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Causes of Delay in Construction Projects

In Abu Dhabi

أسباب تأخير مشاريع الإنشاء في أبوظبي

By

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of

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Abstract

Construction projects experience delays in their completion due to various reasons in the world and United Arab Emirates (UAE) is no exception. Once a project is delayed, it has a negative impact on the concerned parties. Projects being completed on time and handed over is recorded as a performance indicator from technical and commercial point of view. This dissertation aims to make an in-depth evaluation for the causes of delay in construction projects in Abu Dhabi and rank them to know their importance and consequences. Detailed literature review was carried out and a list of delays was concluded which was further divided into associated groups of the project. Survey questionnaire was developed from the list and used for further evaluation. All associated stakeholders (client, consultants, project managers, contractors, authorities) in the project can be the reason for delay. Some delays are compensated whereas some are not depending on the type of delays.

Quantitative research approach is applied in this study conducting a survey from stakeholders. Report analysis shows that the top ten (10) cause of delay based on the ranking are 1) Lack of coordination with Electro Mechanical works, 2) Selection of the lowest bidder commercially, 3) Delay in approvals and late decision making, 4) Material delivery delays, 5) Client introduction of additional works during construction stage, 6) Inefficient planning and scheduling of the projects, 7) Labor and equipment non productivity, 8) Coordination issues and quality of works, 9) Delay in design approvals by Client and 10) Original contract duration is not realistic. A limitation to this dissertation was that there were 61 respondents whereas a larger number of respondents can give a bigger perspective.

It was concluded through this dissertation study that project team, owners and contractor factors were the key reasons for delay and if they take responsibility of their action on time, coordinate and work as team they can have successful projects with minimal or no delay.

Key Words: Causes; Delays; Abu Dhabi; Construction projects

خلاصة البحث

إن التأخير بتسليم مشاريع الإنشاء هو لعدة أسباب سواء على مستوى العالم أو الإمارات العربية المتحدة، عندما يتأخر تنفيذ المشروع فهذا له تأثير سلبي على الأطراف المعنية، إن المشاريع المنجزة والمسلمة ضمن الوقت المحدد هي مؤشر لمقدار الإنجاز من الجانب التقني والتجارية. إن أهداف هذه الأطروحة هو التقييم العميق لأسباب تأخر إنجاز المشاريع في أبوظبي وترتيب هذه الأسباب من حيث الأهمية والعواقب الناتجة. تم عمل محاضرة مفصلة بقائمة الأسباب وتصنيفها لمجموعات، وتم عمل استطلاع للرأي لهذا التصنيف والتقييم. جميع الأطراف المعنية (المالك، الاستشاري، مدراء المشاريع، المقاولين، الجهات الحكومية) ممكن أن يكونوا السبب بالتأخير. بعض التأخيرات يمكن تعويضها بينما البعض الآخر حسب نوع التأخير .

طريقة البحث هي طريقة كمية تعتمد على إجراء استطلاع من الأطراف ذات المنفعة، إن التقارير التحليلية أظهرت أن أهم عشر أسباب لتأخر المشاريع هي : 1. ضعف التنسيق بمجال أعمال الميكانيك والكهرباء 2. اختيار المقاول الأقل سعرا 3. التأخر بالموافقات واتخاذ القرارات 4. التأخير بتوفير المواد 5. رغبة المالك بإضافة أعمال جديدة خلال تنفيذ المشروع 6. التخطيط وجدولة الأعمال بطريقة غير كافية للمشروع 7. قلة إنتاجية العمال والتجهيزات 8. مشاكل التنسيق وجودة العمل 9. التأخير بموافقات التصميم من قبل المالك 10. مدة التعاقد غير الواقعية للمشروع. هذه الأطروحة اعتمدت على 61 استقصاء وبالتأكيد العدد الأكبر من الاستقصاءات يعطي دقة أكبر .

الخلاصة من هذه الأطروحة أن فريق المشروع المعين من طرف المالك والمقاول هم المسببين الرئيسيين للتأخير وأن تحملهم لمسؤولية اتخاذ القرارات ضمن الوقت المحدد والتنسيق والعمل كفريق واحد ستمكنهم من إنجاز مشاريع ناجحة بتأخير لا يذكر أو حتى بدون تأخير .

Dedication

I dedicate my dissertation work to the soul of my beloved Father and continuous prayers of my beloved Mother who have always protected me and guided me in to the right direction.

I am very grateful to my wife and my eldest daughter for their constant support, patience, assistance and love. I will always appreciate the questions and complaints of my son and my youngest daughter for not being there even on holidays during the dissertation preparations period.

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Chapter 1

1 Introduction and Background

1.1 What is a Project?

Several attempts have been carried out to describe and define by many people and concerned organizations that “what is a project”?, or what it should be, and how it can be defined, this may seem like an easy question to answer; majority would think they can recognize one debated by Paul (2005), to have an understanding from different perspectives of researchers for example: Mintzberg (1983) defines a project “As an organizational unit that solves a unique and complex task” and Collins (1987) defines a project as “An idea or plan that you intend to carry out in the future or that is being carried out at present” and explains it as “A detailed study of a particular subject”, further Webster (1989) defines a project as “Something that is contemplated, devised, or planned, plan, scheme and a large or major undertaking, especially one involving considerable money, personnel, and equipment and further a specific task of investigation”. MacLachlan (1996) defined “A project is a task with a beginning, a middle and an end, which you as a manager need to complete”. BS 6079 Guide to Project Management refers that a project is “A unique set of coordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters”. The Project Management Institute (PMI) defines a project by its two key characteristics i.e. all projects are temporary and undertaken to create a product, service, or result that is unique and further explains the definition of a project as a “temporary endeavor to create a unique product, service, or results and it lasts for a certain period of time” i.e., a project is special and unique with a specified duration PMI (2006, p.4). Rajegopal, McGuin & Waller (2007) states that “Projects are a series of planned activities with clearly defined start and end points and clearly defined deliverables”. Greg (2007) explains project as a unique endeavors which have start and end time frame in order to achieve the desired goal which satisfies the customers/stakeholders needs & requirements. A project is a temporary endeavor with a defined start and finish undertaken to create or deliver a unique product or service (Moustafev 2011).

Based on the above definitions stating different perspectives of a project as a temporary task or an assignment with a predefined set of activities possessing a start and conclusion date, or

even as an individual task or a combined effort to achieve a target deadline or to another level as a unique process composed of a set of well-coordinated and comparatively controlled activities with a beginning and a ending dates, undertaken to reach a target conforming to specific contractual requirements, including constraints of time, cost, quality and resources.

1.2 Project Characteristics

Projects are said to be one of the most significant characteristics of contemporary organizations Clegg (1990). Lundin & Soderholm (1998) states that most of the western economy are interested to be heading towards “Projectified society” further Maylor (2001) described that projects are initiated so that problems of almost any size and type can be solved and in almost any type of business. This provides us with a perspective that it is not only theoretical and scholarly interest but it provides a practical systematic perspective of solving problems.

Levine (2005), narrated that not all projects are same, reviewing the available literature it has given different classifications of projects and accordingly research authorities various perspectives provided three classifications of projects i.e. *Maintenance project*; such projects generally cater for projects in progress and regular maintenance services. *Growth or enhancement project*; such projects support strategic initiatives and expect continued increasing value and are also needed by the companies to keep in a solid competitive position. *Transformation project*, are the projects which offer unique opportunities to enhance companies to a new level or to indulge into new portfolios or services that will dominate the market. The ultimate target is to capture a new market or innovate into new technology; it has the potential of reaching new heights but requires special handling. In the real world, projects often need to get moving while at least some of these questions remain imperfectly answered. Projects become projects because of certain characteristics i.e. they are an instrument of bringing in change, they are unique in nature and off the routine works, and their activities are inter-dependent on each other. Generally, those people are involved who have varied experience and have different roles in life i.e. masons, carpenters, welders, painters, designers, engineers, IT specialists and many other trades. Although it is temporary but must have defined start and end dates, baseline always stays same however dates may change due to many reasons. The term project can be divided into three major parts i.e. *Program*, operates comparatively in long-term and is designed to use the organization’s resources to impact a specific subject area that is part of an organization’s mission to improve public health. *Project*; it has a beginning and an end and possess defined resources and creates innovative and unique product or service

as per customer choice, *Process*; it is part of the ongoing operations of the organization, can be changed with the time. Once established, an organizational process operates on a continuous basis without a specified end.

1.3 Projects Scope and Limitations

As a general practice in projects and construction industry, required scope of a construction project is defined and set out in a written contract between the associated parties witnessed by the members of the project team. Scoping of a project is basically communicating the requirements it not only helps the team but also determine how the project and its team is going to achieve with their strengths Briner et al. (1996). Albert (2001) described that the scope of the project is related to clearly identify and further develop all the required works that is needed to start and complete a project. It is further narrated that scoping is considered to be the most important area to be considered in a project life cycle and it is not done adequately and comprehensively than the project execution team will always have problems. Paul (2005) quoted "it is about turning in all the stakeholders to the project, goal of the project, and how the project is going to benefit the organization and its people". A project execution is decided into a number of stages, each with specific milestones and targets to know the periodic progress status and can control (Roberts 2011).

Brewer and Dittman (2010) highlighted that every project has a list of customer required *scope* that always mentions the amount of *time* for the product and the limitation of funds (*Cost*) available the three components are known as triple constraints and they are also the criteria to evaluate a project's success. Before one can most effectively manage a project, there needs to be a comprehensive understanding of that project, its purpose, objectives, scope, sponsorship, funding and ultimate target. Research studies shows that projects are considered not existing until they are properly provided with adequate definition. In several ways everyone plays a role of a project manager in their life by executing some group of activities, it is just that in project management the roles are more defined and organized.

Projects have internal and external stakeholders and their involvement is very important depending on the stages of the project. Planning plays the most important role in any project from inception to close out. Most importantly, it is said that "Planning launches a project" having planned the work the next key activity is to work the plan.

If the project is looked at as a system there are inputs (requirements, needs) then we start the management process constraints which include triple constraints, customer satisfaction, legal parameter) using the mechanism (tools and techniques, resources) and ultimately output (product is ready as delivered)

1.4 The Triple Constraint

Highlighted by Levine, (2005) and described by Cohen et al. (2000) that there are three (3) most important project elements called triple constraints: Outcome, Cost and Schedule/Duration. Brewer & Dittman (2010) debated that “Every project is constrained by a list of customer-requested requirements (scope), the amount of (time) available to produce the system in support to the requirements, and the limit of the money available (cost). This is referred to as the triple constraint of project management”. Schwalbe (2007) debated that “to create a successful project, a project manager must consider scope, time and cost and balance these three often-competing goals” he further debated that “Managing the triple constraint involves making trade-offs between scope, time and cost goals for a project. Kerzner (2009) highlighted “Successful project management can be defined as having achieved the project objectives, within time, within cost, at the desired performance \ technology level while utilizing assigned resources effectively and efficiently accepted by the customer”. Brown et al (2010) pointed out that “An organization must clearly established the relative priority of triple constraint criteria”. Brown & Hyer (2010) debated that “The most commonly recognized project metrics are time, cost and performance. In combination they form a set of potentially competing project priorities known as the triple constraints. The triple constraints definitions form a successful program. Larson et al. (2011) highlighted that “one of the primary jobs of the project manager is to manage the trade-offs among time, cost and performance”.

Scope, time and cost are considered as major elements and quality is ultimately impacted by the balance between these three (3) elements. Projects are represented as parts or components of the portfolio and therefore it is critical to understand the inter-relationship between them. The triple constraints provide the criteria for evaluating the project status and for project decision-making. Thus, the triple constraints is also a source of resolving problems for project managers and other associated management. The project management process starts with the initiation of a project, followed by planning, execution and control, and closing processes. Projects come from requirements, needs, necessities, developments, stakeholder requirements,

public needs, government requirements, community requirements etc. Projects are launched by project sponsors, owners, clients, governments, schools, offices, an individual, i.e. if couple got married and now they need new house to live in gives us a new project, a college campus upgraded its technology infrastructure to provide wireless internet access creates a new project, all school busses in UAE to have close circuit television system is a new project, a pharma company launches a new drug, creates a new project, so when there is a “need” a project is evolved having many resources and stakeholders from within or out.

