect of the causes of the change orders. The ranking of those controls is done based on the raltive index coefficient as given in the *Table 32* below.

Table 32. Survey Questionnaire Change Order Controls Results

CONTROLS OF CHANGE ORDERS	RII
Use of Work Breakdown Structure (WBS)	**0.87**
Negotiation of change order	**0.81**
Clarity of change order procedures	**0.81**
Justification of changes	**0.81**
Approval in writing	**0.80**
Review of contract documents	**0.80**
Early setting of change order handling procedures	**0.78**
Team effort	**0.66**
Change order scope	**0.65**
Freezing design	**0.62**
Market Investigation	**0.05**
Control of Design	**0.04**

According to the table the main control for the effects of the change orders in Albanian infrastructure projects is use of work breakdown structure with a relative index coefficient 0.87, followed by negotiation of the change order control with relative index coefficient 0.81 which is found in the same place and the same coefficient with clarity of change order procedures and justification of changes. All the other controls are ranked with their respective relative index coefficient as given in the table 33.

5.5. Case Studies Results

5.5.1. Case Studies Change Order Causes and Effects

The case studies which are composed of three main infrastructure projects are part of the change order execution. Based on this, those change orders are mainly caused by some factors and have they effect on project. The causes and effects of those projects are

disussed and anlysed in the section 5.3, case study analysis. Below is shown a summary of the causes and effects of the case studies change orders:

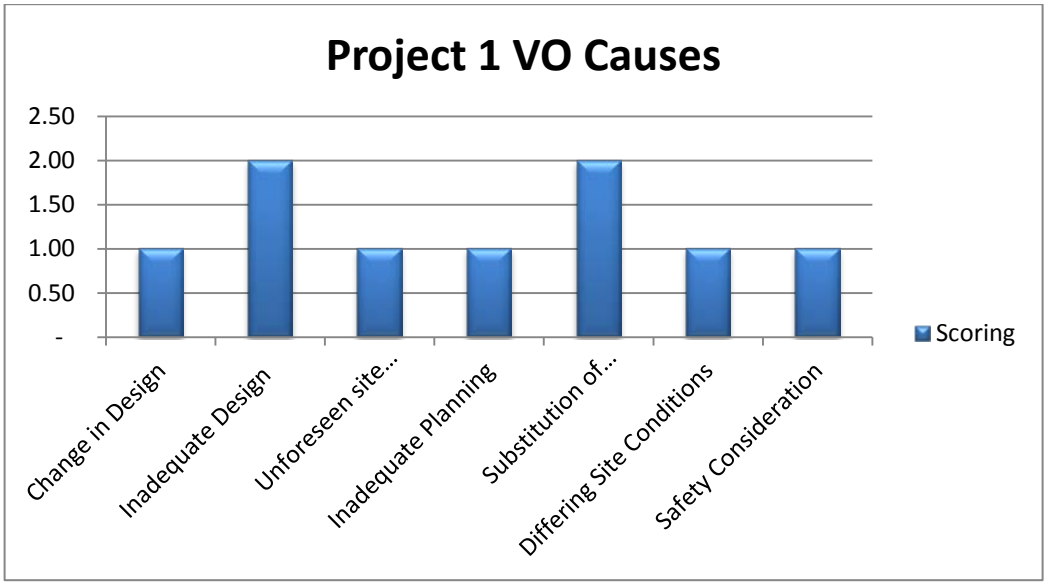

Figure 17. Project 1 Variation Order Causes Chart

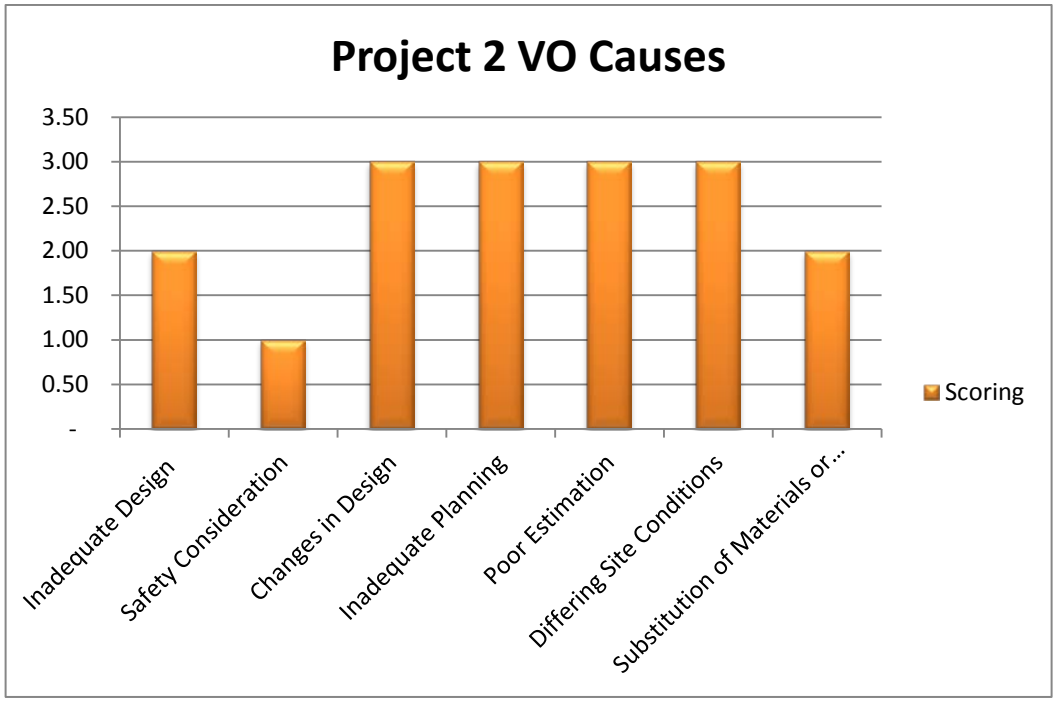

Figure 18. Project 2 Variation Order Causes Chart

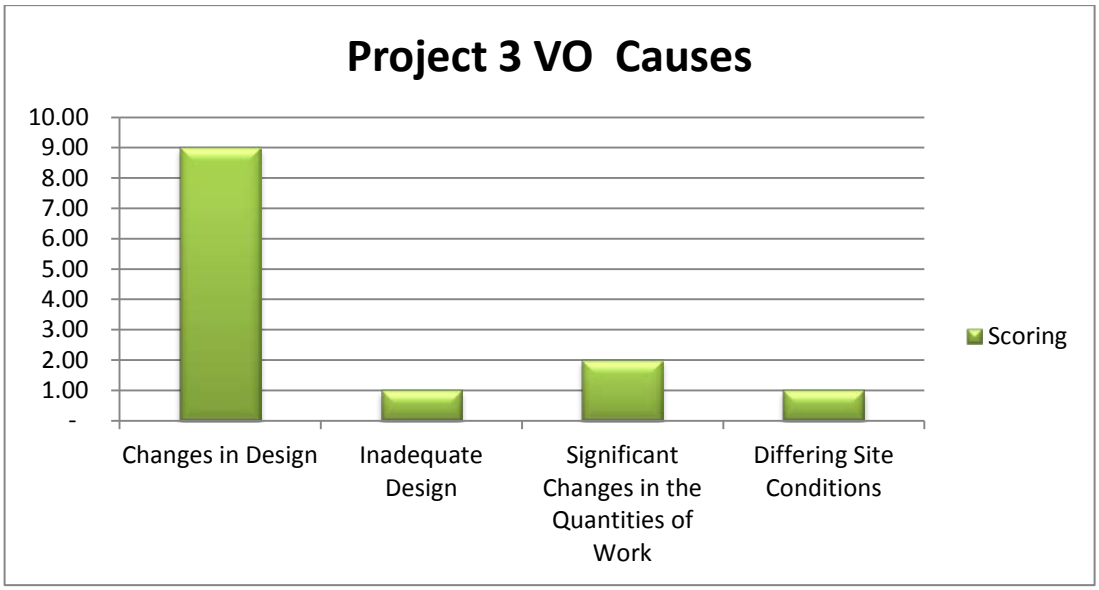

Figure 19. Project 3 Variation Order Causes Chart

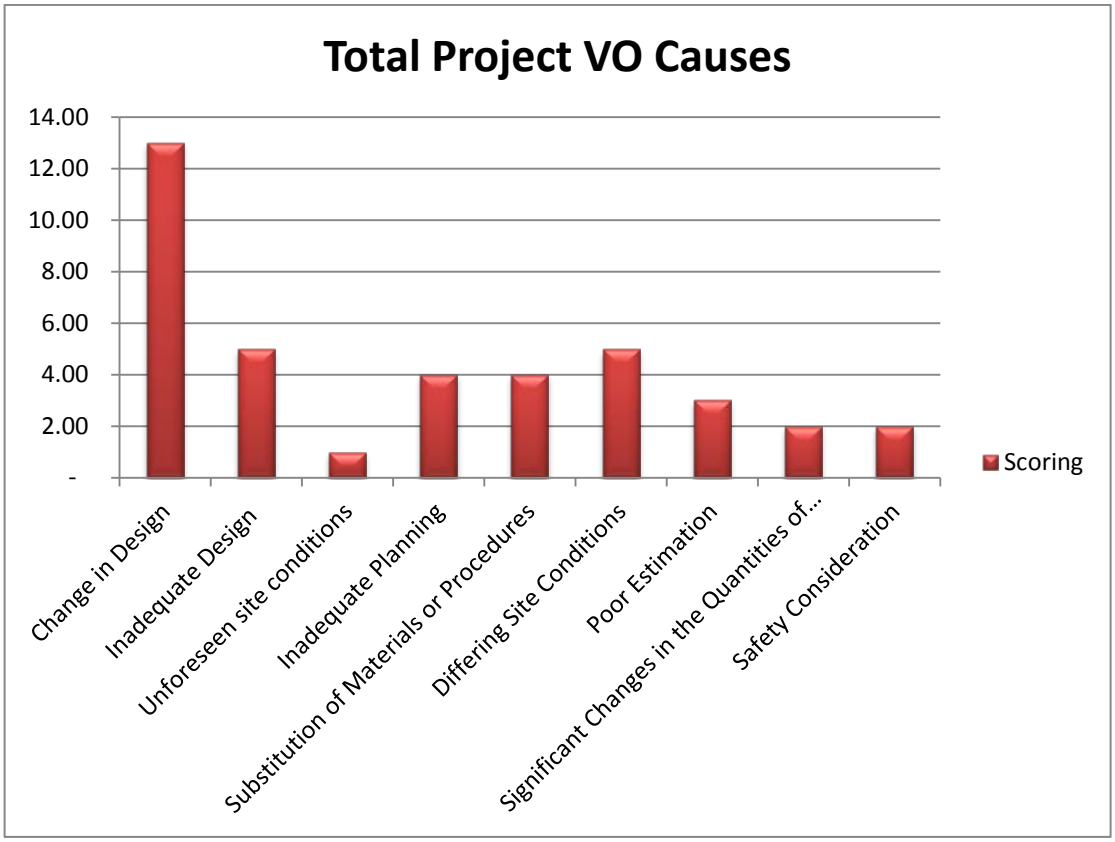

Figure 20. Total Projects Variation Order Causes Chart

From the above graphs can be seen that in the project 1 the main causes are inadequate design and substitution of materials and procedures while the other causes can be seen on the chart. In the chart of the project 2 can be seen that the main cause are changes in design, inadequate planning, poor estimation and differing site condition followed by the other causes as shown in chart. In the third chart can be seen that the main cause is the change in design followed by the other causes as shown in the chart. The last chart is total collection of the causes of the change orders which if composed of changes in design as the main cause, followed by the differing site condition, inadequate design and other causes as shown in the charts.

According to the chart above there has been prepared a ranking of those causes based on their percentage which are shown in the pie charts below:

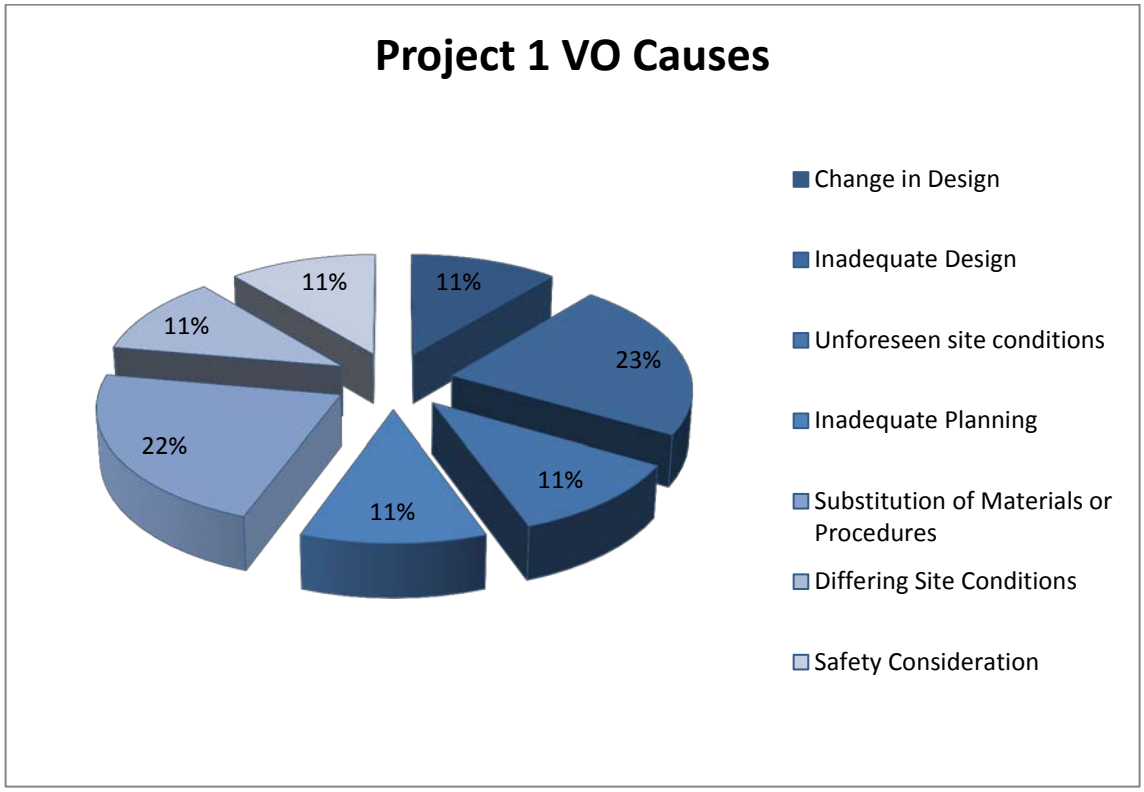

Figure 21. Project 1 Variation Order Causes Percentage Chart

According to this chart can be seen that the main cause of the change orders in the project 1 is the inadequate design which fits 23% of the cases, followed by the substitution of materials or procedures with 22% of the cases and all the other causes of this case with 11% as given in the chart.

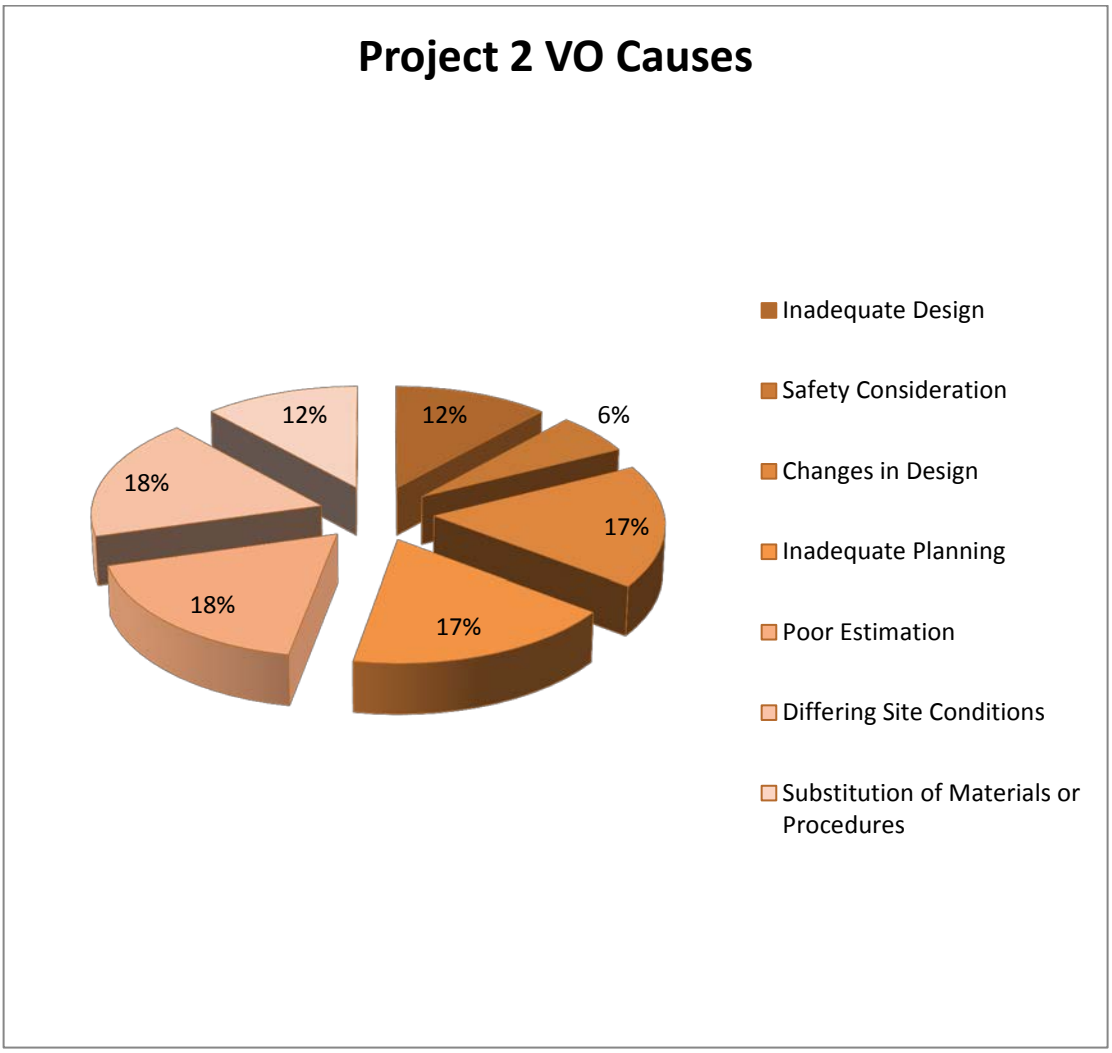

Figure 22. Project 2 Variation Order Causes Percentage Chart

According to this chart can be seen that the main cause of the change orders in the project 2 are poor estimatio which fits 18% of the cases, followed by the substitution of materials or procedures with 18% of the cases, changes in design and inadequate

planning with 17 % and all the other causes of this case with their respective percentage as given in the chart.

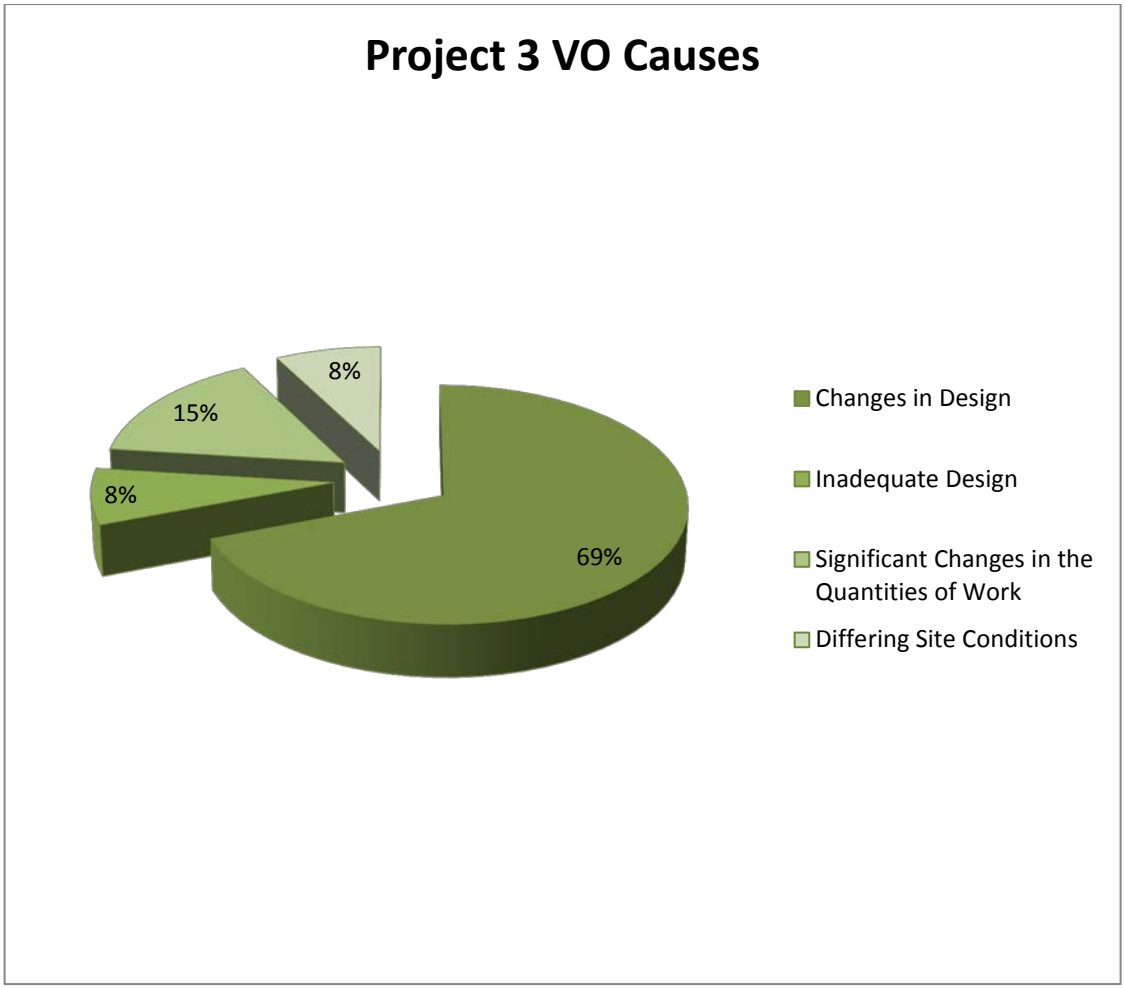

Figure 23. Project 3 Variation Order Causes Percentage Chart

According to this chart can be seen that the main cause of the change orders in the project 3 is changes in design which fits 69% of the cases, followed by inadequate design with 8% of the cases, significant changes in the quantities of the work with 15% and differing site conditions with 8%.

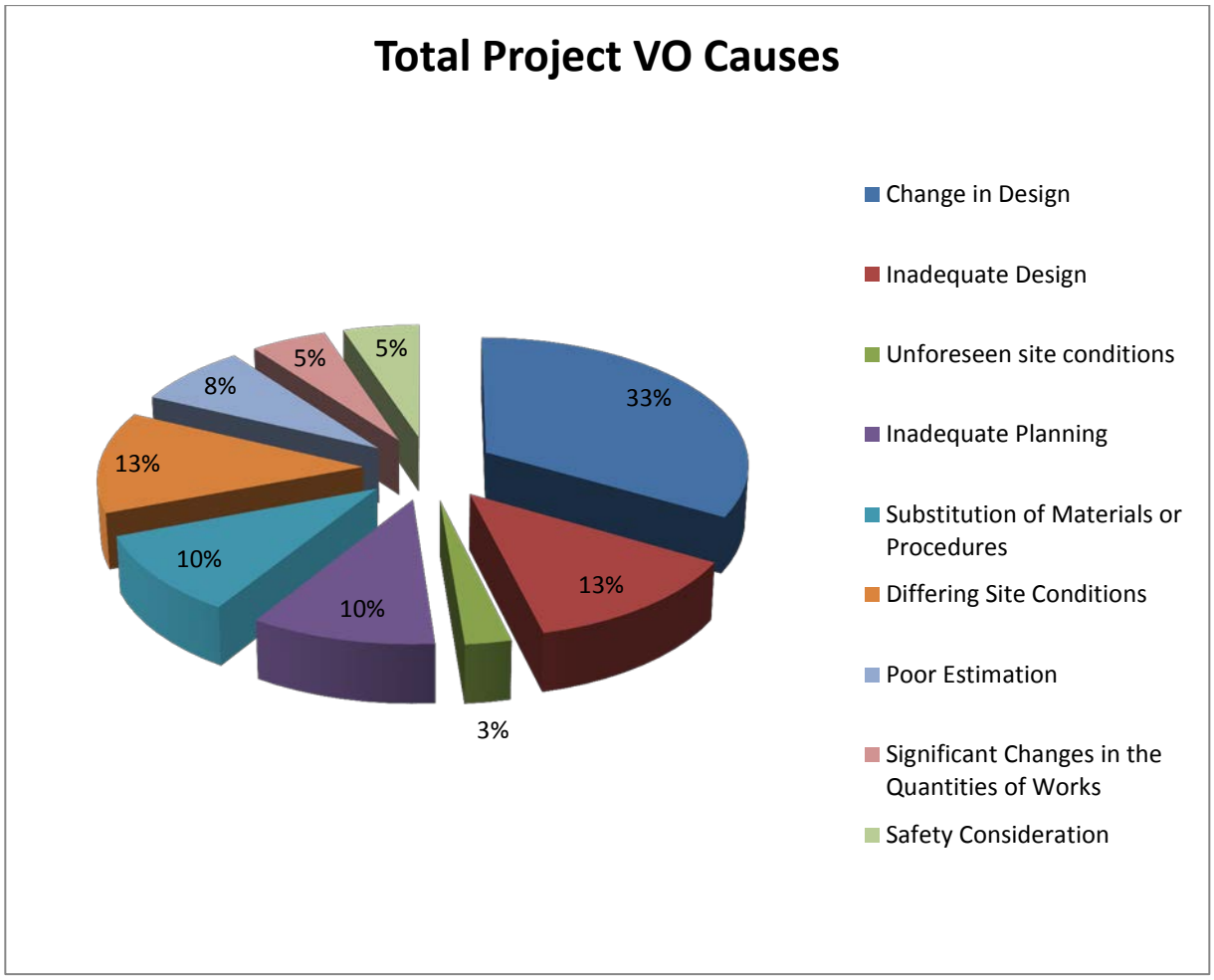

Figure 24. Total Projects Variation Order Causes Percentage Chart

According to this chart can be seen that the main cause of the change orders in all projects is changes in design which fits 33% of the cases, followed by inadequate design with 13% of the cases, differing site conditions with 13% and other causes as shown in the chart above.