1.5 What is Project Management?

Atkinson (1999) discussed in detail that in the past many researchers have attempted to define project management, one of the most oldest attempt was by Oisen (1971) who quoted “Project Management is the application of a collection of tools and techniques (such as the CPM and matrix organization) to direct the use of diverse resources toward the accomplishment of a unique, complex, one-time task within time, cost and quality constraints. Each task requires a particular mix of these tools and techniques structured to fit the task environment and life cycle (from conception to completion) of the task”. Reiss (1993) suggests a “Project is a human activity that achieves a clear objective against a time scale, and to achieve this while pointing out that a simple description is not possible, suggests project management is a combination of management and planning and the management of change”, while Burke (1993) defined project management as specialized management technique where planning and controlling projects is considered under a strong single point of responsibility”, Lock's (1994) view was that “Project management had evolved in order to plan, co-ordinate and control the complex and diverse activities of modern industrial and commercial projects”. The British Standard for project management BS6079 1996 proposed project management definition as “ The planning, monitoring and control of all aspects of a project and the motivation of all those involved in it to achieve the project objectives on time and to the specified cost, quality and performance”, The United Kingdom (UK) Association of Project Management (APM) have produced a UK Body of Knowledge UK (BoK) defined project management as “ The planning, organization, monitoring and control of all aspects of a project and the motivation of all involved to achieve the project objectives safely and within agreed time, cost and performance criteria. The project manager is the single point of responsibility in achieving this”. Turner (1996) suggest that project management can be described as “The art and science of converting vision into reality”. Atkinson (1999) commented, based on the several attempts done to define the project

management that the main criteria for success of a project is always revolving around cost, time and quality and are included in the actual description in one way or another. He further suggested that the example given to define project management by Oisen in 1971 was either correct, or mentioned as a discipline, project management has very less probability of changes or developed the success measurement criteria in almost 50 years. Project management is always represented as a continuous learning profession with development and innovation.

Atkinson (1999) further reinforced by saying that project management is an continuous evolving phenomenon which is considered to remain vague and wide open to be non-definable with flexible attributes having the capacity to absorb many new innovations.

It is understood that project management started gaining attention from late 1950s, although it was only the beginning but from 1970s it became more popular as reported by (Winch, 2000). Morris (1997), Morris et al. 1997 discussed that project management confirms a system with which one can deliver, confirming on time and budget within the required scope, although planning and controlling of variables which includes productivity cost, schedule, risks and quality. He also confirms that majority of the ground works for project management technics was done in United States defense and aeronautics in 1950s for Manhattan projects while developing the first atomic bomb. Hodgson (2002) commented that project management techniques have been developing in the last four (4) decades and it is not limited to technology and engineering but is widely used in education, social services, health and other industries. He further reinforced that in the last 10 years, project management has been very flexible for managerial staff and have been widely used in knowledge management innovation and many other professional fields. It is further described that development of project management in to a specific profession is dependent on the representation of knowledge as the objective, proactive, self-evident and more effective field. He compared the definition from PMI and APM for project management which somehow differs in nature but both set out broadly the similar type of model which requires knowledge and techniques (such as project life cycle, budgeting, scheduling, etc.). Flyvbjerg (2007) have raised his concerns as well by mentioning that with time, project based environment and project management has become more complex with its forms and processes. Maylor et al. (2008) commented that projects have become a most prominent means of addressing and acknowledging complexity, as it has the capacity to handle the most complex ones. Louis et al. (2014) further highlighted in his explanation that "Project management is complex and therefore a fruitful ground for creative, spontaneous and

initiative applications of particular theories to meet a stated objective in a constantly changing environment”.

So developing an understanding project management is basically utilization of learned skills, acquired knowledge from books or other sources, utilization of available tools and techniques in order to fulfill the project requirements and objectives. It is the process of achieving project objectives (schedule, budget and performance) through a number of defined activities that start and end at certain point of time and produce required deliverables. As per PMI project management is described through the nine (9) knowledge areas i.e. scope of project, time required, cost estimated, quality, human resources, communication, risks involved, procurement, stake holder management and the last one is their integration. This will ensure the project gets delivered as per the client requirements and further project management processes fall into five groups, initiating, planning, executing, monitoring and controlling and closing.

As stated in PMI (2010) nowadays almost all the leading organizations across the world have been supporting and implementing Project Management as a tool to control the expenses and thereby improving their results. Due to recession crisis, the project management practice became more prominent in the major companies. The professionals in the field identified the advantages of applying Project management tools to their system and the important findings noted were reducing the risks involved in the process, cost reduction and improved success rates. The turning point of the mentioned factors was the survival of the organizations in the severe economic crisis conditions. With the success rate of major businesses, the importance of project management started playing a crucial role in the business industry among the professionals indulging them to: Invest more time in project planning, conduct more project reviews to assess risk milestones, overall project value analysis. Project management implementation processes further lead to fruitful and achievable results creating a strategic perspective that gives companies an edge on their competitors, more specifically in high-risk markets. Thus efficient project management processes enable different organizations in delivering their products on the agreed timeframes and within the agreed budget limits. This nature of consistency and success in the market defines the business growth of an organization on whether they will receive the new job orders in future, whether they can survive in the industry etc. An efficient project management process requires a highly qualified project manager possessing the overall deep knowledge in the field to lead the team and come up with

desired results. Also the skill and knowledge of the whole team in identifying the risk factors plays a major role in obtaining the desired results.

1.6 Construction Project Failures and Success

The construction project is generally considered as successful when it is completed and delivered within the required period, defined budget, as per the required specifications and fulfilling stakeholder satisfaction. Takim & Akintoye (2002) stated that project is considered as successful if it is fulfilling the functionality, has been profitable to the contractor, they were no claims and it was fit for the purpose. Ashley et al. (1992) highlighted a project success as not only fulfilling the requirements but exceeding the expectations which are generally referred in terms of cost, quality, time, safety and owners satisfaction, further Sanvido et al. (1992) projects are considered successful, if the goals and objectives are met. Chua et al. (1999) recommended a hierarchical model for construction success are the key objectives of cost quality time considered as key measures that contribute to the objective which is project success.

Julie & Frank (2005) proposed that a project is a temporary and unique achievement carried out to reach some specific objective with delivery of associated results. They further highlighted that projects bring in changes in society and for the companies associated with the projects, one or more at a given specific time. Projects start with a requirement and ends at a certain time and situation which brings in certain changes positive or negative in terms of success and failure. Project management is the overall concept, methodology and tools used to make the concept realized in form of meeting the objectives and delivery of results.

If projects are successful further new developments are planned, new changes happen within society and associated companies. If a projects fails due to any reason then it has socio-economical and commercial impacts which further bring in changes in society and associated companies lead to bringing in bad name and sometimes complete closure.

Project life cycle is described by PMI process: Project initiation, Project Planning, Project execution and controlling and Project Closing. The planning process identifies, estimates and prepare all the activities from start to end for the required objectives and delivery of the goods. The output from the project planning process is the project execution plan that contains the structure deliverables, required resources and a clear estimate on time cost and quality

dimensions which is also known as the “triple constraints” of a project. Julie & Frank (2005) stated that “The project planning process is very important and not under control”. Very important because input in upstream will have a direct impact in downstream in other words” failing to plan is planning to fail”. Not under control means that it is not possible to know exactly what the future holds future but only an apprehension/ forecast can be given as an estimated plan which is always subjected to changes as per the requirements.

As reported in the United States Department of Interior Bureau of Reclamation it is important to establish certain standards so that the project success can be measured and defined. In the true sense, a project is successful if the required service or a product is delivered to the client within time and allocated budget with the required quality. PMI illustrated quality of projects through “triple constraints” i.e. scope, time and cost. Quality of the projects is directly affected due to these interrelated factors and any change in them will have impact on at least one. Cost and time are generally fixed however scope plays a greater role in order to achieve the project objectives if any changes are introduced then both will have a positive or negative impact which results in not achieving the required objectives.

1.7 Construction Project in UAE and their Challenges:

UAE is considered as one of the most quickest developing economies in the Middle East, Leaders have always been visionary in terms of development for the people and the country there has been major investment in the construction sector in the last four (4) decades. Ahsan & Gunawan (2010) highlighted the construction industry in the UAE has developed greatly as compared to the rest of the Middle East, most specifically Saudi Arabia. Adel & Martin (2009) highlighted that even if there was a commercial crunch in 2008 the construction industry recorded high growth rate during the year 2007 till 2009 where GDP was recorded 8%. Fenten (2009) highlighted that the construction industry is directly related to increase revenues from the Oil & Gas sector. It was further pointed out that the major expansion of the industry happened during the economic development period which started from 1990. As per the present economic situation of UAE they are still in the process of getting involved with mega projects from residential, commercial and infrastructure project most of the project execution is done by national and international contractors which involves different kinds of contracts and requirements complained to different standards. Robert (2005) carried out the study in UAE and observed that contractors need to be established and more importantly must maintain good

relationship with suppliers and sub-contractors in order to have continued material delivery as and when required this will avoid any disruption for the project. However it was noticed that even if the relationships are maintained with the associated parties, it is very important to scrutinize their pricing to keep budget within the limits. Robert (2005) further added that many foreign contractors are aware of the UAE's construction scenario to keep their pricing considerable. Some of them are even interested to procure materials in advance and keep them in-stocks which may disrupt the pricing in the market. Nael (2008) reported that many local companies are going beyond the UAE region and procuring on more competitive rates.

1.7.1 Causes for Cancellation of Construction Project in UAE

Faridi & El-Sayegh (2006) reported that almost half the number of the projects delayed or completely shelved in the UAE increased in the year 2002 with value of almost 170 Billion US Dollars which indicates that the construction industry can easily be exploited. It was also reported in MENA construction project tracker that the increase of construction development is approximately 13%. They also indicated the most of the project cancelled were from the UAE region. Ahsann & Gunawan (2010) highlighted in their report that the investment and property boom in UAE came to almost a dead end in 2008, it was reported that the property prices came down to almost 60% and most of the developers had no other way but to abandon ongoing projects. HSBC global research division (2009) reported that developers like M/S. Nakheel had to wright off projects worth AED 78.6 Billion due to the crisis in 2008. A major reason always discussed and debated for the delay of the construction project in government and private sector is availability of enough finance and funding for the project.

Adel & Martin (2009) debated that the delays of construction projects are classified in many categories which are based on the nature, causes and the magnitude. A major reason always discussed and debated for the delay of construction projects in government and private sector is availability of enough finance and funding for the project. Additional work orders introduced by owners are one of the major reasons of the delay, wrong planning delayed decision making, delayed approvals, low productivity, mismanagement, cash flow problems, etc. are contributing for delays.

1.7.2 Projects and their Associated Requirements in UAE:

Ren et al. (2008) highlighted that UAE had witnessed remarkable development in economic and social sector in the last 20 years, many project done in the public and private sector from housing, hospitals, schools, education institutes and infrastructure facilities due to the major requirements the construction industry was facing many challenges all over UAE. Mc Caig (2008) highlighted that the main objective of the construction industry development within the UAE was to improve the living standards of individuals coming from the visionary leadership who are having the perspective and vision of continued development. This has given a large boost to the Emirates in the private and public sector with major investment for the construction industry.

Abu Dhabi city is considered a well-planned city and the capital of UAE. Actual developmental works started some thirty to forty years ago and the construction industry is still developing. During the recession period in the year 2008 including Dubai, Abu Dhabi did not had much problem in construction scene. Most of the construction industry from Dubai was forced to explore Abu Dhabi as an alternative market with their available resources for business during the commercial crunch. They are still cherishing opportunities available in Abu Dhabi as compared to other Emirates. Abu Dhabi Government's wise and progressive approach helped local and international industries and provided opportunities to develop themselves and become an integral part of the economy. Development projects were launched from the government and private sector, which includes commercial and residential buildings, housing developments, hospitals and health facilities, schools and education sector, and industrial free zones etc. Many specialist oil field and developments of natural islands were one of the major area of concentration in progressive works. It is a well-known fact that UAE is a multicultural society with a very ethnic background and bureaucratic systems. Construction industry had to face many challenges with its booming construction environment, which affected them in several ways. Masdar city and Sadiyat Island are major examples of developments in Abu Dhabi, the government has been investing and provided funds constantly for construction and development of infrastructure, drainage system, housing and commercial development. Many projects were announced in Abu Dhabi with their inauguration dates even before the projects were officially kick started and tough tasks were given to the related teams to achieve. Yas Marina Circuit is a one of a kind project that require all special requirements and the Formula

1 race dates were already announced, the project itself was even launched later however the completion of the project was achieved with determination. World Trade Center and Souq, Grand Mosque, Emirates Palace Hotel, YAS & Sadiyat Island and many other projects are examples of such fast track projects. Those projects require very high end finishing, must maintain high quality standards in design and materials and also in the workmanship which becomes a critical bottleneck in the projects.