In the above charts are ranked the causes of the change orders based on the case studies while below is explained the effects of the change order again based on the case studies projects.

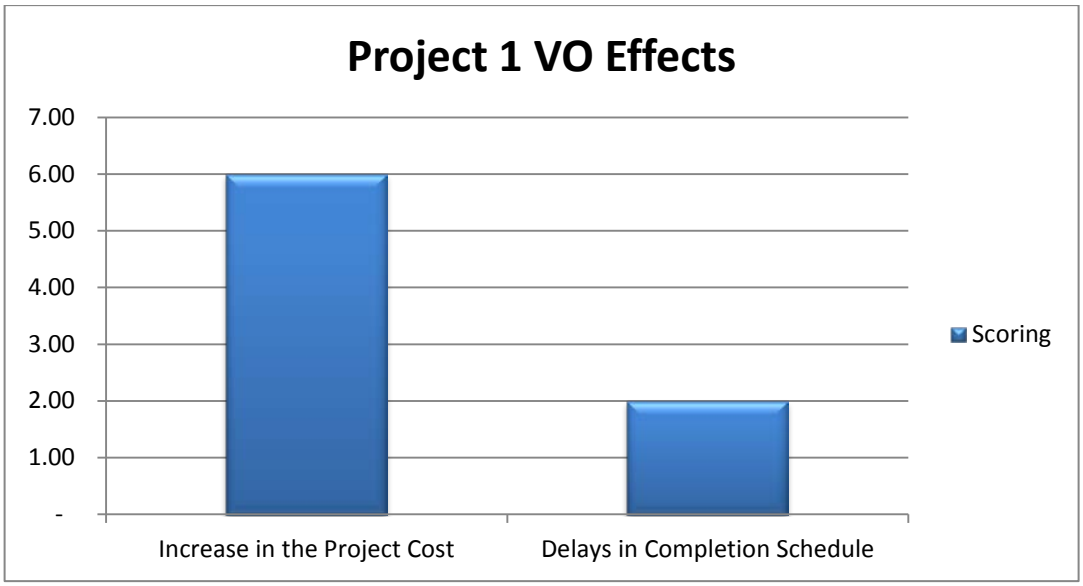

Figure 25. Project 1 Variation Order Effects Chart

According to the graph can be seen that the main effects of the causes for the project 1 is increase in the project cost followed by the delays in completion schedule.

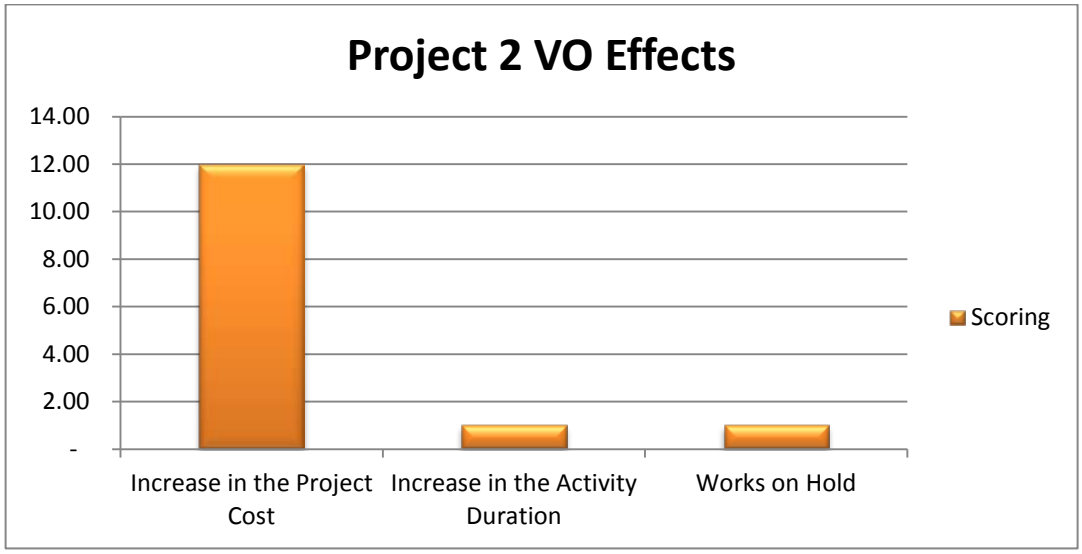

Figure 26. Project 2 Variation Order Effects Chart

According to the graph can be seen that the main effect of the causes for the project 2 is increase in the project cost followed by the increase in activity duration and works on hold.

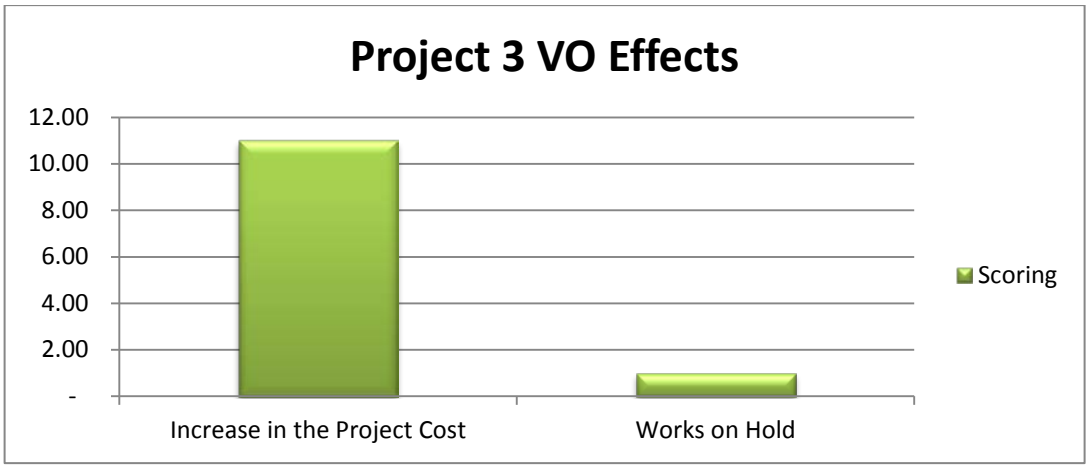

Figure 27. Project 3 Variation Order Effects Chart

According to the graph can be seen that the main effect of the causes for the project 3 is increase in the project cost followed by works on hold.

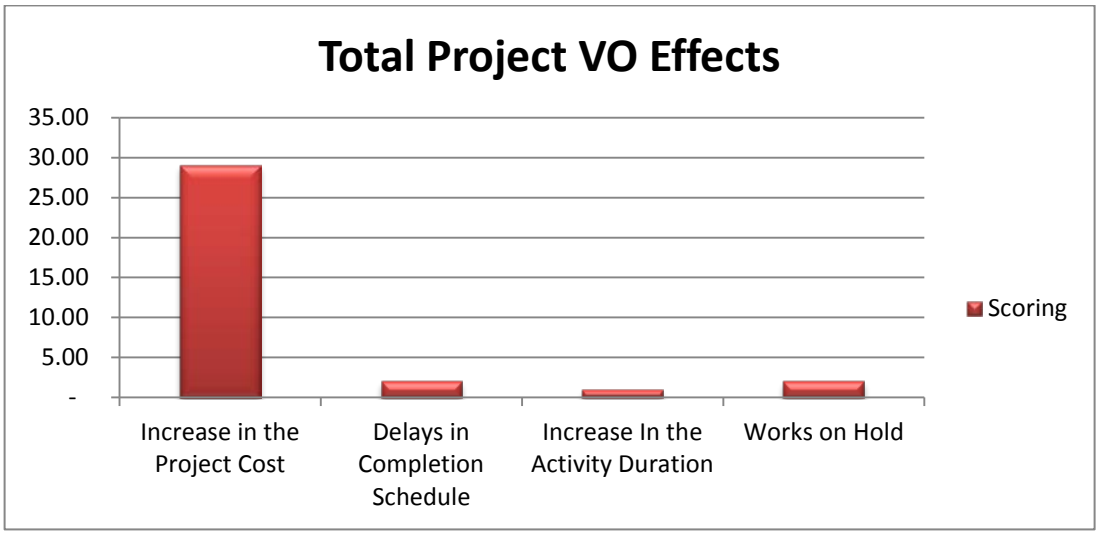

Figure 28. Total Projects Variation Order Effects Chart

According to the graph can be seen that the main effect of the causes for the all projects is increase in the project cost followed by works on hold, delays in completion schedule and increase in activity duration.

According to the chart above there has been prepared a ranking of those effects based on their percentage which are shown in the pie charts below:

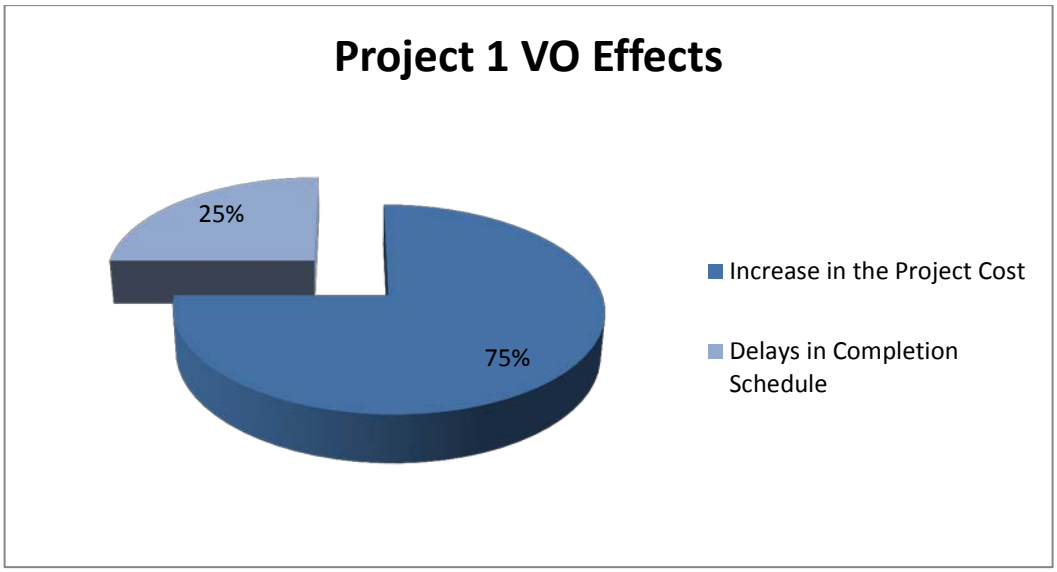

Figure 29. Project 1 Variation Order Effects Percentage Chart

According to this ranking can be observed that in the project 1 increase in the project schedule is the main effect of the caused change order for this project fitting 75 % of the cases followed by the delays in completion schedule with 25% of the cases.

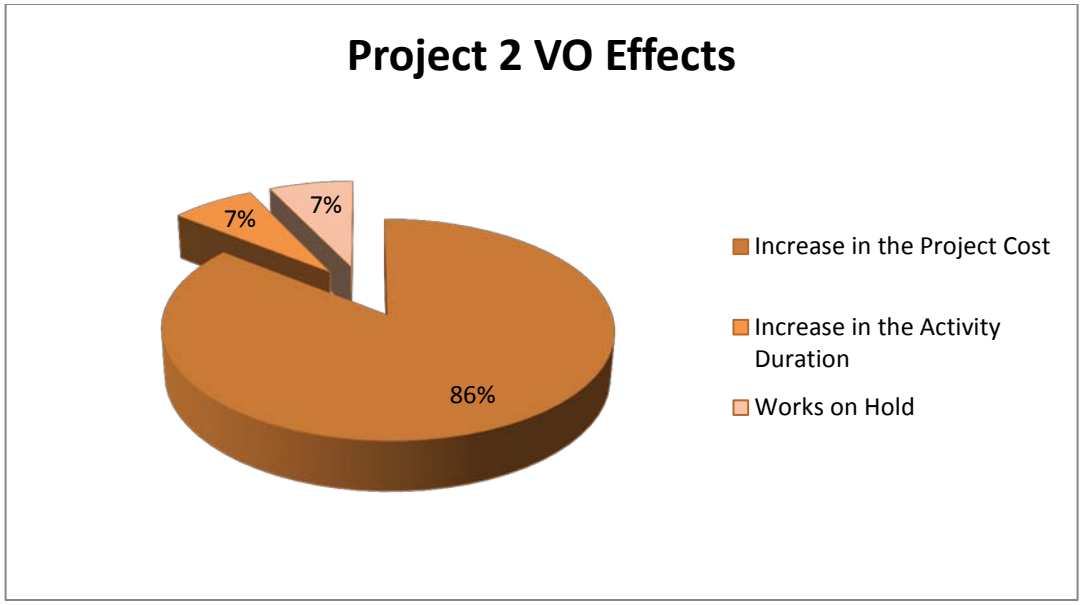

Figure 30. Project 2 Variation Order Effects Percentage Chart

According to this ranking can be observed that in the project 2 increases in the project cost is the main effect of the caused change order for this project fitting 86 % of the cases followed by the increase in each activity duration with 7% and works on hold with 7%.

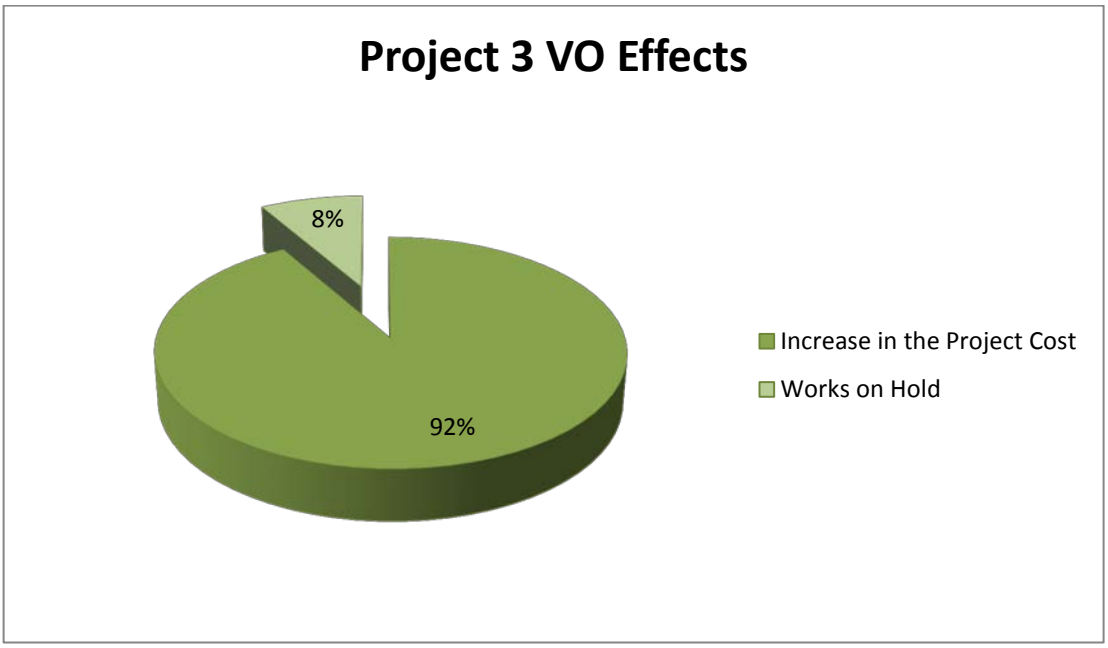

Figure 31. Project 3 Variation Order Effects Percentage Chart

According to the ranking for project 3 based on the analysis result increases in the project cost is the main effect of the caused change order for this project fitting 92 % of the cases followed by works on hold with 8% of the cases. The total ranking of tge effects of all projects is shown in the chart below.

According to this chart the main effect as a result of the change orders in rela projects is increase in the project cost with 85% of the cases, followed by delays in completion schedule and works on hold with 6%, and increase in the activity duration with 3%.

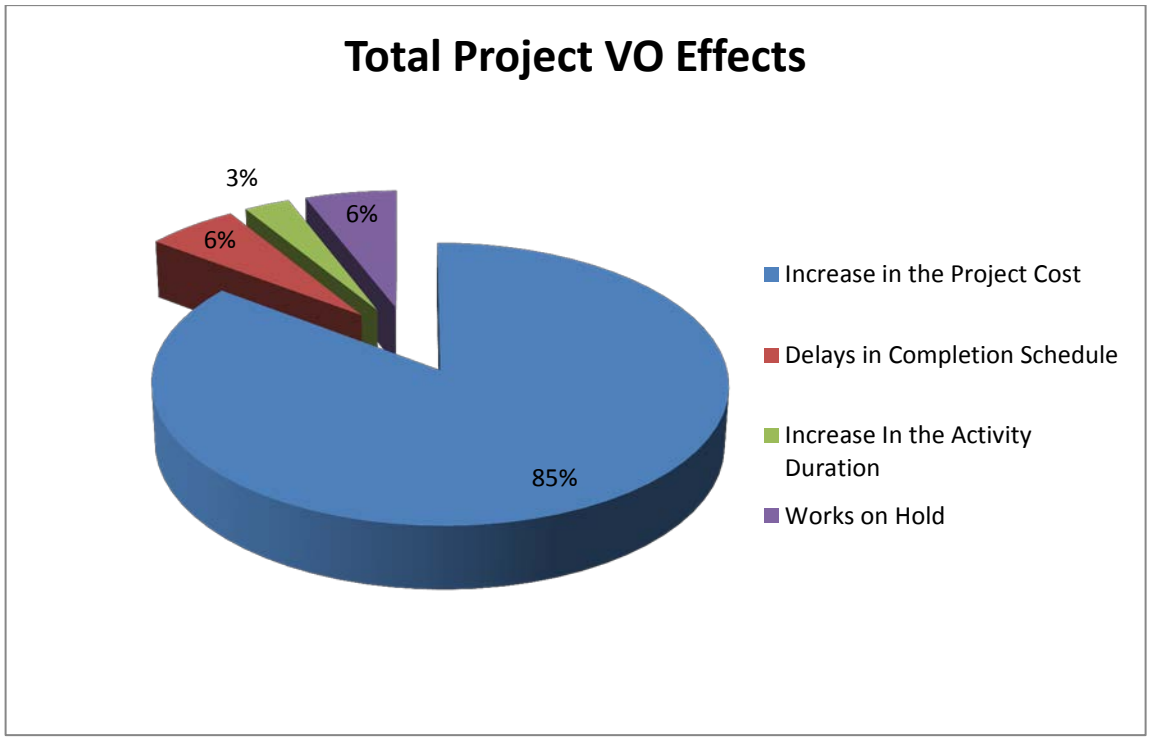

Figure 32. Total Projects Variation Order Effects Percentage Chart

5.5.2. Case Studies Change Order Cost Impact

In the above section were determined the main causes and effects of the change orders for each of the projects and based on all three projects by carrying out the main causes and effects. Those change orders have impact on cost of the project. The impact of those change orders on cost is explained in this section based on the data analysed in section 5.3 of this chapter. Based on the analysis a summary of the cost impact is given in the below tables:

Table 33. Project 1 Variation Order Cost Impact Summary

VO-NO	VALUE OF VO (EURO)	CONTRACT VALUE (EURO)	PERCENTAGE
1	290,000.00	28,627,444.91	**1.01%**
2	11,366.37	28,627,444.91	**0.04%**
3	5,213.60	28,627,444.91	**0.02%**

4	-	28,627,444.91	**0.00%**
5	-	28,627,444.91	**0.00%**
6	470,784.49	28,627,444.91	**1.64%**
7	1,086,497.00	28,627,444.91	**3.80%**
8	2,183,562.86	28,627,444.91	**7.63%**
-	**505,928.04**	**28,627,444.91**	**1.77%**

On *Table 33* are presented the 8 variation orders that are part of the project 1 together with their monetary value and their percentage cost impact for case. As it can be seen the VO 1 has an impact of 1.01%, VO 2 has an impact of 0.04%, VO 3 has an impact of 0.02%, VO 4 has an impact of 0.00%, VO 5 has an impact of 0.00%, VO 6 has an impact of 1.64 %, VO 7 has an impact of 3.80% and VO 8 has an impact of 7.63%. Based on the values and percentage cost impact of those variations for this case study the total cost impact on this project is 1.77% of the contract value, 505 928.04 Euro.

Table 34. Project 2 Variation Order Cost Impact Summary

VO-NO	VALUE OF VO (EURO)	CONTRACT VALUE (EURO)	PERCENTAGE
1	-	8,346,878.40	**0.00%**
2	8,203.78	8,346,878.40	**0.10%**
3	3,888.70	8,346,878.40	**0.05%**
4	69,094.44	8,346,878.40	**0.83%**
5	29,702.00	8,346,878.40	**0.36%**
6	24,086.03	8,346,878.40	**0.29%**
7	126,974.04	8,346,878.40	**1.52%**
8	27,184.35	8,346,878.40	**0.33%**
9	796,842.34	8,346,878.40	**9.55%**
10	9,261.00	8,346,878.40	**0.11%**
11	6,875.96	8,346,878.40	**0.08%**
12	39,157.80	8,346,878.40	**0.47%**
13	-	8,346,878.40	**0.00%**
14	58,152.18	8,346,878.40	**0.70%**
-	**85,673.04**	**8,346,878.40**	**1.03%**

On *Table 34* are presented the 14 variation orders that are part of the project 2 together with their monetary value and their percentage cost impact for case. As it can be seen the VO 1 has an impact of 0.00%, VO 2 has an impact of 0.10%, VO 3 has an impact of 0.05%, VO 4 has an impact of 0.83%, VO 5 has an impact of 0.36%, VO 6 has an impact of 0.29 %, VO 7 has an impact of 1.52% and VO 8 has an impact of 0.33%, VO 9 has an impact of 9.55%, VO 10 has an impact of 0.11%, VO 11 has an impact of 0.08%, VO 12 has an impact 0.47%, VO 13 has an impact of 0.00% and VO 14 has an impact of 0.70% Based on the values and percentage cost impact of those variations for this case study the total cost impact on this project is 1.03% of the contract value, 85 673.04 Euro.

Table 35. Project 3 Variation Order Cost Impact Summary

VO-NO	VALUE OF VO (EURO)	CONTRACT VALUE (EURO)	PERCENTAGE
1	70,350.16	43,949,303.24	**0.16%**
2	2,124,141.88	43,949,303.24	**4.83%**
3	-	43,949,303.24	**0.00%**
4	14,400.00	43,949,303.24	**0.03%**
5	92,976.00	43,949,303.24	**0.21%**
6	(30,481.99)	43,949,303.24	**-0.07%**
7	184,962.18	43,949,303.24	**0.42%**
8	132,849.27	43,949,303.24	**0.30%**
9	27,754.44	43,949,303.24	**0.06%**
10	36,099.02	43,949,303.24	**0.08%**
11	4,681.31	43,949,303.24	**0.01%**
12	173,255.00	43,949,303.24	**0.39%**
-	**235,915.61**	**43,949,303.24**	**0.54%**

On *Table 35* are presented the 12 variation orders that are part of the project 3 together with their monetary value and their percentage cost impact for case. As it can be seen the VO 1 has an impact of 0.16%, VO 2 has an impact of 4.83%, VO 3 has an impact of

0.00%, VO 4 has an impact of 0.03%, VO 5 has an impact of 0.21%, VO 6 has an impact of -0.07 %, VO 7 has an impact of 0.42% ,VO 8 has an impact of 0.30%, VO 9 has an impact of 0.06%, VO 10 has an impact of 0.08%, VO 11 has an impact of 0.01% and VO 12 has an impact 0.39%. Based on the values and percentage cost impact of those variations for this case study the total cost impact on this project is 0.54% of the contract value, 235 915,61 Euro. An average cost impact for the all three projects is 1.11% of the contract value.

The impact on cost depends even on the causes of the changes orders that produce the cost impact. Based on this issue the cost impact according to the causes of the change orders are as given below:

Table 36. Project 1 Causes Cost Impact Results

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 1	Change in Design	290,000.00	28,627,444.91	1.01%
	Inadequate Design	482,150.86	28,627,444.91	1.68%
	Unforeseen site conditions	11,366.37	28,627,444.91	0.04%
	Inadequate Planning	5,213.60	28,627,444.91	0.02%
	Substitution of Materials or Procedures	-	28,627,444.91	0.00%
	Differing Site Conditions	1,086,497.00	28,627,444.91	3.80%
	Safety Consideration	2,183,562.86	28,627,444.91	7.63%

According to the *Table 36* above 1.01 % of the cost impact is caused by the changes i design, 1.68 % is caused by the inadequate design, 0.04% is caused by the unforeseen site conditions, 0.02 % is caused by the inadequate planning, 3.80% is caused by the differing site conditions and 7.63 % is caused by the safety considerations. As it can be observed the biggest cost impact is done by the safety consideration cause for project 1 in the amount 2 183 562.86 composed of 7.63% of the contract value.