1.7.3 Mega projects requirements:

Ren et al. (2008) highlighted in their study that in mega projects they are several interrelated requirements which become the critical part of the project. *Specialist requirement:* Such projects need involvement from world-renowned specialist resources (manpower, equipment's, tools etc.) that develop state of the art engineering and technology where the financial and commercial requirements become secondary. Projects with such needs are expected to be hit by delays due to special requirements and are not very well planned so they end up in litigations, claims and major cost over runs and in some cases projects have been kept on hold for longer periods of time. *Supply and Demand Issues:* One of the major issue was over commitment from stakeholders, promising to execute were not able to deliver due to limitations of existing resources. There were many entities involved in projects who agreed for execution (design, engineering, construction) but due to their limited resources and over commitment, they could not deliver on time. *Multicultural Resources:* UAE is a multicultural society so people come from all walks of life their backgrounds are different, cultural values, religions, traditional norms, customary habits and then they are asked to work together on one project or even live in the same place. Thinking progressively, this will create a positive and competitive environment but sometimes this is the only reason for major issues. *Higher Expectations from Limited Resources:* Such specialist projects have higher level of finishes as high-end quality of materials are used but such specialist resources are very limited and this creates issues of delays in the projects. *Unrealistic Project Durations:* Proposing unrealistic project durations has always been an issue in this environment. *Project teams* (design phase) generally take excessive time to conceptualize the plan and design projects but when it comes to execution and deliveries the durations are cut short and become urgent. Fast track projects where contractors commit for delivery but cannot deliver due to unrealistic project durations. Once unrealistic and wrong estimated durations are considered for the projects they will always end

up in deals and bring bad reputation for the associated parties. *Language Barriers*: Arabic language is the preferred language in Abu Dhabi as this is the national language of UAE. Due to the cultural mix community, there are many mix culture nationalities and several languages existing and every one prefer to use their own medium of communication, which in several ways creates bottlenecks. *Clients Decision Making*: Owner is considered as the key stakeholder in any project and has maximum authority, as they are the ones who financially sponsor the projects. Client have the authority and power to introduce changes at any given time regardless that the change will have positive or negative impacts on the project. Making final decisions on time from Client is one if the major issue as well and also there are incidents where the client gave approvals and then after delivery of materials, changed their mind affecting the project closure. *Local Authority Requirements*: Local rules play an important role in the completion of projects on time. There are unexpected changes every now and then in the local rules and regulation for approvals etc. Local authorities for utility connections is very important and can affect projects. There are many examples in the United Arab Emirates where projects are complete but cannot be handed over as service connections are not yet done by the concerned authorities.

In the presence of such complex circumstances, it is normal to have late project deliveries which lead to many associated contractual problems making it more difficult for the apprehensive project related teams.

1.8 The United Arab Emirates Construction Industry (Context and Relationship in UAE Environment)

The development and construction industry is considered to be the most essential for boosting the economy of countries and UAE is thought to be one of these developing countries. Shehu & Akintoye (2010) reported in their study that the construction industry is playing a major role to boost the economy of countries in many different ways. The Construction industry provides Job opportunities in all areas from management to labours, from the local available resources and international influx. It does not only provide employment but reduces unemployment and at the same time, develops infrastructure. In the last four (4) decades UAE has transformed from a desert to a very modern country with the developing infrastructure of sky scraper buildings and initiatives developments following international standards and connecting to the world. Cole (2008) highlighted that schools, major malls, residential developments and very

high end luxury hotels have been constructed in the last thirty (30) years of development in the UAE.

Developing the understanding that the construction sector is important for the economy of a country and is always linked to issues and problems of delays, postponements and cancellations of projects due to numerous reasons. Cole (2008) also highlighted that the delays are likely to bring a bad reputation and negative impact on the economy of country. It is very important and necessary to acknowledge the reasons and causes of delays in projects in order to overcome and mitigate them accordingly.

1.8.1 Development and assurance returning to a UAE construction market.

Paul Maddinson who is also a partner in EC. Harris (2013) highlighted in their report that “After the 2008 recession in Dubai, growth and confidence area expected to return with more mature construction market and development based on Abu Dhabi’s huge investment in energy and infrastructure, Dubai is a prime location as a hub for trade and tourism”. They also concluded in their research that after a struggling few years, the United Arab Emirates economy is set on a course of recovery. IMF came out with a report in 2013 and concluded that the UAE had achieved an estimated rise in real gross domestic product (GDP) of 4.9% in 2011. Analysis of that figure shows that non-hydrocarbon growth enhanced to an estimated 2.7% for 2011 supported by logistics, tourism and trade, as well as assistance for the construction and real estate sectors.

1.8.2 UAE Construction Scenario

As far as UAE is concerned, Abu Dhabi and Dubai control the construction sector of the UAE and both emirates set the pace for the country. With a strategy of development and improvement, the government of the UAE continues to drive the economy forward. EC. Harris (2013) commented that Abu Dhabi and Dubai continue to develop and urbanize through a comparatively young and growing population, which in turn incites demand in further developments and facilities. The UAE is considered the center of regional tourism and this continues to generate a significant revenue from the industry and also creates further demand across the entire leisure sector. Insecurity in the wider region has emphasized the UAE as a safe haven and this has positive developmental impact on the market. However, the

inconsistency in the global economy environment which continues to confine the ability to increase required financial support to sustain real estate progress.

After the ups and downs of the construction market in recent years, it is now steadier, although the main construction development markets of Abu Dhabi and Dubai are at different stages of the project life cycle.

1.8.2.1 Abu Dhabi:

As reported by EC. Harris (2013), in the beginning of 2012, the Abu Dhabi Executive Council declared its major spending program. This stressed on investment in the projects that have important tactical impact and established the government's commitment to the 2030 Vision after complete evaluation of the Emirates plans. There were various construction projects completed in Abu Dhabi in the year 2013. As a result, supply was entering the market when demand was restricted and so rents for commercial offices and residential units were reduced. The residential market was refreshed by the authority's declaration that all personnel of Abu Dhabi Government branches and agencies must live in the concerned emirate. Social growth remained to be high priority on the schedule with plans for enhancement and expansion of healthcare facilities along with social/national housing programs. Funds were also allotted to the extension of Abu Dhabi International Airport which will be supplied with an estimated cost of AED 25 billion (£4.3 Billion) and is to be introduced for further developments. The development of 700,000 square meter extension will lodge an expected 27 million passengers a year.

The Executive Council has also established plans for the Saadiyat Cultural District in Abu Dhabi which comprises of the Zayed National Museum, the Louvre Abu Dhabi, and the Guggenheim Abu Dhabi so as to fulfil the aim to become a "world class tourist destination." Infrastructure projects are also given great importance on the schedule with ventures such as Khalifa Port, Etihad Rail, STRATA and general road enlargements.

1.8.2.2 Dubai:

EC. Harris (2013) further reported that after the market catastrophes and low times of 2008 and 2009, Dubai displaying signs of recovery. Projects that had previously been kept on hold were being reevaluated and restarted as the emirate looks to reorganize and attract investors. The

Dubai Department of Economic Developments states that in 2011, the local economy grew by 3% with an estimated 4.5% GDP growth in 2012.

In 2011, passenger traffic at Dubai Airport increased to 51 million foreign passengers, an increase of 8% since 2010. This rise shows the strength of the tourism sector of the UAE, regardless of the regional insecurity. Generally investor focus in Dubai is linked to high-quality with high standards, well located and having the required amenities, income producing resources and there has been a rise in the market of annulments of less appealing projects, including 220 projects cancelled by the Real Estate Regulatory Agency (RERA200).

1.8.2.3 Construction Prices:

Tender charges in the UAE dropped by 3% during 2011 and have remained at the same level throughout 2012, as stated by the EC. Harris (2013) construction cost index. Consumer price inflation, construction labor rates and material prices have continued to remain even throughout 2012 and are not likely to increase by more than 2% during 2013.

1.9 Problem Definition

The key indicator of a developing country is development of construction projects, it may be the development of residential, commercial, infra-structures or building facilities. Assaf & Hejji (2006) quoted that “In construction, delays could be defined as the time over run either beyond completion date specified in the contract or beyond the date that parties agreed upon for delivery of project”. It is further explained that a delay is a slippage over its planned schedule. A very common issue that has been raised in the past several years is “the delays in construction projects” Arditi & Pattanakitchamroon (2006). Sambasivan & Soon (2007) quoted that “a very common phenomenon identified in developmental works are delays”.

Construction and production industry in United Arab Emirates (UAE) has been developing and producing for more than three (3) decades in all areas and directions, horizontally and vertically. Landmark projects are announced every now and then and completed, giving an alternative perspective to the construction industry all over the world.

UAE is a lucrative market for local and foreign investors and attracts people to invest in real estate market resulting in rapid growth of populations in a very short time and effect GDP as well (Abu Dhabi chamber of commerce 2009). Faridi & El-Sayegh (2006) cited that “50% of the projects were facing delays in UAE” and, further, Motaleb & Kishk (2010) stated that

“Delays were increased in the corresponding years”. According to Motaleb & Kishk (2010), “Delays in construction industry can directly or indirectly affect the overall economy of a country like UAE taking into consideration that construction plays important role in its development and contributes 14% to the GDP”. Clients and investors have been complaining of non-receipts of their projects on time due to delays in the projects as reported to be one of the most critical problem in UAE.

The main purpose and justification for selecting this dissertation topic is, that it seems that there has not been any particular work done in Abu Dhabi to know the reasons of delays in projects although many projects have been delayed. This develops an opportunity and enables us to explore reasons for delays in the construction industry in general, and specifically in Abu Dhabi which may assist the related industry professionals to keep an attentive mind and execute appropriately. To earn benefits one must take proactive and effective action in order to be successful. It would be interesting to review the scenario of an everyday problem encountered by the construction industry in Abu Dhabi - “Causes of delays in construction projects in Abu Dhabi” and to have an in-depth review and analysis through available literature and hard work done by specialists in the industry, conducting a questionnaire-based survey from industry specialists that are a part of construction projects in Abu Dhabi, to be able to know the key reasons and contributors towards the delay of the projects and develop an understanding and a check list of causes of delay that can help others to counter the problem.

It is also important to know if the problem has been addressed in the correct direction and to come up with some conclusion that maybe beneficial for the technical and management staff involved with decision making authorities in much of the developing construction industry of UAE.

Matters relating to financial crises and recession periods; there is a huge potential in construction activity of the country. Shelved and closed out projects have been recommenced again and with the leadership and management visions and announcement of expo 2020, it is likely that the construction sector will once more have many developmental projects.

1.10 Understanding Delays

Delay is defined by Assaf & Hejji (2006) as “time over run either beyond completion date specified in the contract or beyond the date that the parties agreed upon for the delivery of a

project”. It is further discussed that delays in projects are exceeding its planned schedule and considered to be a common issue in construction all over the world, due to the issues with construction it is also commented that “it rarely happens that projects complete on time”. Sambasivan & soon (2007) rated delays in construction industry a global phenomenon and established that delays can negatively affect the project, leading to assertions for time, costs, proceedings and disagreements and even complete abandonment of projects. El Razeq et al. (2008) stated that “Construction delays are for the most part costly”, further reinforced by Okumbe & Verste (2008) that delays are the most recurring, very expensive and high risk holdup faced by the construction industry with substantial effects on the project and associated groups.

Chan & Kumaraswamy (1997) worked on the construction delays in Hong Kong and emphasized that projects getting completed on time and within budget to the required quality standards as per the specification of client is an index of successful projects delivery. Assaf & Hejji (2006) suggested that projects accomplished on time is an indicator of efficiency for all concerned teams however the construction process have unpredictable factors and it is very difficult to achieve in the construction industry due to the volatility and additional factors originating from many other sources. It is further discussed that sources who become a part of the team are parties involved, available resources, environmental conditions, other related parties and contractual conditions. Akinsiku et al. (2012) commented that owners always demand that their projects are completed and delivered on time and the susceptibility of delays attracted the attention of many researchers all over the world who identified the root causes of delay. They also mentioned that even after several research activities and investigations done to know the causes of delay “it has continued to be a deadly monster which plagues the construction industry”.

1.10.1 Impact of Delays

Projects getting delayed due to any reason will have impacts of different types and scale. Chan & Kumaraswamy (1997) emphasized that projects not being completed as per the target plan budget, cost and the required quality will result in many unexpected negative impacts on the projects. Assaf & Hejji (2006) stated that “To the owners, delay means loss of revenue through lack of production facility and rentable space or a dependence on present facility”. They further highlighted that generally in some cases contractors are badly impacted due to delays as

resulting in high over-heads due to longer working period, very high materials cost due to inflation in the market and higher labor costs. Sambasivan & Soon (2007) highlighted that whenever there is a delay in the project the tendency is that they are either extended or accelerated and carries additional costs. The associated contracted parties agree or disagree on the legibility of time and associated cost with delays but, most of the time this comes with legal issues, problems and dissatisfaction between client and contractors and all other associated parties.