Table 37. Project 2 Causes Cost Impact Results

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 2	Inadequate Design	9,261.00	8,346,878.40	0.11%
	Safety Consideration	8,203.78	8,346,878.40	0.10%
	Changes in Design	43,046.50	8,346,878.40	0.52%
	Inadequate Planning	122,882.47	8,346,878.40	1.47%
	Poor Estimation	122,882.47	8,346,878.40	1.47%
	Differing Site Conditions	161,034.35	8,346,878.40	1.93%
	Substitution of Materials or Procedures	854,994.52	8,346,878.40	10.24%

According to *Table 37* 0.11% of the cost impact is caused by inadequate design, 0.10% by the safety consideration, 0.52% by the changes in design, 1.47% by the inadequate planning, 1.47 % by the poor estimation, 1.93 % by the differing site conditions and 10.24 % by substitution of materials or procedures. As it can be observed the biggest cost impact is done by the substitution of materials or procedures cause for project 2 in the amount 854 994.52 Euro composed of 10.24% of the contract value.

Table 38. Project 3 Causes Cost Impact Results

	VARIATION ORDER CAUSES	VO VALUE	CONTRACT VALUE	PERCENTAGE
PROJECT 3	Changes in Design	533,590.39	43,949,303.24	1.21%
	Inadequate Design	173,255.00	43,949,303.24	0.39%
	Significant Changes in the Quantities of Work	2,124,141.88	43,949,303.24	4.83%
	Differing Site Conditions	27,754.44	43,949,303.24	0.06%

According to *Table 38* 1.21% of the cost impact is caused by changes in design, 0.39% is caused by inadequate design, 4.83 % is caused by significant changes in the quantities of work and 0.06 % is caused by the differing site conditions. As it can be observed the

biggest cost impact for project 3 is done by the significant changes in the quantities of work in the amount 2 124 141.88 Euro composed of 4.83% of the contract value.

Table 39. Total Projects Causes Cost Impact Results

AVERAGAE COST IMPACT PERCENTAGE	VARIATION ORDER CAUSES	PERCENTAGE	PROJECT NO	AVERAGE PERCENTAGE
	Change in Design	**2.74%**	**3.00**	**0.91%**
	Inadequate Design	**2.19%**	**3.00**	**0.73%**
	Unforeseen site conditions	**0.04%**	**3.00**	**0.01%**
	Inadequate Planning	**1.49%**	**3.00**	**0.50%**
	Substitution of Materials or Procedures	**10.24%**	**3.00**	**3.41%**
	Differing Site Conditions	**5.79%**	**3.00**	**1.93%**
	Poor Estimation	**1.47%**	**3.00**	**0.49%**
	Significant Changes in the Quantities of Works	**4.83%**	**3.00**	**1.61%**
	Safety Consideration	**7.63%**	**3.00**	**2.54%**

The last table *Table 39* shows the impact on cost of the causes based on the combination of all of the three projects from which can be observed that 0.91% is caused by changes in design, 0.73% is caused by inadequate design 0.01% is caused by unforeseen site conditions, 0.50% is caused by inadequate planning, 3.41% is caused by substitution of materials or procedures, 1.93% is caused by differing site conditions, 0.49% is caused by poor estimation, 1.61% is caused by significant changes in the quantities of the work and 2.54% are caused by safety considerations. As it can be analyzed from the above table the biggest cost impact is done by substitution of materials or procedures followed by safety considerations and significant changes in the quantities of the work.

5.6. Analysis and Results Summary

In this section will be concluded the results summary in a table format as it is shown below in *Figure 33* :

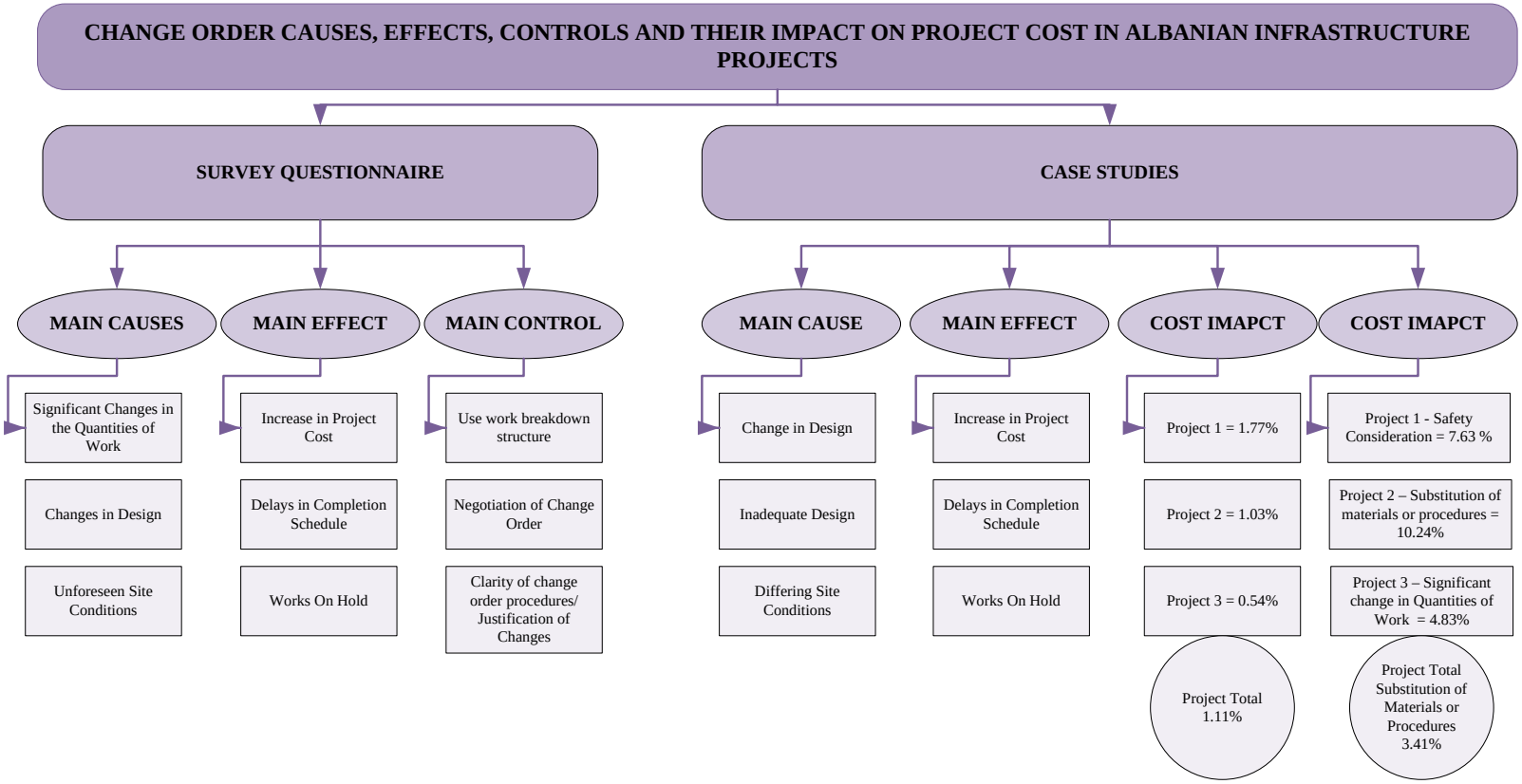

Figure 33. Analysis & Results Summary

5.7. Analysis and Results Comparison with Other Countries

After carrying out the analysis and result for the Albania infrastructure project change order causes, effect and controls based on the survey questionnaire and case studies a comparison was achieved comparing to some other countries as are given in the tables below. The first section will be focused on the survey questionnaire comparison while the second one in the case studies comparison.

5.7.1. Survey Questionnaire

Below is given the comparison table for the causes, effects and controls of the change orders for different countries:

Table 40. Cause of Change Orders Country Comparison (Survey Questionnaire)

CAUSES OF CHANGE ORDERS					
Albania	**Nigeria**	**Oman**	**India**	**Saudi Arabia**	**Sri Lanka**
Significant changes in the quantities of the work	Additional Work	Additional Work	Owner financial Problems	Change of plans by owner	Poor Estimation
Changes in Design	Modification to designs	Modification to Designs	Change of Scope	Owner financial Problems	Unforeseen Site Conditions
Unforeseen Site Conditions.	Usage of grey area of the general contract conditions	Non-availability of manual and procedures	Change of Design	Errros and Ommissions of Design	Political Pressures

As it can be seen from the above table the causes of the change order carried out at this research the first and second one are mostly the same in the other countries. In Albania the significant change in the quantities works was achieved as the main cause which compared to the other contries comes the same as the main cause of the Nigeria and Oman but changes for the other countries such as owner financial problems for India, change of plans by owner per Saudi Arabia and poor estimation for Sri Lanka. As the

second main cause in Albania was found to be changes in design which compared to other countries was the same as the first cause same for Nigeria and Oman and changing for the other countries while the third main cause found in Albania changes from other third main cause found in the other countries.

Table 41. Effects of Change Orders Country Comparison (Survey Questionnaire)

EFFECT OF CHANGE ORDERS				
Albania	**Nigeria**	**Oman**	**Saudi Arabia**	**India**
Increase in the project cost.	VO results in claims and disputes	Delays in completion schedule	Increase in the project cost.	Increase in the project cost.
Delays in completion schedule	Delays in completion schedule	VO results in claims and disputes	Delays in completion schedule	Increase in each activity duration
Work on hold	Cost Overruns	Cost Overruns	Additional Revenue for Contractors	Delays in completion schedule

As per effects of the change orders in Albania the first main cause was found to be increase in project cost which was found to be even in Saudi Arabia, India and changes for the other two countries as given in the table. As per second main cause is the delays in the completion schedule which was found in the four countries (except Oman) as it was found in Albania while the third main cause changes from the Albania to other countries.

Table 42. Controls of Change Orders Country Comparison (Survey Questionnaire)

CONTROLS OF CHANGE ORDERS				
Albania	**Nigeria**	**Oman**	**Saudi Arabia**	**India**
Use of Work Breakdown Structure (WBS)	Assignment of a Specialized Quantity Surveyor	Review of contract documents	Clarity of Scope of Change	Review of contract documents
Negotiation of change order	Early setting of change order handling procedures	Early setting of change order handling procedures	Negotiation of change order	Negotiation of change order
Clarity of change order procedures	Creation of a database	Creation of a database	Approval in Writing	Timely approval of change order

Lastly the controls of the change order found for the Albania changes in comparison to the other countries for the first and the third main cause while as per the second cause the same is found in Albania, Saudi Arabia and India while changes for the other two countires from which was carried out early setting of change order handling procedures as the second main cause.

5.7.2. Case Studies

Below is given the comparison table for the causes and effects of change orders found in Albania against the other countries as given in the tables below:

Table 43. Cause of Change Orders Country Comparison (Case Study)

CHANGE ORDER CAUSES			
Albania	**Sri Lanka**	**United Kingdom**	**Gaza Strip**
Change in Design	Poor Estimation	Design Changes	Inadequate Design
Inadequate Design	Poor Investigation	Risk and uncertainty associated with projects	Significant changes in quantities of Work
Differing Site Conditions	Unforeseen Site Conditions	Inaccurate evaluation of project's time/OR duration	Suggestions to Initiate more Quality

In Albanian case studies taken in consideration was found out that the main cause is changes in design which is even found as the main cause for the United Kingdom, the second main cause inadequate design and the third differing site conditions which does not match with the other countries main causes except the inadequate design which is found even in Gaza Strip but as the main cause.

Table 44. Effects of Change Orders Country Comparison (Case Study)

CHANGE ORDER EFFECTS		
Albania	**United Kingdom**	**Gaza Strip**
Increase in the Project Cost	Increase in the Project Cost	Increase in the Project Cost
Delays in Completion Schedule	Delays in Completion Schedule	Delays in Completion Schedule
Works on Hold	Increase in each activity duration	Decrease in productivity

In Albanian case studies taken in consideration was found out that the main effect of the change order was increase of the project followed by delays in completion schedule and the works on hold. In comparison with Sri Lanka, Gaza Strip and United Kingdom the first and the second main cause are found to be the same for all the countries.