1.10.2 Types of Delay

Types of delays are categorized as Excusable; where causes of delays are from client side and associated contractors are entitled to be compensated with additional time and money. *Non Excusable Delays*; where contractors are the reason of delays in the project, therefore, no excuse is acceptable which ends up in commercial damages and implications. *Excusable but no compensation*; the contractors or their subcontractors are the reasons of delay and excusable delays are generally referred to act of GOD “*force majeure*” which are permissible to the contractor in terms of time but no commercial compensation awarded. Unexpected rains/ floods (natural disasters) may completely halt the projects so compensation is awarded as it was not the contractor’s fault. Concurrent delays are described as multiple delay factor occurring in the same period so only the longest upholding activity will be considered and the rest will be merged and become concurrent into the same activity.

1.11 Aim

The aim of this dissertation research is to develop an understanding the causes of delay in the construction projects in Abu Dhabi and to rank them to know their importance and criticality.

1.11.1 Research Question

In order to develop an understanding for the causes of delay in the construction projects in Abu Dhabi, this dissertation will review the existing accessible information, data, research, journals and will conduct a questionnaire survey from construction industry professionals to know the actual reason of delay in Abu Dhabi that may help other professionals in the industry to avoid or prevent the projects from delays.

Thus, the research question is as follows: What are the causes of delay in construction projects in Abu Dhabi?

1.11.2 Objectives

To accomplish the research target, the following points have been identified:

- After detailed literature review a list of key causes of delay in construction projects has been identified and developed with reference and relation to the construction industry of Abu Dhabi.
- To identify and understand the key contributors/ groups of causes of delay and categorize them as project team related, Client related, Consultant related, Contractor related, Authorities related or as belonging to others category.
- To know the importance of the key causes (top 10) of delays in Abu Dhabi construction projects and recommendations to industry professionals for future projects.
- To evaluate the perspective of construction stakeholders towards the major factors and causes of delay.

1.12 Scope of Research

This dissertation research intends to develop an understanding and create a list of causes of delays from the groups involved and their associated factors of delay. The developed list will further create a framework and survey questionnaire for the experts to give their opinion and come up with an effective list of delays that are related to the construction industry of Abu Dhabi. The developed list will help practitioners prevent or remedy their projects in future. A quantitative research will be conducted by hypothesizing a conceptual framework from the literature review along with the questionnaire survey with the industry professionals from different perspectives i.e. Owners/ Client/ Engineers/ Consultants and Contractors.

2 Chapter 2 Literature Review

2.1 Literature Review

Delay is defined as an “act or event which extends required time to perform or complete work or the contract manifest itself as additional days of works” as described by Zack (2003). In one of the studies of Assaf & Al Hejji (2006), construction delay was defined as “the time overrun either beyond completion date specified in the contract, or beyond the date that the parties agreed upon for delivery of a project”. Change is generally considered a reason for delay in a project and associated team members would favor to have projects with no change “However it is rarely happens that a project is completed within specified time”, quoted by Assaf & Hejji (2005). Delay is considered as a major obstacle faced by the building construction industry globally. It is most greatly risked and is identified to be highly expensive for the projects as highlighted by Alaghbari et al. (2007). Owners and designers may upgrade and introduce changes at any execution stage of the project which will result in delays. As mentioned earlier change is considered to be the primary cause of delay, if construction projects do not have changes then they would be expected to complete on time and there will be minimal disruptions. Generally contractors prefer projects where the designs are finalized and will have no changes, however that probably happens in a perfect world. Molner (2007) commented that contractors commonly embrace change because it gives them extra work which brings more time and money and most contractors would prefer their projects to complete without changes. Although it is mostly said that projects commence once their designs are complete but it is always noticed that changes are inherent to almost all projects of any considerable size. Molner (2007) added that “Change to work complicates the project invites delays and increases the project cost and all of them makes owners unhappy”. It is very important that the stake holders of the project agree to the required changes of the project and who will handle the concerned changes. This would be beneficial for the entire team if the process is agreed on and followed accordingly. Due to the new research and developments it is necessary to incorporate changes even if the designs are complete although this results in disruption in ongoing works but it is necessary and required to keep upgrading. It is very important for a project when change is to be introduced and at which phase of the project. If the changes are introduced during the initial stage that can be incorporated with little hassle, but if the proposed changes are introduced in

the advanced stages of progress they will complicate the work flow and will be a major cause of delay. It is also understood that introduced changes will always have an impact on cost.

Zaneldin (2006) discussed the variances and mentioned that the most common issue in the UAE construction industry was change orders and client related delays. Faridi & El-Sayegh (2006) identified the top ten key causes of delay to avoid recurring issues or mitigate their impact. El Sayegh (2008) evaluated the risks involved and recommended proper allocation of risk in order to manage it proactively and consistently.

2.2 Previous Studies on Causes of Delay

Research studies have been carried out by researchers to create an understanding of the reasons for delays in the construction projects for numerous years and it is undoubtedly recognizable that they have a diverse view on the causes of delay. Investigations concentrate on particular delay factors; some situations are referred to by the contributors of delay with their causes and effects. Internationally, research works are done on different levels and reported that residential and commercial projects are always hit by causes of delay factors.

Mansfield et al. (1994) listed 16 causes for delay and further costs overrun as an effect for projects in Nigeria. A formal opinion poll aided in concluding the outcomes from the contractors, consultants, and clients of referred organizations. The study determined that the delay causes and added costs were because of the changes in the conditions of site, instability of rates, financing and payments of completed works, material shortage, inaccurate estimation and lack of contract management. 56 main causes of delay in construction projects in Saudi Arabia were pointed out by Assaf et al. (1995). A detailed survey was conducted on the contractors and key factors for delay were developing shop drawings and getting approvals, delays in contractor's execution progress on site, payment by client and design changes and other related factors. Based on the consultants and engineers point of view, it was financial problems during execution stage, inter relationship between sub-contractors and the slow decision making by client were the main causes. However, owners were of the perspective that design errors by consultant, shortage in resources and inadequate manpower skills were key delay factors as well. Ogunlana et al. (1996) carried out studies for delay in building construction projects in Thailand which at that time was considered to be a country whose economy was in the developmental stage. It was reported that the main issue of the construction

industry in a developing country can be in 3 areas. 1. Lack in supply of resources 2. Issues created by Client and consultant & 3. Issues created by incompetent contractors. Kumaraswamy & Chan (1997) developed strategies to decrease construction duration in different building projects based on the lessons learned from Hong Kong research reports. The available literature from different countries on the causes affecting construction duration and causes of project delays with the existing models for duration expectations were reviewed. A survey was carried out by the concerned research team to know the construction time performance of projects in public housing, public non-residential and private sector. The survey reports for Hong Kong highlighted 83 anticipated causes for delay and divided them into two (2) groups; i) related groups i.e. owner, contractor and consultant and ii) Project classification; They stated 5 major delay factors i.e. poor administration on site and unsuitable construction supervision, matters related with site environments, delay in decision making, further works/ differences due to customer necessities. They also suggested that biases of different industry groups have the tendency to directly blame delays on other groups. Mezher & Tawil (1998) conducted a detailed survey of the causes of delay in construction in the booming construction industry in Lebanon from 3 perspectives i.e. owner, contractor and consultants. It was concluded that the clients is more concerned with regard to commercial issues, contractor concerns were with contractual relationships, whereas the consultants were considering project management to be most important cause of delay. A quantitative research study was conducted by Al-Momani (2000) on 130 Government projects in Jordan and they stated that the major reasons for delay were consulting engineers and designers, clients change orders, changes in weather, and late delivery of resources, socio-economic conditions, site surroundings and extra works and change in quantities. The study suggested that if special attention was given by industry professionals to the factors identified it will help professionals to minimize contract disputes. Odeh & Battaineh (2002) reported through their survey aiming to identify the most critical cause of delay in construction projects with traditional contracts in construction, contractors and consultants point of view was; Resulting in clients interference, lack of contractors experience, financing and payment deficiencies, productivity of manpower, slow decision making, inappropriate planning and the sub-contractors were among the top 10 important factors. A survey was conducted by Frimpong et al. (2003) to highlight and evaluate the importance and key important factors in contribution to delay in the Ghana ground water construction project. A questionnaire was developed with 26 factors to carefully investigate the projects between 1970 and 1999. The questionnaire pointed out three major groups of

government and private organizations i.e. owners, consultants and contractors. Random sampling of 55 clients, 40 contractors and 30 consultants were done, survey questionnaire were distributed and the results depicted that the main reasons of delay in Ghana were intermittent financial expenditure from officials, purchase of materials, poor contractor administration, poor technical performance and an increase in cost of materials. Assaf & Al-Hejji (2006) conducted a detailed survey on the time performance factor of major construction projects in Saudi Arabia. The survey was identified with 73 difference causes of delay. They studied the various causes and their importance from the perspective of a client, consultant and contractor and acknowledged that the most common reason for delay was “modifying the order”. Research studies from Saudi Arabia illustrates that nearly 70% of the construction projects were overdue. According to Sambasivan & Soon (2007) the ten (10) major delay reasons were deficiency in contractors works in general, client’s financials and settlement of payment issues, materials availability, internal coordination and communications etc. They highlighted six (6) effects i.e. time and cost exceeding, disputes & litigations and complete closures in particular cases. Alaghbari et al. (2007) debated that commercial problems were the key factor and as the second most important reason initiating delays in developments in Malaysia. Ren et al. (2008) established in their research that the major reasons for delay differ from unrealistic project durations to client nominated and preferred sub-contractors and mix cultural related concerns. Hadi Tumi et al. (2009) highlighted that the foremost factors to be incorrect preparation, lack of efficient correspondence and design mistakes result in delay in construction projects in the city of Zentan, Libya. About 42 delay reasons were identified by Motaleb & Kishk (2010) and they mentioned the major contributors were amended in the workorders, commercial and financial issues from owners and most essential effects were time and cost exceeded. Frank et al. (2010) studied the causes of delay in the building construction industry in Ghana according to the most important participants i.e. client, consultant and contractor. As per their report, almost 32 probable causes of delays were identified from the literature review and interviews. The delay factors were further divided into 9 groups. An extensive field survey included 130 representatives having 37 clients, 54 consultants and 39 contractors. The overall report indicates that the commercial and financial group factor ranked highest in the major factor causing delay in projects. The financial growth factor was indicated creating delays in honoring payment certificates having issues in accessing credits and continuous fluctuations in market rates. The second key factor was materials group followed by the planning and controlling factor.

Previous studies conducted by many renowned researches shows different perspectives and they varies according to the value and scale of the projects. It is noted that the delay in projects is surrounding the main stakeholders of the projects i.e. client/ owners, Engineers/ consultants and contractors. Akinsiku et al. (2012) highlighted that once the causes of delays are identified it is easier to mitigate and avoid them in construction projects. Knowing the factors which influence the causes of delay in construction projects are somehow common as they directly or indirectly impact the project. There are some other factors obtained through literature review which are equally important however they fall with the above mentioned main stakeholders group in one way or another. Identified main causes of delay in previous studies are used to develop an understanding and relating the same in the context of this research report which revolves around considerably similar environment in developing economies. Using the relationship of previous studies to this environment a comprehensive list is developed of the probable causes of delay. It was noted that delay factors were previously used to develop a comprehensive list and then the same can be used as a questionnaire to collect data for a certain environment and make references accordingly.

2.3 Listing the Causes of Delays in Construction Projects

Literature review provides us an opportunity to list down the causes of delay happening in different parts of the world which further can be used in our methodology to enhance this study. Based on the previous studies and recommendations by researchers, a list of the factors that influence delay in construction industry has been created, keeping in mind the references and environment of UAE, it is further divided into 8 groups with specific reference to their initiators.

A comprehensive list of delays is produced which are common and are in related to the Abu Dhabi environment as per Table-1 which provide an index of the factors influencing causes of delays and the delay factor identified by the researcher that can be utilized for further study and analysis.

Table- 1: Summarizing the causes of Delay in Construction Projects:

Summarizing the Causes of Delay in Construction Projects			
No.	Associated Teams in Project	Highlighted Causes of Delays	Researched Studies and their References
1	Project Team	Original contract duration is not realistic	Assaf et al (2005), Megha & Rajiv (2013), M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010), Ren et al (2008)
2		Construction contract (Lump sum, turnkey etc.)	Assaf et al (2005)
3		lowest bidder selection criteria	Assaf et al (2005)
4		Change order after tender award	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Chan & Kumaraswamy (1997), M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010), Faridi & El-Sayegh (2006)
5	Client/ Owner	Delay in periodic payment to contractors effecting cash flow	Assaf et al (2005), Megha & Rajiv (2013), M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010), Ren et al (2008)
6		Site handing over delay by Client	Megha & Rajiv (2013)
7		Clients introduction of additional work during the construction period	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Ren et al (2008)
8		Delay in design approvals by Client	Assaf et al (2005), Megha & Rajiv (2013)
9		Delay in approvals and late decision making	M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010), Faridi & El-Sayegh (2006), Ren et al (2008)
10		Lack of technical knowledge by Client	Alaghbari et al (2007), Motaleb & Kishk (2010), Faridi & El-Sayegh (2006)
11		No incentives to contractors for better performance	Assaf et al (2005), Megha & Rajiv (2013)
12	Engineers/ Consultants factors	Inadequate technical experience of consultant	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Chan & Kumaraswamy (1997), Motaleb & Kishk (2010), Ren et al (2008)
13		Deficiencies in drawings details and specifications	Alaghbari et al (2007), Assaf et al (2005), Megha & Rajiv (2013), Chan & Kumaraswamy (1997), M Sambasivan & Y W Soon (2007), Ren et al (2008)
14		Drawings and deign documents late issuance	Motaleb & Kishk (2010), Ren et al (2008)
15		Complexity of engineering design	Chan & Kumaraswamy (1997)
16		Supervision staff on site not available	Alaghbari et al (2007), Ren et al (2008)
17		Materials and drawings late approvals	Assaf et al (2005), Aibino & Jigbroo (2002), Ren et al (2008)
18		Stubbornness of consultants	Assaf et al (2005), Megha & Rajiv (2013)
19	Contractors and subcontractors factors	Arranging financing facilities for the project	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Motaleb & Kishk (2010), Ren et al (2008)
20		Coordination issues and quality of work	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013)
21		Labor and equipment non productivity	Assaf et al (2005), Alaghbari et al (2007), Aibino & Jigbroo (2002), M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010)
22		Lack of coordination with Electro- mechanical works	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Ren et al (2008)
23		Inefficient planning and scheduling of the project	Assaf et al (2005), Megha & Rajiv (2013), Alaghbari et al (2007), Chan & Kumaraswamy (1997), M Sambasivan & Y W Soon (2007)
24		Contractor management incompetency	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), Chan & Kumaraswamy (1997), Aibino & Jigbroo (2002), M Sambasivan & Y W Soon (2007), Faridi & El-Sayegh (2006), Ren et al (2008)
25		Rework due to mistakes in construction	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013), M Sambasivan & Y W Soon (2007), Ren et al (2008)
26		Subcontractors/ suppliers inefficiency	M Sambasivan & Y W Soon (2007), Motaleb & Kishk (2010), Ren et al (2008)
27		Frequent changes of subcontractors	Assaf et al (2005)
28		Main contractor and Subcontractors disputes	Assaf et al (2005), Alaghbari et al (2007), Megha & Rajiv (2013)
29	Materials	Materials shortage in market	Aibino & Jigbroo (2002), M Sambasivan & Y W Soon (2007), Ren et al
30		During construction change of material	Aibino & Jigbroo (2002), M Sambasivan & Y W Soon (2007)
31		Material delivery delayed	Motaleb & Kishk (2010), Faridi & El-Sayegh (2006), Ren et al (2008)
32	Govt Authorities factors	Government Authorities and Bureaucracy	Kikwasi (2012)
33		Late issuance of required permits to work by Authorities ADM, ADCC, ADSSC, ETISALAT, CIVIL DEFENSE, DOT etc.	Assaf et al (2005). Ren et al (2008)
34		Short working hours in authorities and many holidays	
35		Changes in requirements and regulations	Aibino & Jigbroo (2002), M Sambasivan & Y W Soon (2007), Assaf et al (2005), Hsieh et al (2004), Wu et al (2004)
36		Delay in connecting utilities (electricity, water, etc.)	Assaf et al (2005)
37	Social and Economic factors	Criminal Activities by workers	
38		Issues and conflicts among workers	Assaf et al (2005)
39		Culture and traditional conflicts	Assaf et al (2005), Ren et al (2008)
40		Inflation and sudden changes in prices	Faridi & El-Sayegh (2006)
41	Others	Availability of required Materials, manpower, equipment	Assaf et al (2005), Megha & Rajiv (2013), Ren et al (2008)
42		Delaying in resolving contractual issues	Kikwasi (2012),
43	Others	Delays in resolving arbitration/ disputes and litigations	M Sambasivan & Y W Soon (2007)
44		Unfairness in awarding tendering	
45		Local protection issues	
46		Insurance compensation claims and delay issues	

2.4 Specific Studies on Causes of Delays in Different Countries

Mansfield et al. (1994) stated in their research report some important reasons for delay for projects in *Nigeria* and they pointed out fluctuation in price of products, financial settlements for completed works, wrong approach in management of contract, frequent site related changes, wrong materials used and most importantly project not planned properly. Assaf et al. (1995) carried out survey and identified 56 main reasons of delay in major construction projects in *Saudi Arabia*. Most important delay factors highlighted from the contractor's perspective were approvals of drawings, inadequate site progress by contractors, periodic contractor's payment and changes in design introduced during the construction stage. Consultants and design engineer's perspective is liquidity and cash flow issues during execution stage, very slow finalizing decisions from client and inter-relationship between the contractors/ subcontractors. Client's perspective is that the delays are more commonly due to wrong design, not enough manpower and further unqualified resources. Ogunlana et al. (1996) conducted a research study in the developmental phase of Thailand on the delays in building construction projects. They reported that issues with the construction industry of Thailand can be divided into three areas i.e. 1) Inadequate industry facilities, mainly lack of resources, 2) Problems caused by client and consultants and 3) Problems caused by incompetence of contractors. Chan & Kumaraswamy (1997) reported in their research study in *Hong Kong* and highlighted 83 expected delay factors and bifurcated them further into two (2) groups 1) role of parties i.e. client, contractor and consultant 2) type of projects. They concluded 5 major reasons of delay i.e. unqualified supervisory staff and inappropriate risk assessment and management, lack of knowledge of existing site conditions, slow decision making, variations due to client and additional works introduction. Mezher & Tawil (1998) conducted a detailed survey in *Lebanon* and highlighted that the client perspective, consulting and contractor mentioned financial issues are the major factors, contractors highlight inter-relationship and in consultants perspective was project not being managed from project management team was the main reason of delay. Al-Momani (2000) conducted a detailed study on 130 public projects in *Jordan* and pointed out that the main delay contributors were consultants and design engineers, introduction of changes by client, abrupt weather conditions, site conditions, additional works, long lead items and their delivery issues and economic conditions of the country. Frimpong et al. (2003) conducted a survey that concludes the key factor of delay was authorities' procedures in

payment settlement, procurement of materials, wrong approach in contractor management, under performance by technical staff and materials price escalation.

Research works done in various parts of the world with respect to their specific related issues that may be due to the customs, weather, environment social setup, socio economic conditions etc. Some of the important factors are researched and reported to be common in all cases, whereas there are some identified specific delay factors that are attributed to a isolated project and location.

Some of the research professional who worked on the causes of delay are mentioned in the produced list below in a tabulated form mentioning the researcher and the country they did their research works in Table -2 with the list, research carried out in the country highlighting various key factors effecting delays in projects.

Table-2: Research Studies and Key factors in Different Countries

STUDIES ON CAUSES OF DELAY			
Sr. No.	Researcher	Country of Research	Identified Major Factor
1	Alaghbari (2005)	Malaysia	Highlighted 31 and explained that all associated parties agreed that financial problems were the main factor and coordination issues were the second key factor causing delays
2	Al Kharashi and Skitmore (2008)	Saudi Arabia	Highlighted Lack of qualified and experience personnel.
3	Al Moumani (2000)	Jordan	130 Government projects were reviewed and major reasons for delay were consulting engineers and designers, client change orders change in weather late delivery of resources socio economic conditions and additional works.
5	Assaf et al (2006)	Saudi Arabia	56 main causes of delay were identified, contractors issues were developing shop drawings and getting approvals from client side delay in contractors payment and several design changes consultant highlighted cash flow issues sub contractors relationship with contractor and slow decision making by client.
6	Assaf & Al-Hejji (2006)	Saudi Arabia	Identified 73 causes of delay, highlighted from contractors (approval of shop drawings, delays in contractors progress, payment by owners, design changes), consultant (cash problem during construction, relationship between contractors, slow decision making), and Client (design errors, labour shortage and inadequate labour).
7	Chan and Kumaraswami (1998)	Hong Kong	4 Major areas
8	Frank D.K. et al (2010)	Ghana	Highlighted 32 probable causes the overall reports indicates financial issues to be the major factor causing delays.
9	Frimpong and oluwoye (2003)	Ghana	Highlighted 26 important factors major concerns were periodic payment contractors poor management an extreme ground conditions.
10	Hadi Tumi (2009)	Libya	They highlighted 42 key factors major reason were amended orders commercial issues with clients.
11	Haseeb et al (2011)	Pakistan	Divided in to 7 major groups and highlighted 37
12	Hancher & Rowin GS (1981)	Saudi Arabia	Major reasons were system failure errors and un- timeliness in credentials.
13	Making et al (1997)	Indonesia	It was highlighted materials due to inflation, wrong materials estimation and complex design structures.
14	Kikwasi (2012)	Tanzania	7 Main causes, design changes, delay in payments to contractors, information delay, funding problems, poor project management, compensations issues and disagreement on valuation of works done.
15	Mansfield et al (1994)	Nigeria	16 major factors identified, highlighted 5 i.e. finance and payment arrangements, poor contract management, material shortage, inaccurate estimation, price fluctuation.
16	Mezhar and Tawil (1998)	Lebanon	3 perspectives or highlighted client is concern with commercial issues, contractor concern was contractual relationship and consultant considered project management to be main cause of delay.
17	Megha and Rajiv (2013)	India	Divided in to 10 groups and highlighted 59.
18	Ogunlana and Promkuntong (1996)	Bangkok, Thailand	3 Major areas, supply of resources, client and consultant, contractor incompetence's.
19	Odeyinka and Yusuf	Nigeria	8 Major areas, variations works, slow decision making, financial/ cash flow problems, resources management problems, planning and scheduling problem, inadequate site inspections, weather related issues and act of nature, labour disputes and strikes.
20	Lo, Fung and Tung	Hong Kong	6 key causes were identified, low bidding, lack of resources due to contractors lack of capital, inexperienced contractors, poor supervisor by consultants, unforeseen ground conditions, underground utilities conflict.
21	Skamris & Flyvbjerg (1996, 1999)	Denmark	Final decision making, accuracy of cost estimates
22	Sambashivan & Soon (2007).	India	10 Major reasons of the delay in reference to contractor, general deficiency, client related issues commercial and payment settlement concerns shortage in materials and communications.

2.5 Types of Delay

Ahmed et al. (2000) came up with an opinion that the delays can be non- excusable, excusable (with/ without compensations) and concurrent delays. They further stipulate that excusable delays happen due to contractors, subcontractors or other related parties however they are within the contractor's control. Non- excusable delays are due to wrong planning, breakdown or equipment's unavailability, mismanagement of projects, wrong estimation and underperformance, poor management and supervision unreliable suppliers and subcontractors. Under such circumstances of delays, the contractor is not in a position to claim delay damages and no entitlement for extension of time but rather, the client has the right to claim for liquated damages, citing an example, if contractor cannot provide enough manpower to execute the works. Excusable delays are caused by unforeseen circumstances which are beyond the contractor or other associated parties involvement, negligence or fault. In such cases contractor is not legible for any cost however time compensations are considered.

Delays are classified with reference to the responsibility of the concerned parties, as per the experts and researchers and several previous studies on construction, project delays are described in four (4) main types.

Delays are categorized as critical and non-critical, excusable & non excusable, compensable & non-compensable, concurrent & non-concurrent delays.

The main types of delays with their corresponding results shown in the table below:

Table-3: Types of Delays and Responsible parties

Types of Delays			
Sr NO	Description	Responsible Parties	Results
1	Excusable/ compensation provided to contractor	Client	Generally Client takes the responsibility and accordingly contractors have the right to claim time and money
2	Excusable however no compensation is	Contractors	This kind of delay is excusable however contractor cannot claim compensation.
3	Non-Excusable delay	Contractors	Contractors are delayed in such cases and ends up paying liquidated damages
4	Concurrent delay	Either	Due to concurrent situation no compensation is granted however anything beyond is compensated

2.5.1 Critical & Non-critical delays

For any project, a master baseline program is developed which is governed by its critical path. Project networks plan have a critical path which is also the longest path in the plan. Any activity on a critical path, that is not completed on time results in delays in the overall project plan. Critical activities in a program are considered very important and due care should be given to avoid any delays.