5.7.3. Change Order Cost Impact Comparison

In Albanian case studies taken in consideration was found out that the percentage of cost effect was found to be 1.11% as an average of the selected projects. In comparison with all the other countries such as Netherland 6.30%, Norway 7.90%, US 2.95%, Saudi Arabia 22%, Gaza Strip 7.55%, Albania is found in less percentage in project cost increase. Taking in consideration the all over the world range of the project cost increase that is found to be up 20% the Albanian cost increase is within the limit of this range and less than the developed country which can be even as a result of limited case studies taken in consideration.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1. Conclusion

Change orders are changes done to the project as a result of different causes, effects and controls. As a fact all those causes gave different effects on the project and it is very difficult to be predicted and planned making them risk and uncertainty for the project. In this thesis the causes, effects, controls and cost impact are studied for the Albanian infrastructure projects. For the achievement of the objectives that were determination of the causes, effects, controls and their impact on project cost were used a surev questionnaire and case studies. The survey questionnaire was distributed to the professional and then analyzed using the relative importance index RII while the for the case studies section were taken three road projects located at different parts of Albania from which was collected the required information and then analysed using simple probability and statistics formulas for determination of the main causes and effects of the executed change orders, their impact on the project cost herein including even the cause that has the biggest impact. Following the methodology at the end from the results was concluded that from the survey questionnaire analysis the main cause was significant changes in the quantities of works followed by changes in design and unforeseen site conditions, the main effect was increase in the project cost followed by delays in completion schedule and works on hold, the main control was use of work breakdown structure followed by the negotiation of the change order and clarity of the change order procedures. As per conclusion from the case studies was achieved that the cost impact is 1.77% for the first project, 1.03% for the second project and 0.54% for the third project producing an average of 1.11% cost impact on the projects which is less than the other countries taken in consideration and within the range limit that is up to 20%. For the

cause that imapacts mostly the cost was carried out that in project 1 is safety consideration with 7.63%, in second project substitution of material or procedures with 10.24% and in third project significant changes in the quantities of work with 4.83% producing an average 3.41% impact on cost by the substitution of the materials or procedures cause.

6.2. Recommendation

Based on the findings of this thesis together with the conclusion listed above and referring the previous studies which are mentioned in the literature review the following recommendaations are done:

As it can be seen that siginificant changes in quantities of the works together with change sin design and unforeseen site conditions that were concluded as the main causes and they have relationship between them it is suggested that the project needs to be reviewd before starting the works in order to eliminate the change order which cause even increases in project cost.

It is recommended that the project must be carefully planned in different stages in order to eliminate those changes.

It is recommened that the engineer must be included in selection of the materials in order not to cause change orders as a result of the substitution of the materials or procedures.

It is recommened usage of a professional project management team for effective management of the project which is a step that reduces or mitigates the change orders.

It is recommended usage of work breakdown structure for the control of the change orders which produces an effective tracking procedure which helps in mitigating the change orders.

Another recommendation is creation of change order procedures and clarity of those procedures to the required personeel.

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APPENDIX A – SURVEY QUESTIONNAIRE

SECTION I - GENERAL INFORMATION	
Name	ESMERALDA
Surname	LLAGACI
Email	esmeralda-llagaci@general
Address	Rr. Kavajes
University Degree	Master in Comp. Science

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENER 2 SH.P.K
Position Held	PROCUREMENT MANAGER
Work Experience	CONTRACTS & PROCUREMENT

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design				X	
Errors and Omissions in Design		X			
Substitution of materials or procedures.		X			
Significant changes in the quantities of the work				X	
Contractor financial difficulties			X		
Owner financial difficulties					X
Inadequate planning			X		
Poor estimation			X		
Material non-availability		X			
Unforeseen Site Conditions.		X			
Differing site conditions		X			
Safety consideration		X			
Delays in the approval			X		
Defective workmanship			X		
Poor procurement process		X			
Long procurement process		X			
Unavailability of skills		X			
Unavailability of equipment		X			
Poor performance of contractors			X		
Conflicts between contract documents			X		
Weather Conditions		X			
Force Majeure	X				
Suspensions			X		
Subcontractor claims				X	

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration				X	
Decrease in productivity			X		
Decrease in quality	X				
Delay in Payment			X		
Demolition & Rework		X			
Dispute between owner and contractor				X	
Increase in Overhead expenses			X		
Work on hold		X			

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures		X			
Change order scope			X		
Approval in writing				X	
Justification of changes					X
Review of contract documents					X
Freezing design					X
Team effort				X	
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: Esmeralda Surname: Llagaci SIGN

SECTION I - GENERAL INFORMATION	
Name	ZACHARIAS
Surname	MANZOKEFALIDIS
Email	[illegible]@yahoo.com
Address	TRIPOLIS 22 AGIA PARASKEVI, ATHENS
University Degree	CIVIL ENGINEER

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENERZ - SKIADOS J.V.
Position Held	CONSTRUCTION MANAGER
Work Experience	20 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		X			
Changes in Design		X			
Errors and Omissions in Design			X		
Substitution of materials or procedures.	X				
Significant changes in the quantities of the work					X
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning		X			
Poor estimation				X	
Material non-availability				X	
Unforeseen Site Conditions.					X
Differing site conditions				X	
Safety consideration			X		
Delays in the approval		X			
Defective workmanship			X		
Poor procurement process					X
Long procurement process		X			
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors	X				
Conflicts between contract documents					X
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration		X			
Decrease in productivity		X			
Decrease in quality	X				
Delay in Payment					X
Demolition & Rework		X			
Dispute between owner and contractor					X
Increase in Overhead expenses				X	
Work on hold				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope	X				
Approval in writing					X
Justification of changes					X
Review of contract documents					X
Freezing design	X				
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: ZACHARIAS Surname: MANZOKEFALIDIS SIGN

SECTION I - GENERAL INFORMATION	
Name	IOANNIS
Surname	ROTSIOS
Email	—
Address	KORINTHOS, GREECE
University Degree	CIVIL ENGINEER

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	FREE LANCER
Position Held	STRUCTURAL
Work Experience	15 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		X			
Changes in Design	X				
Errors and Omissions in Design				X	
Substitution of materials or procedures.	X				
Significant changes in the quantities of the work				X	
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning			X		
Poor estimation					
Material non-availability			X		
Unforeseen Site Conditions.					X
Differing site conditions					X
Safety consideration		X			
Delays in the approval	X				
Defective workmanship			X		
Poor procurement process				X	
Long procurement process			X		
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors	X				
Conflicts between contract documents				X	
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule				X	
Increase in each activity duration			X		
Decrease in productivity			X		
Decrease in quality		X			
Delay in Payment				X	
Demolition & Rework		X			
Dispute between owner and contractor					X
Increase in Overhead expenses					X
Work on hold				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope		X			
Approval in writing					X
Justification of changes				X	
Review of contract documents					X
Freezing design	X				
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: IOANNIS Surname: ROTSIOS SIGN

SECTION II - GENERAL INFORMATION	
Name	GEORGIOS
Surname	TABOURIAS
Email	—
Address	KALAMATA, GREECE
University Degree	CIVIL ENGINEER

SECTION III - COMPANY/EXPERINCE IFORMATION	
Company Name	GENOTE
Position Held	CONSTRUCTION DIRECTOR
Work Experience	18 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		X			
Changes in Design		X			
Errors and Omissions in Design			X		
Substitution of materials or procedures.	X				
Significant changes in the quantities of the work					X
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning			X		
Poor estimation				X	
Material non-availability				X	
Unforeseen Site Conditions.					X
Differing site conditions				X	
Safety consideration			X		
Delays in the approval		X			
Defective workmanship			X		
Poor procurement process					X
Long procurement process			X		
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors		X			
Conflicts between contract documents				X	
Weather Conditions				X	

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration			X		
Decrease in productivity			X		
Decrease in quality		X			
Delay in Payment				X	
Demolition & Rework		X			
Dispute between owner and contractor					X
Increase in Overhead expenses				X	
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope	X				
Approval in writing					X
Justification of changes					X
Review of contract documents					X
Freezing design	X				
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: GEORGE Surname: TABOURIAS SIGN

SECTION I - GENERAL INFORMATION	
Name	Fodsinos
Surname	Melesis
Email	[illegible]
Address	Thiva - Greece
University Degree	Civil Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Frodsinos Ltd.
Position Held	Director/Owner
Work Experience	23 yrs

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design	X				
Changes in Design	X				
Errors and Omissions in Design		X			
Substitution of materials or procedures.			X		
Significant changes in the quantities of the work			X		
Contractor financial difficulties			X		
Owner financial difficulties			X		
Inadequate planning		X			
Poor estimation		X			
Material non-availability					X
Unforeseen Site Conditions.				X	
Differing site conditions			X		
Safety consideration		X			
Delays in the approval		X			
Defective workmanship				X	
Poor procurement process			X		
Long procurement process		X			
Unavailability of skills		X			
Unavailability of equipment		X			
Poor performance of contractors		X			
Conflicts between contract documents				X	
Weather Conditions				X	

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule					X
Increase in each activity duration	X				
Decrease in productivity					X
Decrease in quality		X			
Delay in Payment					X
Demolition & Rework					X
Dispute between owner and contractor					X
Increase in Overhead expenses					X
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope					X
Approval in writing					X
Justification of changes					X
Review of contract documents					X
Freezing design					X
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: Melesis Surname: Frodsinos SIGN:

SECTION I - GENERAL INFORMATION	
Name	GIOVA
Surname	SAMADA
Email	Samada@gmail.com
Address	Sulaiman
University Degree	Architect Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	VODAFONE
Position Held	SITE SUPERVISOR
Work Experience	30 YEAR

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		X			
Changes in Design		X			
Errors and Omissions in Design			X		
Substitution of materials or procedures.	X				
Significant changes in the quantities of the work					X
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning		X			
Poor estimation			X		
Material non-availability			X		
Unforeseen Site Conditions.				X	
Differing site conditions				X	
Safety consideration				X	
Delays in the approval			X		
Defective workmanship		X			
Poor procurement process				X	
Long procurement process	X				
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors	X				
Conflicts between contract documents					X
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration		X			
Decrease in productivity		X			
Decrease in quality	X				
Delay in Payment					X
Demolition & Rework	X				
Dispute between owner and contractor				X	
Increase in Overhead expenses				X	
Work on hold					

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope		X			X
Approval in writing		X			
Justification of changes					X
Review of contract documents					X
Freezing design					X
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: Giovla Surname: Samada SIGN

SECTION I - GENERAL INFORMATION	
Name	ALBAN
Surname	RAPI
Email	albanrrapi@yahoo.com
Address	
University Degree	Civil Engineer. (Water re

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Genex 2
Position Held	Facility Manager
Work Experience	10 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design		X			
Errors and Omissions in Design	X				
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work		X			
Contractor financial difficulties					X
Owner financial difficulties					X
Inadequate planning					X
Poor estimation				X	
Material non-availability				X	
Unforeseen Site Conditions.		X			
Differing site conditions			X		
Safety consideration	X				
Delays in the approval				X	
Defective workmanship					X
Poor procurement process			X		
Long procurement process			X		
Unavailability of skills		X			
Unavailability of equipment		X			
Poor performance of contractors					X
Conflicts between contract documents			X		
Weather Conditions	X				

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.	X				
Delays in completion schedule			X		
Increase in each activity duration					X
Decrease in productivity			X		
Decrease in quality					X
Delay in Payment					X
Demolition & Rework	X				
Dispute between owner and contractor					X
Increase in Overhead expenses			X		
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures		X			
Change order scope			X		
Approval in writing					X
Justification of changes					X
Review of contract documents			X		
Freezing design					X
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: ALBAN Surname: RAPI SIGN

SECTION I - GENERAL INFORMATION	
Name	Aurel
Surname	Mako
Email	a.mako@hotmail.com
Address	R. Tafte Teshle
University Degree	Civil Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	MCQ
Position Held	Project Planning & Control
Work Experience	11 Years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design			X		
Errors and Omissions in Design		X			
Substitution of materials or procedures.			X		
Significant changes in the quantities of the work		X			
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning	X				
Poor estimation			X		
Material non-availability					X
Unforeseen Site Conditions.					X
Differing site conditions			X		
Safety consideration		X			
Delays in the approval	X				
Defective workmanship	X				
Poor procurement process		X			
Long procurement process		X			
Unavailability of skills				X	
Unavailability of equipment				X	
Poor performance of contractors				X	
Conflicts between contract documents		X			
Weather Conditions	X				

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.			X		
Delays in completion schedule			X		
Increase in each activity duration			X		
Decrease in productivity			X		
Decrease in quality			X		
Delay in Payment			X		
Demolition & Rework		X			
Dispute between owner and contractor		X			
Increase in Overhead expenses			X		
Work on hold				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope				X	
Approval in writing				X	
Justification of changes					X
Review of contract documents			X		
Freezing design					X
Team effort			X		
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: Aurel Surname: Mako SIGN

SECTION I - GENERAL INFORMATION	
Name	Ervis
Surname	Gepele
Email	—
Address	Br. Frosina plaku
University Degree	Finance