Koo et al (2007) stated that it is necessary to carefully review the critical activities and their sequences for effective project control. “Resequencing construction activities is a critical and most important task for project planning professionals and for effective project control”. Planners need to specifically determine the impact or ‘role’ when resequencing activities. Every activity has one or more successor activity, they also need to determine the status of activities i.e. which activities may or may not be delayed.

As discussed earlier, overall duration of the project is extracted from critical path where as in certain cases there are delays in activities which are not on critical path but they have a float. During the process of the project such activities which were initially not critical become critical due to their delays. Under the current planning processes, the total float is considered to be a free float and does not belong to any associated parties but to the project itself. De La Garza et al (2007) highlighted that utilization of a float is considered on first come, first served basis. It belongs to the project and can be used for client or for the contractor to overcome the expected negative impacts of delays. A critical path method is becoming a more widely acceptable method for the management of projects. This method is also generally utilized for claims and analyzing delays with the impacted programs.

It is very important to know the allocation of responsibility of delay between the client and the contractor for delay claims and their analysis. The agreed baseline program indicates all critical and non-critical activities on a critical path, it also indicates the free float for each activity and the amount of time an activity can be dragged for without effecting the end date. So the utilization of a free float has always been an issue as to who will use it first, client or contractor. The same can be agreed in the favor of projects.

2.5.2 Non Excusable Delays

Delays caused by contractors in the project is considered a non-excusable delay and the contractor holds sole responsibility for it. It is very important to identify the main causes of non-excusable delay and to identify the factors that contribute to the causes of delays. Although a lot of research work has been done regarding the reasons of delay it is worth mentioning that no major work has been carried out to evaluate the reasons of non-excusable delays. Majid et al. (2008) explained “Understanding the underlined factors that contributes to causes of non-excusable delays would help in identifying the issues encountered by contractors during the construction process”. A fish bone diagram has been used as an analytic tool to identify the factors contributing non-excusable delays. Generally it is identified major contributing factors are materials, equipment and labor that hampers the contractors to perform. Ruff et al. (2008) describes that flexible project management strategies i.e. turnkey and partnering arrangements and flexible contracting such as cost plus fee prove to be helpful in accommodating such changes. Turnkey and design built project structures are reported to be the best performers overall. Projects were reported to be more successful when mechanisms to promote partnering and team building introduced.

It is understandable that the contractor has considerable control on non-excusable delays. Non-excusable/non-compensable delays i.e. delays caused by late mobilization, late equipment deliveries not enough or late deputation of manpower are all controllable and are within the jurisdiction of contractors. In such cases contractor is responsible and owners has the right to claim delay penalties as stipulated in the contract documents, generally in the form of liquated damages (LD). Agreed plan of works should be followed by all concerned parties and in particular contractors, and if they are not followed carefully such delays happens. LDs can be implicated to consultants as well if they are unable to fulfill their tasks.

2.5.3 Excusable with Compensation (Owner cost)

The reason for this type of delays are the client, and contractor entitlement for compensation becomes confirmed in terms of time and cost highlighted by Alaghbari (2005). This delay happens due to in-adequacy and non-availability of drawings and

specifications and or delay in response from the client, client initiated changes, introduction of changes during execution stage disrupting the sequence of work.

The owner is considered to be fully responsible for both time and cost impact of the delays. The contractor has the right to claim for time and cost as the delay happened due to the interference of clients resulting in delays. There can be many reasons such as non-delivery of the materials (owner purchased), owner actions or inactions causing delays etc. Client cannot escape out of their contractual obligations for the delay compensation although he may be able to limit his liabilities in such cases. Introduction of any change order by the client in most of the projects is considered to be most common reasons for the cost of delay. The issuance of additional works requirement affects the work that has already been done, although the time/stage of issuance of additional works requirement is very important. Change order requires modifications, new works, removal and additions etc. Such delays are demonstrated with the impact analysis on the critical path to claim for additional time and cost caused by the changes.

With the new contractual clauses, the client and consultant have the right to nominate some specialized contractors at the beginning of the project. The Client is required to finalize their nominations which sometimes are connected with provisional sum items as the entire scope of work is not known. During the process of scope finalization for such activities client and consultants are engaging and finalizing scope in the same process of tendering and selections which sometimes end up in delays in finalization of the nominated parties. The traditional contracts did not have those special features and specific scope of works and setting up their logic and sequences was comparatively easy. When changes are introduced at the advanced stages of the project, construction becomes more problematic and expensive in nature.

The new contractual concepts in the emerging market like design and built contracts provide flexibility to the client and to the contractors to follow on agreed scope of work. Seraj et al. (2008) highlighted that in such arrangements, projects will be benefitted as it is easier to integrate design and construction.

2.5.4 Excusable but no Compensation (Contractors Cost)

Delays are generally the responsibility of the contractor or their concerned suppliers/ sub-contractors or that can be from the identified subcontractors from owners. Contractors are not in a position to claim any compensations from client but they can further imposes the same to their suppliers or sub-contractors and get some compensation for delays, this was specifically highlighted by Alaghbari (2005).

2.5.5 Excusable Delays (Force Majeure)

Act of GOD “*force majeure*” is a type of delay that is excusable to the contractor but no compensations can be considered in such scenario so it is always contracts cost. Only time compensations can be granted to contractors due to heavy and unforeseen rains/ floods or natural disaster that may be reason to a complete closure of works and will results in delay. Some other examples are abnormal weather, labor strike, act of God, act of war etc.

2.5.6 Concurrent Delays

Concurrent delays referred as identification of two or more independent causes of delay happening at the same time period. Same time period where concurrency is evaluated, sometime does not happen at the exact period of time. The duration of concurrency of the delays can be dependent on situations and circumstances. Concurrent delays are also described as multiple delay factors happening at one point of time so only one activity which is also the longest, can be considered the rest will merge and become concurrent.

2.6 Effects of Delay

Effects of delay are also considered to be an impact, a change and change is due to a reason. In this reference, cause is delay. The effects of this cause lead to major problems for projects. Although there are chances that some projects may benefit from a positive change, the main concern is that change always interrupts the flow of work and results in time and cost overrun. Although enough research work is being done to review and analyze causes of delay, there are few research studies available on the effects of delays. Akinsiku et al. (2012) highlighted that effects happen generally as a liability on the owner’s team or can be on the contractors shoulder.

The effects of natural disasters, political instability and change of laws are always devastating and have a worse impact on the project attributes.

Buratti et al. (1992), Love et al. (1999) and, Love & Li (2000) emphasized that “Many times delay, cost overruns and quality defects of construction can be attributed to changes at various stages of project”. As discussed earlier, change is referred to alteration of design, building related activities, plan of work or other aspects of project caused by modification of works to something which is pre-agreed upon conditions or requirements. Skamris & Flyvbjerg (1996, 1997) reported as per the investigations done in Denmark, where cost estimate accuracy on major infrastructure projects were compared. Costing of tunnels and bridges before the final decision were made and considered in their study and it was concluded from this research is that cost exceeding by 50–100% is common for major transportation infrastructures projects, and that overruns can be more than 100%. Kaming et al. (1997) conducted a detailed study on the influencing factors on more than 30 high-rise building construction projects in Indonesia and discovered that cost overrun is the common factor and is a more devastating problem than time overrun. The major effects were identified as the increase in material cost due to inflation, wrong material estimations and complex building structures. Whereas important factors concerning time overrun were manpower productivity, wrong planning, shortage of resources and continuous design changes. Love et al. (1999), Josephson (2002) concluded that “One of the most harmful consequence of project change is rework or revision of works”. It was further illustrated that the rework cost on projects are as high as 10-15 % of the contract value. Hanna et al. (1999) recognized that “The indirect impact of change as disputes and claims, loss of productivity, loss of rhythm, unbalanced gangs and resource allocation, change in cash flow, increased risks of coordination, failure and errors, lower morale of work force loss of floats and many others”. Li et al. (2000) pointed out that projects which are delayed will expect that the project manager will always faces situations where additional cost, below standard quality and rework are common. Under such circumstances they don't have much choice but introduce additional working hours as over time to overcome such delays, bringing in additional manpower or multiple shifts. Such situations will always results in additional costs and adding more man-hours will result in less productivity and inadequate performance, most of the times which results in rework. Aibinu & Jagboro (2002), mentioned in their studies that “There are almost six (6) effects of delays on projects delivery in the Nigerian construction scenario and they are, time exceeding, cost overrun, disputes, arbitration, total abandonment and litigation”.

Sambasivan & Soon (2007) mentioned in their study the same effects of delays in Malaysian construction projects as were pointed out in the Nigerian construction industry. There might be minor difference in parameters but the effect were almost the same. Flyvbjerg et al. (2002) reported, based on a study of road infrastructure project and based on a sample of 258 infrastructure transportation projects costing around US\$90 billion, that cost estimates given were the reason of acceptance of projects but they were all systematically misleading. Flyvbjerg et al. (2002) they further concluded that “The underestimations observed cannot be explained by error, but are best explained by strategy, they thus warn legislators, administrators and those who value honest numbers not to trust cost estimates and benefit-cost analysis produced by project promoters”. Frimpong et al. (2003) highlighted 26 important factors that were the reason of cost overruns in the construction of ground water projects. It was reported that, according to the contractors and consultants, periodic payment issue was the key factor for cost-overrun. Clients, however, ranked poor contractor management as the key factor. There were some conflicts in point of view among the three (3) groups surveyed but there were agreed on the ranking of the factors. The overall ranking results highlighted that the three (3) groups felt the major factors that cause extreme groundwater project-cost exceeding in developing countries are: periodic and interim payment issues; contractor poor management; poor technical abilities; material procurement related issues; and escalation of material prices. Flyvbjerg et al. (2005) discussed that almost 90% of projects have cost overrun all over the world, and on an average cost overrun for infrastructure, major projects can be from 20% to 44%. , Flyvbjerg et al. (2004) , (Bruzelius et al., 2002) further explained that there have been no considerable systematic development or improvements in exceeding cost related issues of infrastructure projects whereas, two key reasons discussed are optimism of decision makers and to be over-optimistic about results of planned actions and strategic misrepresentations and the misleading actions used in by planners. Flyvbjerg et al. (2002) further concludes that traditional estimation practices have proved to be ineffective, resulting in inaccurate estimation accuracy in previous studies. It is apparent that there are a large number of projects hit by causes of cost exceeding and many share similar patterns of impact. Ming et al. (2009) explains that planning and scheduling is done at an earlier stage to define the activities and their inter relationship knowing the fact that the parameters are uncertain and assumed. Variations during execution of projects will lead to changes in the plan of works from the conceptual baseline plan. Typical changes include delays of start and completion of activities, their additional activities or removal of activities and their required resources etc. Ramabodu & Verster (2010)

highlighted important factors as effects of delays were cost exceeding in constructions projects as and when scope of work changes, design documentation not complete at the time of tender and award, contractual claims in terms of cost and time, wrong planning approach and wrong financial disbursement, considerable delay in working out the variations and additional works. Chileshe & Berko (2010) identified that cost overrun in Ghanaian road construction industry badly effected periodic payment for contractor, variations, inflation and project schedule slippage. Haseeb et al. (2011) concluded in their study in Pakistan that the most common consequences were: clashes, cost and time exceeding the limits, disputes and complete project abandonment.

Literature review for the effects of delay researched through several studies provides us an opportunity to find out the most common effects of delay happening in the construction industry all over the world. There can be difference of some factors depending of the socio economic and environmental condition but mostly there are common delay effects in many of the projects. Time and cost related effect is one of the most frequent results of delay that changes the entire position of the project in terms of cost resulting in exceeding the budget project and time in terms of product not being delivered on time and leading to financial losses to related parties. Under such circumstances contractors have the right to claims for time and money specifically the items initiated by client. Additional cost required more resources to be utilized in terms of manpower, staffing and overtime to cater for the additional requirements of the project due to the subject change. Rework is one of the common effects of delay that incurs additional costs on the ongoing projects in terms of wasted resources on the completed tasks and then redoing the same work and abandoning or demolishing. Productivity related effects are also considered common in the construction industry, productivity is reduced as the speed and efficiency is affected. Different research theory concludes that productivity is reduced due to change, magnitude, size, timing, complexity, schedule and overtimes etc. are the key factors in reduction of productivity. Risk related effects are discussed as the activities that are specifically done in order to overcome the delays such as accelerations in certain areas, deceleration in some areas, prioritizing some activities, interference and congestion due to complexities. As per the literature review some other effects of delays are developing disputes and claims, inadequate professional relationships, bad reputation, bad quality and even in some cases complete abandonment of projects.