SECTION II - COMPANY/EXPERIINCE IFORMATION	
Company Name	MAG
Position Held	Cost Engineer
Work Experience	10 years

SECTION III - CAUSES OF CHANGE ORDERS

Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design			X		
Errors and Omissions in Design		X			
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work					X
Contractor financial difficulties			X		
Owner financial difficulties			X		
Inadequate planning				X	
Poor estimation				X	
Material non-availability			X		
Unforeseen Site Conditions.			X		
Differing site conditions			X		
Safety consideration	X				
Delays in the approval		X			
Defective workmanship	X				
Poor procurement process			X		
Long procurement process			X		
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors				X	
Conflicts between contract documents			X		
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS

Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration				X	
Decrease in productivity			X		
Decrease in quality			X		
Delay in Payment					X
Demolition & Rework		X			
Dispute between owner and contractor				X	
Increase in Overhead expenses			X		
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER

Scoring	1	2	3	4	5
Negotiation of change order				X	
Clarity of change order procedures					X
Change order scope		X			
Approval in writing				X	
Justification of changes			X		
Review of contract documents					X
Freezing design		X			
Team effort		X			
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures				X	

Name: Ervis Surname: Gepele SIGN

SECTION I - GENERAL INFORMATION	
Name	ERJON
Surname	SABELJA
Email	ejonsadrijo@hotmail.com
Address	Pr. Steven Theveli
University Degree	Civil Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gener 2
Position Held	Project Planning & Control
Work Experience	3 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design				X	
Errors and Omissions in Design			X		
Substitution of materials or procedures.			X		
Significant changes in the quantities of the work		X			
Contractor financial difficulties		X			
Owner financial difficulties		X			
Inadequate planning				X	
Poor estimation				X	
Material non-availability					X
Unforeseen Site Conditions.					X
Differing site conditions			X		
Safety consideration			X		
Delays in the approval	X				
Defective workmanship		X			
Poor procurement process	X				
Long procurement process	X				
Unavailability of skills		X			
Unavailability of equipment			X		
Poor performance of contractors			X		
Conflicts between contract documents			X		
Weather Conditions		X			
Sub-contractors claims				X	
Force Majeure		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule			X		
Increase in each activity duration			X		
Decrease in productivity		X			
Decrease in quality		X			
Delay in Payment				X	
Demolition & Rework		X			
Dispute between owner and contractor			X		
Increase in Overhead expenses				X	
Work on hold					X
Suspension of works			X		

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope					X
Approval in writing					X
Justification of changes					X
Review of contract documents				X	
Freezing design		X			
Team effort			X		
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures				X	
Control of design					X
Market Investigation			X		

Name: ERJON Surname: SABELJA SIGN

SECTION I - GENERAL INFORMATION	
Name	Reborta
Surname	Usui
Email	reborta.usui@hotmail.com
Address	—
University Degree	CEM Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Eneas 2
Position Held	Cost Engineer
Work Experience	1 year

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design					X
Errors and Omissions in Design				X	
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work					X
Contractor financial difficulties		X			
Owner financial difficulties		X			
Inadequate planning	X				
Poor estimation				X	
Material non-availability				X	
Unforeseen Site Conditions.				X	
Differing site conditions		X			
Safety consideration		X			
Delays in the approval	X				
Defective workmanship	X				
Poor procurement process	X				
Long procurement process	X				
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors				X	
Conflicts between contract documents				X	
Weather Conditions	X				

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration				X	
Decrease in productivity	X				
Decrease in quality	X				
Delay in Payment			X		
Demolition & Rework	X				
Dispute between owner and contractor				X	
Increase in Overhead expenses				X	
Work on hold		X			

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope					X
Approval in writing					X
Justification of changes					X
Review of contract documents					X
Freezing design	X				
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures	X				

Name: Reborta Surname: Usui SIGN

SECTION I - GENERAL INFORMATION	
Name	ANTONELLO
Surname	PAU
Email	
Address	
University Degree	

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	STRUGNIS-J
Position Held	QA NC MANAGER
Work Experience	35

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design (BASIC)				X	
Changes in Design (BASIC)					X
Errors and Omissions in Design (BASIC)				X	X
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work					X
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning	X				
Poor estimation	X				
Material non-availability	X				
Unforeseen Site Conditions.	X				
Differing site conditions				X	
Safety consideration	X				
Delays in the approval					X
Defective workmanship	X				
Poor procurement process	X				
Long procurement process	X				
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors	X				
Conflicts between contract documents	X				
Weather Conditions	X				

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule		X			
Increase in each activity duration		X			
Decrease in productivity	X				
Decrease in quality	X				
Delay in Payment	X				
Demolition & Rework				X	
Dispute between owner and contractor			X		
Increase in Overhead expenses				X	
Work on hold	X				

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope					X
Approval in writing					X
Justification of changes					X
Review of contract documents					X
Freezing design	X				
Team effort			X		
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: ANTONELLO Surname: PAU SIGN

SECTION I - GENERAL INFORMATION	
Name	Dine
Surname	Asqeri
Email	[illegible] gmail
Address	Rr. Kodi Sykuth, Kompa Grand
University Degree	Civil Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gener 2
Position Held	Designer (TAP)
Work Experience	7 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design				X	
Errors and Omissions in Design			X		
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work				X	
Contractor financial difficulties		X			
Owner financial difficulties		X			
Inadequate planning					X
Poor estimation				X	
Material non-availability			X		
Unforeseen Site Conditions.			X		
Differing site conditions			X		
Safety consideration	X				
Delays in the approval	X				
Defective workmanship		X			
Poor procurement process		X			
Long procurement process		X			
Unavailability of skills			X		
Unavailability of equipment			X		
Poor performance of contractors			X		
Conflicts between contract documents				X	
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule			X		
Increase in each activity duration				X	
Decrease in productivity		X			
Decrease in quality			X		
Delay in Payment				X	
Demolition & Rework	X				
Dispute between owner and contractor			X		
Increase in Overhead expenses				X	
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures					X
Change order scope		X			
Approval in writing				X	
Justification of changes				X	
Review of contract documents					X
Freezing design			X		
Team effort		X			
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: DINE Surname: ASQERI SIGN

SECTION I - GENERAL INFORMATION	
Name	Roland
Surname	Sinjari
Email	rlndsinjari@yahoo.com
Address	TIRANE
University Degree	CIVIL ENGINEER

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENER 2
Position Held	ENGINEERING COORDINATOR
Work Experience	

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design					X
Errors and Omissions in Design					X
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work			X		
Contractor financial difficulties	X				
Owner financial difficulties	X				
Inadequate planning		X			
Poor estimation		X			
Material non-availability			X		
Unforeseen Site Conditions.				X	
Differing site conditions				X	
Safety consideration			X		
Delays in the approval	X				
Defective workmanship		X			
Poor procurement process		X			
Long procurement process		X			
Unavailability of skills			X		
Unavailability of equipment			X		
Poor performance of contractors			X		
Conflicts between contract documents				X	
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule					X
Increase in each activity duration					X
Decrease in productivity			X		
Decrease in quality	X				
Delay in Payment	X				
Demolition & Rework			X		
Dispute between owner and contractor	X				
Increase in Overhead expenses			X		
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					X
Clarity of change order procedures					X
Change order scope					X
Approval in writing					X
Justification of changes				X	
Review of contract documents				X	
Freezing design			X		
Team effort					X
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					✓

Name: Roland Surname: Sinjari SIGN

SECTION I - GENERAL INFORMATION	
Name	ILIRJAN
Surname	PREKA
Email	ilir_preka@hotmail.com
Address	TIRANE
University Degree	STRUCTURAL CIVIL ENGINEER

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENER 2
Position Held	QUANTITY SURVEYOR
Work Experience	6 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design				+	
Changes in Design					+
Errors and Omissions in Design				+	
Substitution of materials or procedures.		+			
Significant changes in the quantities of the work				+	
Contractor financial difficulties	+				
Owner financial difficulties		+			
Inadequate planning			+		
Poor estimation	+				
Material non-availability	+				
Unforeseen Site Conditions.		+			
Differing site conditions	+				
Safety consideration	+				
Delays in the approval			+		
Defective workmanship	+				
Poor procurement process	+				
Long procurement process	+				
Unavailability of skills		+			
Unavailability of equipment		+			
Poor performance of contractors			+		
Conflicts between contract documents	+				
Weather Conditions				+	

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					+
Delays in completion schedule			+		
Increase in each activity duration					+
Decrease in productivity	+				
Decrease in quality	+				
Delay in Payment	+				
Demolition & Rework			+		
Dispute between owner and contractor			+		
Increase in Overhead expenses				+	
Work on hold		+			

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					+
Clarity of change order procedures				+	
Change order scope		+			
Approval in writing			+		
Justification of changes				+	
Review of contract documents			+		
Freezing design				+	
Team effort	+				
Use of Work Breakdown Structure (WBS)					+
Early setting of change order handling procedures		+			

Name: ILIRJAN Surname: PREKA SIGN

SECTION I - GENERAL INFORMATION	
Name	Andrina
Surname	Guma
Email	andrina.guma@gener2.al
Address	Tirana
University Degree	Civil Engineering

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENER 2
Position Held	Cost engineer
Work Experience	6 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design				+	
Changes in Design					+
Errors and Omissions in Design					+
Substitution of materials or procedures.				+	
Significant changes in the quantities of the work				+	
Contractor financial difficulties			+		
Owner financial difficulties				+	
Inadequate planning			+		
Poor estimation			+		
Material non-availability				+	
Unforeseen Site Conditions.			+		
Differing site conditions		+			
Safety consideration	+				
Delays in the approval		+			
Defective workmanship	+				
Poor procurement process			+		
Long procurement process			+		
Unavailability of skills		+			
Unavailability of equipment		+			
Poor performance of contractors		+			
Conflicts between contract documents		+			
Weather Conditions		+			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				+	
Delays in completion schedule				+	
Increase in each activity duration					+
Decrease in productivity			+		
Decrease in quality			+		
Delay in Payment				+	
Demolition & Rework			+		
Dispute between owner and contractor					+
Increase in Overhead expenses			+		
Work on hold					+

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			+		
Clarity of change order procedures				+	
Change order scope		+			
Approval in writing				+	
Justification of changes			+		
Review of contract documents			+		
Freezing design				+	
Team effort		+			
Use of Work Breakdown Structure (WBS)		+			
Early setting of change order handling procedures				+	

Name: Andrina Surname: Guma SIGN

SECTION I - GENERAL INFORMATION	
Name	YIRZYT
Surname	HANAJ
Email	yflanaj@gmail.com
Address	
University Degree	CIVIL ENGINEER

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENERZ
Position Held	SUPERVISOR
Work Experience	42 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design				X	
Errors and Omissions in Design			X		
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work					X
Contractor financial difficulties -	X				
Owner financial difficulties			X		
Inadequate planning	X				
Poor estimation		X			
Material non-availability			X		
Unforeseen Site Conditions.		X			
Differing site conditions		X			
Safety consideration	X				
Delays in the approval			X		
Defective workmanship	X				
Poor procurement process	X				
Long procurement process	X				
Unavailability of skills	X				
Unavailability of equipment	X				
Poor performance of contractors	X				
Conflicts between contract documents	X				
Weather Conditions		X			
NEW ITEMS OF WORKS					X
MAJOR FORCES		X			
CONSTRUCTION PERMITS DELAY		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule					X
Increase in each activity duration				X	
Decrease in productivity		X			
Decrease in quality	X				
Delay in Payment	X				
Demolition & Rework			X		
Dispute between owner and contractor			X		
Increase in Overhead expenses				X	
Work on hold				X	
SUSPENSION OF WORKS				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order				X	
Clarity of change order procedures			X		
Change order scope				X	
Approval in writing			X		
Justification of changes				X	
Review of contract documents				X	
Freezing design			X		
Team effort		X			
Use of Work Breakdown Structure (WBS)				X	
Early setting of change order handling procedures			X		
INVESTIGATION OF MARKET			X		

Name: YIRZYT Surname: HANAJ SIGN yflanaj

SECTION I - GENERAL INFORMATION	
Name	Brigitte
Surname	Hadjari
Email	brigitte.hadjari@gmail.com
Address	
University Degree	CIVIL ENG

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GENER 2
Position Held	CIVIL ENG
Work Experience	8

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		+			
Changes in Design			+		
Errors and Omissions in Design			+		
Substitution of materials or procedures.		+			
Significant changes in the quantities of the work		+			
Contractor financial difficulties	+				
Owner financial difficulties			+		
Inadequate planning		+			
Poor estimation		+			
Material non-availability		+			
Unforeseen Site Conditions.			+		
Differing site conditions			+		
Safety consideration			+		
Delays in the approval			+		
Defective workmanship			+		
Poor procurement process		+			
Long procurement process			+		
Unavailability of skills		+			
Unavailability of equipment		+			
Poor performance of contractors			+		
Conflicts between contract documents		+			
Weather Conditions			+		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.			+		
Delays in completion schedule				+	
Increase in each activity duration				+	
Decrease in productivity			+		
Decrease in quality			+		
Delay in Payment			+		
Demolition & Rework		+			
Dispute between owner and contractor		+			
Increase in Overhead expenses		+			
Work on hold			+		