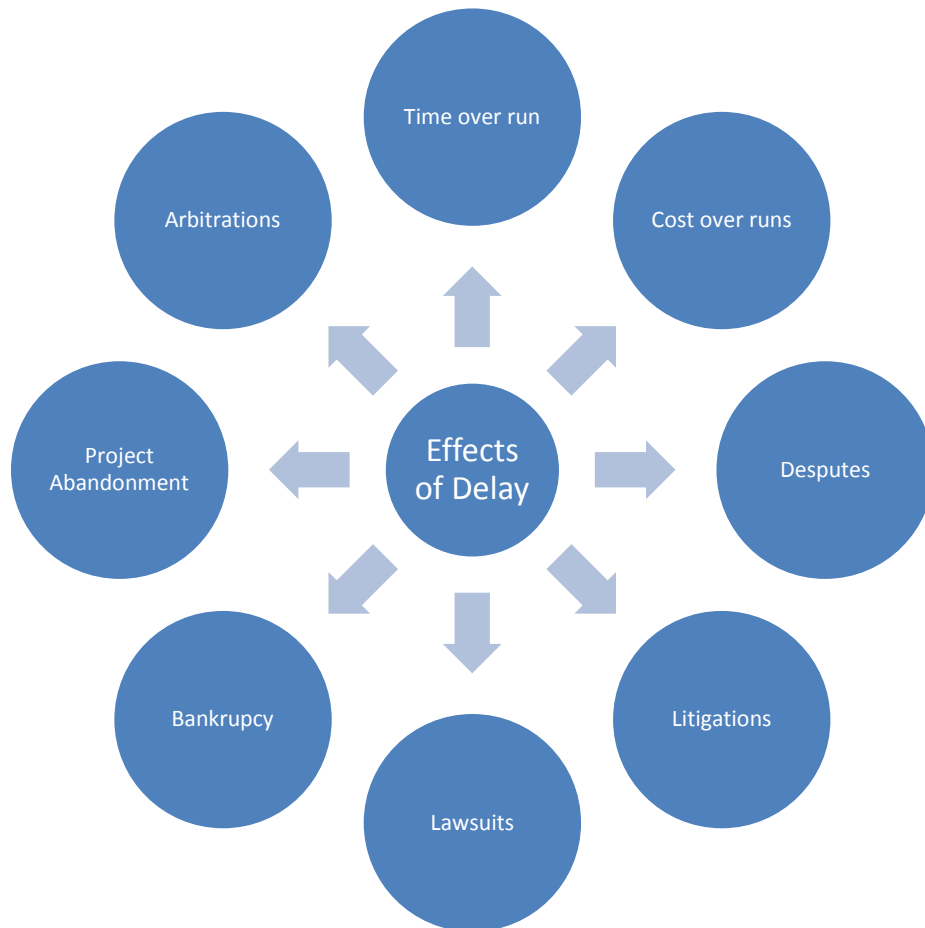
2.6.1 Most Common Effects of Delays

Detailed literature review gave us a opportunity to develop a table listing down the effects of delay that have impacted on various developmental projects in different part of the world. It has been noticed that some of the effects of the dealys listed below in table- 4 are common in may cases which leads us to a concept of avoiding such situation in order to have successful projects. The following table describes the most common dealy factors as per previous studies and research works, and a figure is devoloped to understand the basic effects of delay and what they lead to in terms of major issues created during the project progress.

Table-4 Most Common Delays and Reported by.

Most Common Effects of Delays:		
Sr. No.	Common Effects of Delay	Researched and Identified by:
1	Risk related- Acceleration, interruption, interference, loss of floats, site congestions	Kiswaki G.J (2012), Bower(2000), Hanna(1999, 2002,2004,2005)
2	Others related factors- Arbitration, litigations, disputes, claims, law suits, poor professional relationships, damage of reputation	Kiswaki G.J. (2012), Sambasivan & Soon (2007), Arain & Pheng (2005) Haseeb et al (2011), Motaleb & Kishk (2010), Aibinu & Jagboro (2002).
3	Bankruptcy	Kiswaki G.J (2012)
4	Cost Related- Cost Overrun, increase in over heads, overtime costs, compensations, loss of earnings	Kiswaki G.J. (2012), Sambasivan & Soon (2007), Arain & Pheng (2005) Haseeb et al (2011), Motaleb & Kishk (2010), Aibinu & Jagboro (2002), Li et al (2000), Ramabodu & Verster (2010).
5	Create stress of Contractors	Kiswaki G.J (2012)
6	Delay by the client to return the loans	Kiswaki G.J (2012)
7	Delaying in getting profit by client	Kiswaki G.J (2012)
9	Idling Resources	Kiswaki G.J (2012)
12	Negative Social Impact	Kiswaki G.J (2012)
13	Negotiations	Haseeb et al (2011)
14	Poor Quality of works due to hurry	Kiswaki G.J (2012), Li et al (2000)
15	Time Overrun	Kiswaki G.J. (2012), Sambasivan & Soon (2007), Arain&Pheng (2005), Hanna (1999, 2002,2004,2005), Bower (2000) Haseeb et al (2011), Motaleb & Kishk (2010), Aibinu & Jagboro (2002), Ramabodu & Verster (2010).
16	Total Abandonment	Kiswaki G.J. (2012), Sambasivan & Soon (2007) Haseeb et al (2011), Motaleb & Kishk (2010), Aibinu & Jagboro (2002).

Figure-1: Most common Effects of Delay



3 Chapter 3 Conceptual Frame work

3.1 Conceptual Frame work

This chapter is a reflection of the work connected between the literature review, development of the concept of delays in projects, their related reason and factors, associated practical implications of the experts in the field and research works done by the research experts in the industry and relating them to the objective of the study. Literature review provide us with a wide variety of reasons for delay and related groups however conceptual framework needs to be carried out to have a clear understanding of key team players and their related causes of delay in the context of the studied environment. The conceptual framework will also provide us with guidance on how each group impacts the causes of delay in the construction industry.

Although literature review revealed several key groups or stakeholders who are and can be the reason for delay, a comprehensive group is developed with their related key delay factors. Conceptual framework has been created and it is hypothesized that project associated team members and some other related key reasons can be the cause of delay in one way or another. Associated teams and other reasons are further divided in to eight (8) factors for the ease of understanding and 46 key causes for delay. It is further necessary to be verified through a comprehensive questionnaire survey which is theorized by the literature review list and is later developed into a questionnaire.

Figure-4 Provides a concept of the frameworks of key groups who are generally reasons of delay due to their actions and responsibility i.e. project team, client/ owners, engineering consultants, contractors and their subcontractors, materials, government authorities, socio economic factors and others.

Figure-2: Conceptual Framework for Causes of Delay

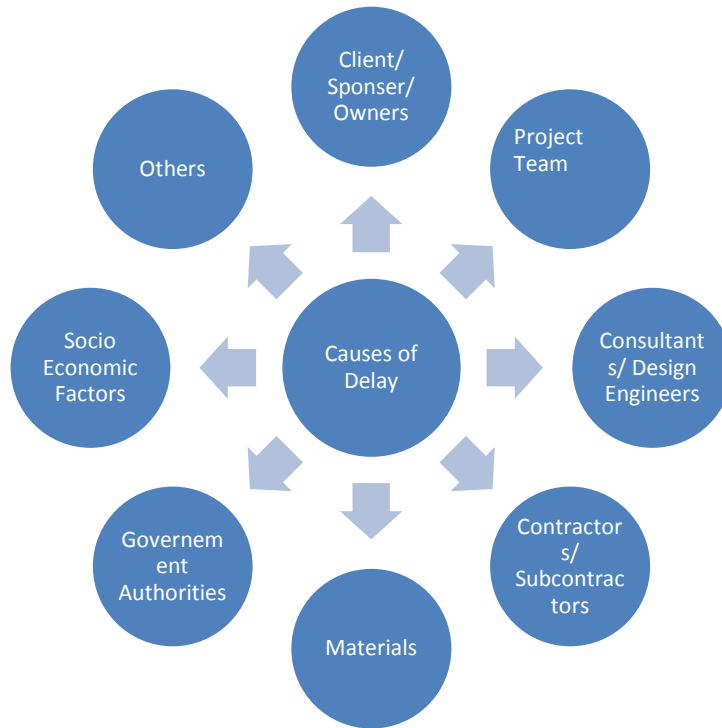
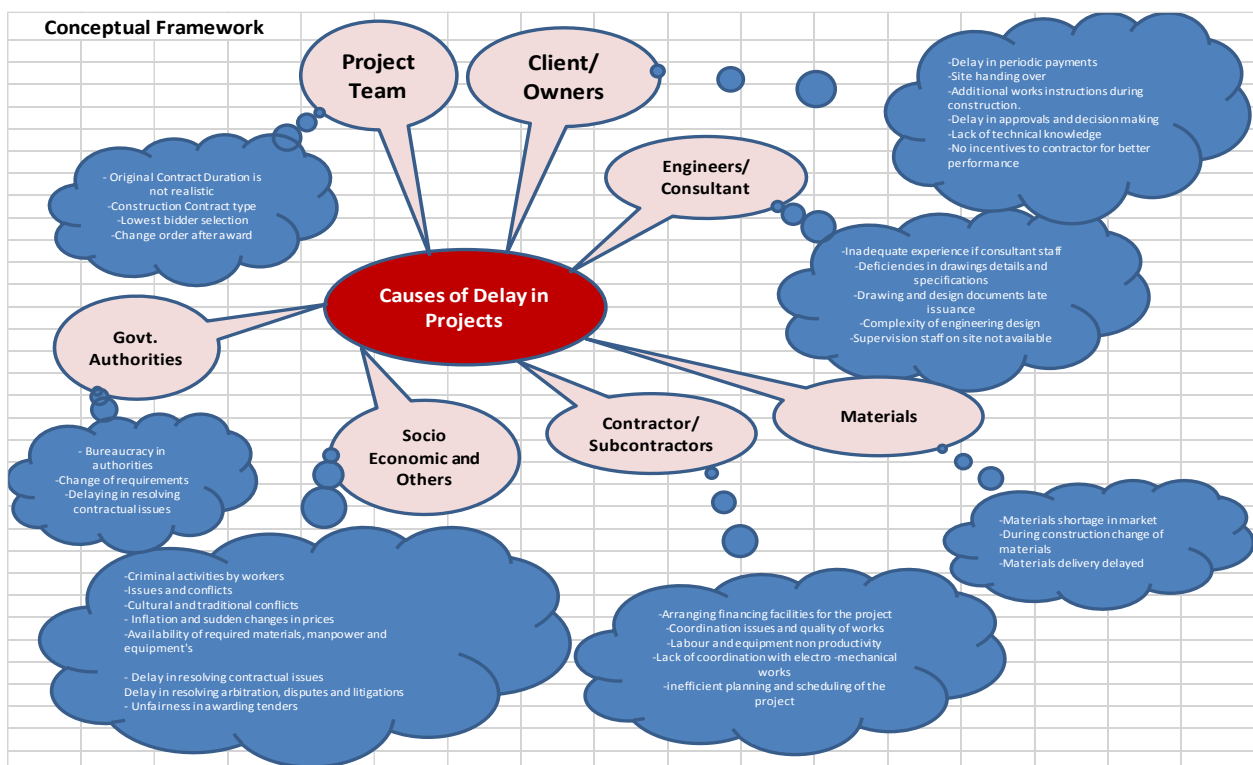


Figure-3 is a further enhancement of the framework showing the highlighted causes of delay with respect to their associated group. A summarized list of causes was derived which is further used in data collection.

Figure-3: Conceptual Framework



4 Chapter 4 Research Methodology

4.1 Research Methodology

4.1.1 Introduction

The purpose of this dissertation is to develop a comprehensive report and understanding on the main causes of delays in the construction industry and then relate them with the Abu Dhabi construction environment. It is necessary to make it more effective and usable knowledge, based on the available research and data collection through the research survey from the ground. The approach is in cohesion with the definition of research quoted by Saunders et al. (2009) as explaining it to be a logical and systematic approach for developing and increasing knowledge.

The way forward for this research will be through exploring the available knowledge on the topic under discussion relating the same to the ground realities and making analysis and explanation for the research findings. It is expected that the findings and results would have useful knowledge for future references. The approach adopted in line with Fellow & Liu (2008) explanation that multiple research approach utilization is one of the best way to have better results.

Although enough research and knowledge is available through literature review on the causes of delay in different parts of the world, it was important to know and understand the reality on ground i.e. the practical difficulty and reason of delay in construction projects in Abu Dhabi. It is expected and intended to add value to the research report by making it theoretical and practical for the potential users of the results who are expected to be an industry practitioner and can relate and improve his projects from the report results.