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			+		
Clarity of change order procedures			+		
Change order scope			+		
Approval in writing		+			
Justification of changes		+			
Review of contract documents			+		
Freezing design		+			
Team effort		+			
Use of Work Breakdown Structure (WBS)		+			
Early setting of change order handling procedures		+			

Name: _____ Surname: _____ SIGN

SECTION I - GENERAL INFORMATION	
Name	Abdo
Surname	Nkaffou
Email	abdo.nkaffou@gmail.com
Address	B. 4000 Gijon Apt. 2.
University Degree	MBA General Mag

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gemar 2
Position Held	Director of
Work Experience	10 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design				X	
Errors and Omissions in Design				X	
Substitution of materials or procedures.		X			
Significant changes in the quantities of the work				X	
Contractor financial difficulties			X		
Owner financial difficulties			X		
Inadequate planning			X		
Poor estimation				X	
Material non-availability			X		
Unforeseen Site Conditions.				X	
Differing site conditions				X	
Safety consideration			X		
Delays in the approval		X			
Defective workmanship			X		
Poor procurement process				X	
Long procurement process			X		
Unavailability of skills		X			
Unavailability of equipment			X		
Poor performance of contractors					X
Conflicts between contract documents				X	
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule				X	
Increase in each activity duration			X		
Decrease in productivity				X	
Decrease in quality		X			
Delay in Payment			X		
Demolition & Rework			X		
Dispute between owner and contractor			X		
Increase in Overhead expenses				X	
Work on hold				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order				X	
Clarity of change order procedures					X
Change order scope				X	
Approval in writing					X
Justification of changes					X
Review of contract documents			X		
Freezing design			X		
Team effort		X			
Use of Work Breakdown Structure (WBS)					X
Early setting of change order handling procedures					X

Name: _____ Surname: _____ SIGN

SECTION I - GENERAL INFORMATION	
Name	BLERINA
Surname	HOXHA
Email	bleribaku@gmail.com
Address	Br. Petro Nini Luarasi
University Degree	MSc. Environmental Engineer

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gener 2
Position Held	QA QC Deputy MANAGER
Work Experience	12

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design	x				
Changes in Design				x	
Errors and Omissions in Design			x		
Substitution of materials or procedures.				x	
Significant changes in the quantities of the work		x			
Contractor financial difficulties	x				
Owner financial difficulties	x				
Inadequate planning			x		
Poor estimation		x			
Material non-availability		x			
Unforeseen Site Conditions.				x	
Differing site conditions			x		
Safety consideration	x				
Delays in the approval				x	
Defective workmanship			x		
Poor procurement process			x		
Long procurement process			x		
Unavailability of skills				x	
Unavailability of equipment				x	
Poor performance of contractors	x				
Conflicts between contract documents		x			
Weather Conditions		x			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					+
Delays in completion schedule				+	
Increase in each activity duration				+	
Decrease in productivity		+			
Decrease in quality		+			
Delay in Payment		+			
Demolition & Rework			+		
Dispute between owner and contractor		+			
Increase in Overhead expenses				+	
Work on hold					+

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order					+
Clarity of change order procedures					+
Change order scope					+
Approval in writing					+
Justification of changes					+
Review of contract documents				+	
Freezing design		+			
Team effort		+			
Use of Work Breakdown Structure (WBS)					+
Early setting of change order handling procedures			+		

Name: _____ Surname: _____ SIGN

SECTION I - GENERAL INFORMATION	
Name	N/A
Surname	
Email	
Address	
University Degree	

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	N/A
Position Held	
Work Experience	

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design			X		
Errors and Omissions in Design				X	
Substitution of materials or procedures.			X		
Significant changes in the quantities of the work				X	
Contractor financial difficulties			X		
Owner financial difficulties			X		
Inadequate planning				X	
Poor estimation				X	
Material non-availability				X	
Unforeseen Site Conditions.			X		
Differing site conditions				X	
Safety consideration			X		
Delays in the approval			X		
Defective workmanship			X		
Poor procurement process			X		
Long procurement process				X	
Unavailability of skills				X	
Unavailability of equipment				X	
Poor performance of contractors			X		
Conflicts between contract documents			X		
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule				X	
Increase in each activity duration			X		
Decrease in productivity				X	
Decrease in quality				X	
Delay in Payment				X	
Demolition & Rework			X		
Dispute between owner and contractor				X	
Increase in Overhead expenses			X		
Work on hold				X	

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures			X		
Change order scope				X	
Approval in writing				X	
Justification of changes				X	
Review of contract documents				X	
Freezing design				X	
Team effort			X		
Use of Work Breakdown Structure (WBS)				X	
Early setting of change order handling procedures			X		

Name: N/A Surname: N/A SIGN

SECTION I - GENERAL INFORMATION	
Name	EVDRIT
Surname	GERISHA
Email	endritherisha 1990 @ gmail.com
Address	Tirane
University Degree	Master of Science

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	
Position Held	
Work Experience	

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design		X			
Changes in Design				X	
Errors and Omissions in Design		X			
Substitution of materials or procedures.	X				
Significant changes in the quantities of the work	X				
Contractor financial difficulties		X			
Owner financial difficulties	X				
Inadequate planning				X	
Poor estimation		X			
Material non-availability	X				
Unforeseen Site Conditions.		X			
Differing site conditions		X			
Safety consideration		X			
Delays in the approval					X
Defective workmanship			X		
Poor procurement process			X		
Long procurement process			X		
Unavailability of skills		X			
Unavailability of equipment		X			
Poor performance of contractors			X		
Conflicts between contract documents			X		
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule					X
Increase in each activity duration					X
Decrease in productivity					X
Decrease in quality		X			
Delay in Payment					X
Demolition & Rework			X		
Dispute between owner and contractor				X	
Increase in Overhead expenses				X	
Work on hold					X

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures			X		
Change order scope		X			
Approval in writing			X		
Justification of changes			X		
Review of contract documents			X		
Freezing design			X		
Team effort			X		
Use of Work Breakdown Structure (WBS)			X		
Early setting of change order handling procedures			X		

Name: Endrit Surname: Gerisha SIGN

SECTION I - GENERAL INFORMATION	
Name	REZAM
Surname	MASHA
Email	rezmasha@gener2.el
Address	V Paulu, Tirana
University Degree	Surveying Engineer (Geomatics)

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gener 2
Position Held	Senior Surveyor
Work Experience	8 yr

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design				X	
Changes in Design					X
Errors and Omissions in Design			X		
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work					X
Contractor financial difficulties		X			
Owner financial difficulties		X			
Inadequate planning			X		
Poor estimation	X				
Material non-availability				X	
Unforeseen Site Conditions.		X			
Differing site conditions	X				
Safety consideration		X			
Delays in the approval	X				
Defective workmanship	X				
Poor procurement process	X				
Long procurement process		X			
Unavailability of skills		X			
Unavailability of equipment		X			
Poor performance of contractors		X			
Conflicts between contract documents		X			
Weather Conditions		X			

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule				X	
Increase in each activity duration				X	
Decrease in productivity		X			
Decrease in quality	X				
Delay in Payment		X			
Demolition & Rework		X			
Dispute between owner and contractor		X			
Increase in Overhead expenses		X			
Work on hold			X		

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order		X			
Clarity of change order procedures		X			
Change order scope	X				
Approval in writing	X				
Justification of changes		X			
Review of contract documents			X		
Freezing design				X	
Team effort		X			
Use of Work Breakdown Structure (WBS)		X			
Early setting of change order handling procedures		X			

Name: Rezam Surname: Masha SIGN

SECTION I - GENERAL INFORMATION	
Name	Gëzim
Surname	Pani
Email	gpani22@yahoo.com
Address	Br. Taga Gjon Pali II, Tirana
University Degree	M.Sc. Electrical Engineering

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Gener 2 Sh.P.K.
Position Held	Director of Planning Department
Work Experience	16 years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design					X
Changes in Design				X	
Errors and Omissions in Design				X	
Substitution of materials or procedures.				X	
Significant changes in the quantities of the work			X		
Contractor financial difficulties		X			
Owner financial difficulties		X			
Inadequate planning					X
Poor estimation					X
Material non-availability			X		
Unforeseen Site Conditions.			X		
Differing site conditions			X		
Safety consideration			X		
Delays in the approval		X			
Defective workmanship				X	
Poor procurement process		X			
Long procurement process		X			
Unavailability of skills				X	
Unavailability of equipment		X			
Poor performance of contractors					X
Conflicts between contract documents					X
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.			X		
Delays in completion schedule				X	
Increase in each activity duration				X	
Decrease in productivity			X		
Decrease in quality		X			
Delay in Payment		X			
Demolition & Rework		X			
Dispute between owner and contractor			X		
Increase in Overhead expenses		X			
Work on hold		X			

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order				X	
Clarity of change order procedures				X	
Change order scope				X	
Approval in writing			X		
Justification of changes				X	
Review of contract documents				X	
Freezing design			X		
Team effort				X	
Use of Work Breakdown Structure (WBS)				X	
Early setting of change order handling procedures				X	

Name: Gëzim Surname: Pani SIGN

SECTION I - GENERAL INFORMATION	
Name	EGJON
Surname	LALA
Email	egjonlala@yahoo.com
Address	
University Degree	MASTER INFRASTRUCTURE ENGINEERING

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	GEUER 2
Position Held	ROAD CONSTRUCTION MANAGER
Work Experience	16 YEARS

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design			X		
Changes in Design				X	
Errors and Omissions in Design		X			
Substitution of materials or procedures.			X		
Significant changes in the quantities of the work				X	
Contractor financial difficulties	X				
Owner financial difficulties			X		
Inadequate planning		X			
Poor estimation		X			
Material non-availability			X		
Unforeseen Site Conditions.					X
Differing site conditions		X			
Safety consideration	X				
Delays in the approval					X
Defective workmanship	X				
Poor procurement process		X			
Long procurement process	X				
Unavailability of skills	X				
Unavailability of equipment		X			
Poor performance of contractors				X	
Conflicts between contract documents					X
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.					X
Delays in completion schedule					X
Increase in each activity duration				X	
Decrease in productivity		X			
Decrease in quality			X		
Delay in Payment			X		
Demolition & Rework	X				
Dispute between owner and contractor				X	
Increase in Overhead expenses			X		
Work on hold			X		

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures		X			
Change order scope		X			
Approval in writing				X	
Justification of changes				X	
Review of contract documents			X		
Freezing design				X	
Team effort		X			
Use of Work Breakdown Structure (WBS)			X		
Early setting of change order handling procedures		X			

Name: Egjon Lala Surname: _____ SIGN

SECTION I - GENERAL INFORMATION	
Name	Florian Sota
Surname	Sota
Email	florian.sota@gmail.al
Address	Durrës 46
University Degree	

SECTION II - COMPANY/EXPERINCE IFORMATION	
Company Name	Company 2
Position Held	HS Manager (Health & Safety)
Work Experience	5 Years

SECTION III - CAUSES OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Inadequate Design				X	
Changes in Design				X	
Errors and Omissions in Design			X		
Substitution of materials or procedures.		X			
Significant changes in the quantities of the work				X	
Contractor financial difficulties			X		
Owner financial difficulties			X		
Inadequate planning					X
Poor estimation					X
Material non-availability		X			
Unforeseen Site Conditions.				X	
Differing site conditions			X		
Safety consideration		X			
Delays in the approval		X			
Defective workmanship		X			
Poor procurement process		X			
Long procurement process			X		
Unavailability of skills				X	
Unavailability of equipment			X		
Poor performance of contractors					X
Conflicts between contract documents			X		
Weather Conditions			X		

SECTION IV - EFFECTS OF CHANGE ORDERS					
Scoring	1	2	3	4	5
Increase in the project cost.				X	
Delays in completion schedule					X
Increase in each activity duration				X	
Decrease in productivity				X	
Decrease in quality				X	
Delay in Payment				X	
Demolition & Rework			X		
Dispute between owner and contractor			X		
Increase in Overhead expenses			X		
Work on hold			X		

SECTION V - CONTROLS OF CHANGE ORDER					
Scoring	1	2	3	4	5
Negotiation of change order			X		
Clarity of change order procedures			X		
Change order scope			X		
Approval in writing				X	
Justification of changes			X		
Review of contract documents			X		
Freezing design				X	
Team effort				X	
Use of Work Breakdown Structure (WBS)				X	
Early setting of change order handling procedures				X	

Name: Florian Surname: Sota SIGN