4.1.2 Research Approach

Kothari (2004) reported two most common practices for research approach are i.e. qualitative or quantitative. Quantitative approach is selected in this research report as theoretical and practical advances can both be used. Although there might be difference of opinion due to their type and years of experience, as per the groups and teams players who are likely to be the causes of delays but for practical and hands on experience of the market and construction

industry, it was imperative to have a clear understanding of the causes of delays in construction industry and with special emphasis on the construction industry of Abu Dhabi.

The research methodology adopted for this dissertation is through research investigation done by renowned researchers, literature review from the printed materials available in forms of books, journals, research reports, other international media, consultation with experts and short meetings, and a survey conducted with experienced professionals, client representatives, sponsors in the construction industry, project management professionals, consulting engineers and engineering contractors.

Figure- 4: Research Methodology



4.1.3 Interviews and Survey Questionnaire:

Survey sampling is a difficult task and was executed carrying the concept of snowball and convenience sampling which is considered to be a non-probability sampling technique. It was carried out through referrals and contacts, the same was quoted by Sambasivan & Soon (2007) in their study done in the developing industry of Malaysia. The survey questionnaire was targeted and distributed to three main players in the construction industry i.e. a) Clients/ Sponsors/ Client Representatives b) Consultants/ Designers/ Engineers and Architects and c) Contractors. The survey questionnaire is composed of two (2) parts; the first part describes

basic details and background on respondents and their demographic profile, the second part is about the reasons for delays extracted from the literature review and identified to be a reason of delay, are further fragmented into eight (8) categories i.e. project teams, Client/ Owners, Engineers/ consultants factors, contractor's and subcontractor's factors, materials, Government /authorities factors, socio-economic factors and others. These sections were designed to obtain responses from the concerned respondent from scale 1 to 5 (response to be from occurrence and severity ranging from 1 being very low to 5 being very high). The concept was developed from previous research done and the questionnaire developed by research specialist i.e. Al Khail and Al Ghafil (1999), Odeh & Battaineh (2002), Koushik et al (2005), Assaf & Al- Hejji (2006), Lo et al (2006), Sweis et al (2008), Motaleb (2009).

4.1.4 Data Collection and Characteristics of Respondents

The questionnaire was sent to the key team players in the construction industry ranging from general managers, technical managers, area managers, department heads, project managers, construction managers, discipline managers and site managers who are expected to be in the construction industry of Abu Dhabi with different years and type of experience, and have firsthand knowledge and can provide in-depth references and relate to the causes of delays.

The survey questionnaire was designed in a way that is easy to read and respond to. Open ended questions were minimized, believing they can lead to a large data which becomes difficult to process and analyze.

It is important to consider the perspective and experience of professionals working in the Abu Dhabi market so the target audience for the survey questionnaire was from Abu Dhabi. The survey questionnaire was directed to the random sampling of experts well integrated in the construction industry from clients, consultants to contracting companies; Most of which are integrated and experienced in the construction sector of Abu Dhabi. Questionnaire survey was directed to many through different modes of communication however sixty one (61) numbers, as per table-5, of respondents were used in the analysis of this dissertation report.

Table-5: Characteristics of Respondents

Sr. No.	List of Responses	Number of people responded	% of People Responded
1	Client/ Owners	19	31.15
2	Engineering Consultants	22	36.07
3	Contractors	20	32.79
	Total	61	100

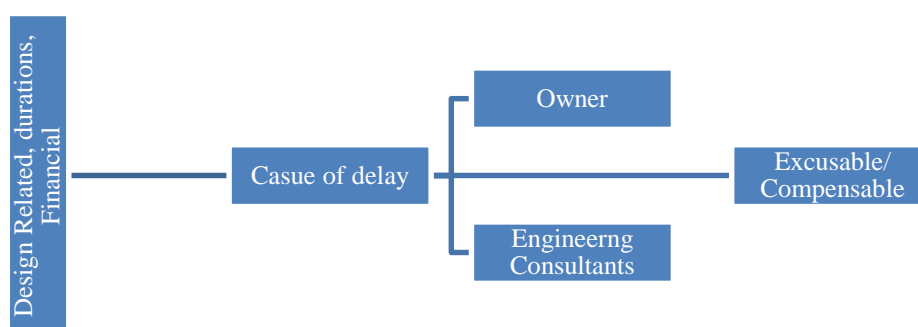
4.2 Basic Structure of Flow and reference to its Delays

The structure and the flow shows the causes of delay (contract duration not being realistic), the responsible party (client, consultant, contractor or any other party), Delay property (excusable or condensable etc.)

Figure-5: Structure of Delay Flow

4.2.1 Project Team/ Client/ Engineering Consultants

The above said teams are responsible for the conceptual design of the project, to its final design to budgets and durations required, and completion of the project.

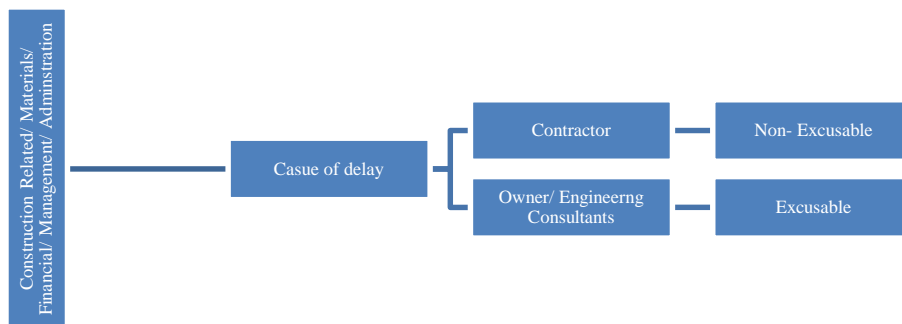
Figure- 6: Project Team Delay Flow

4.2.2 Construction Related Contractors/ Sub Contractors/ Materials/ Management

Construction related stage will always be the responsibility of the contractor to execute the projects as per the contract durations and specification and within the budget if any delay

happens related to contractors it will not be excusable, however if due to reasons related to client or consultants projects get delayed, then the delay becomes excusable.

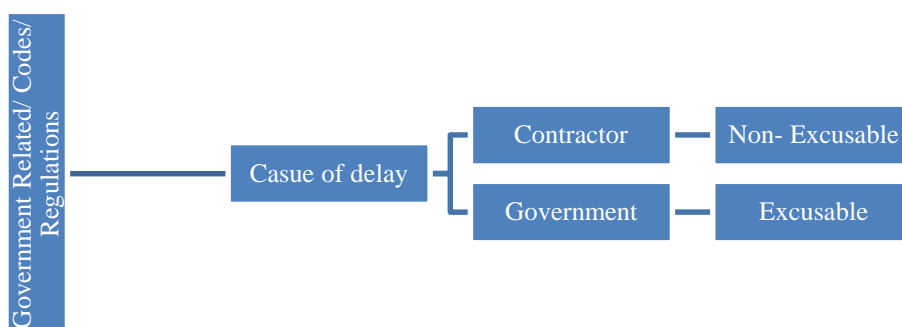
Figure-7: Construction Team Delay Flow:



4.2.3 Government/ Codes/ Regulations and Authorities

Developing countries are always in the process of growth so regular changes and developments are introduced as and when the process moves towards betterment. However this has a positive and negative impact on the projects.

Figure-8: Government and Regulations Delay Flow



4.3 Validity and Reliability

The reported results of this dissertation are considered to have high level of validity as the data has been collected through formal interview questionnaire response and it is expected that the

response given was based on their practical experience. Main key players in the construction industry were selected i.e. client, consultants and contractors who are also hypothesized as the key reasons for delay so the response is considered to be reliable and authentic.

5 Chapter 5 Data Analysis, Findings, Discussions

5.1 Data Analysis, Findings, Discussions

Data collection is a cumbersome process in terms of attaining responses from professionals who are busy with their regular schedules, so various methods were used that includes requesting to participate in the survey via email, one to one meeting, personal visits etc. It is also important to note that some do it very diligently, however some will do it casually. As mentioned earlier three (3) main players in the industry were selected for the survey and it was noted that the perceptiveness of all three was very diverse. The approach to the issues highlighted in the survey questionnaire was different for the participants of survey, the reason being their background and approach towards issues is always protecting their rights however few had the project perspective as well.

5.2 Method of Data Analysis

The software used for analyzing the data and obtaining the results was statistic software IBM SPSS 22 and further transposing the data in a more presentable manner was done using Microsoft Excel.

5.3 Data Analysis

The data analyzed was collected from a survey questionnaire consisting of 46 questions which were grouped into eight (8) major areas according to modifications done from literature review based on the general causes of delay and in specific relation to the area in which the survey was conducted.

5.3.1 Demographic Details and Frequency of Respondents

Sixty One (61) respondents took part in the survey from different professional background nineteen (19) represented client, twenty two (22) represented engineering consultants and there were twenty (20) contractors who responded to the survey. It is interesting to know that 31% believed that more than 50% of their projects were delayed, 29 % reported that 50% or less of their projects were delayed and again 31% confirmed the delays in their projects were 25%.

There were only 9% of respondents claimed that 10% of their projects were delayed. It is evident that majority of the projects in Abu Dhabi were delayed due to various reason as reported by industry professionals through the survey.

Table-6: Demographic Details and Frequency of Respondents



5.3.2 Step one: Descriptive Mean

As a first step for the data analysis minimum, maximum, mean and standard deviation was done as descriptive statistics to know the related values from all the respondents and the same will be used in different ways for further analysis. The process is also a check in a way to know if there are any issues with the data collected and data input in the software.

Table- 7: Descriptive Statistics and Means as per Variable List

Descriptive Statistics & Means as per the variable list						
Sr No	Highlighted Causes of Delay	N	Minimum	Maximum	Mean	Std. Deviation
1	Original contract duration is not realistic	61	1.00	5.00	3.8361	1.05167
2	Type of construction contract (Lump sum, turnkey etc.)	61	1.00	5.00	2.8852	.89626
3	Selection of the lowest bidder commercially	61	1.00	5.00	4.0656	.91047
4	Change order after tender award	61	1.00	5.00	3.7869	.83894
5	Delay in periodic payment to contractors effecting cash flow	61	1.00	5.00	3.7541	1.09019
6	Site handing over delays by client	61	1.00	5.00	3.1311	1.17580
7	Client introduction of additional work during construction period	61	1.00	5.00	3.9180	.89991
8	Delay in design approval by client	61	2.00	5.00	3.8525	.79238
9	Delay in approvals and late decision making	61	2.00	5.00	4.0000	.81650
10	Lack of technical knowledge by client	61	1.00	5.00	3.2295	1.03913
11	Unavailability of incentives for contractors for better performance	61	1.00	5.00	3.0820	1.06919
12	Inadequate technical experience of consultant	61	1.00	5.00	3.3607	.98375
13	Deficiencies in drawings, details and specifications	61	1.00	5.00	3.6557	.94667
14	Drawings and design documents late issuance	61	1.00	5.00	3.6557	.94667
15	Complexity of engineering design	61	1.00	5.00	3.1311	.82614
16	Supervision site staff not available	61	1.00	5.00	3.1803	1.05685
17	Materials and drawings late approvals	61	1.00	5.00	3.7705	1.11644
18	Stubbornness of consultants	61	1.00	5.00	3.2787	1.06663
19	Arranging financing facilities for the project	61	1.00	5.00	3.6721	1.26123
20	Coordination issues and quality of work	61	1.00	5.00	3.8852	.96779
21	Labor and equipment non productivity	61	2.00	5.00	3.8852	.85826
22	Lack of coordination with Electro- mechanical works	61	2.00	5.00	4.1803	.84672
23	Inefficient planning and scheduling of the project	61	2.00	5.00	3.9180	.93622
24	Contractor management incompetency	61	1.00	5.00	3.6885	.86681
25	Rework due to mistakes in construction	61	1.00	5.00	3.5410	.95871
26	Subcontractors/suppliers incompetency	61	2.00	5.00	3.7541	.82977
27	Frequent changes of subcontractors	61	1.00	5.00	3.4918	1.02669
28	Main contractor and Subcontractors disputes	61	2.00	5.00	3.3934	.86176
29	Materials shortage in market	61	1.00	5.00	3.4262	1.17557
30	During construction change of materials	61	1.00	5.00	3.3934	1.06894
31	Materials delivery delay	61	1.00	5.00	3.9344	1.10859
32	Government Authorities and bureaucracy	61	1.00	5.00	3.3934	.98790
33	Late issuance of required permits to work by authorities i.e. ADM, ADDC, ADSSC, ETISALAT, CIVIL DEFENSE, DOT etc.	61	1.00	5.00	3.7705	1.29606
34	Short working hours and many holidays	61	1.00	5.00	2.4262	1.04018
35	Changes in requirements and regulations	61	1.00	5.00	3.0000	1.23828
36	Delay in connecting utilities (electricity, water, etc.)	61	1.00	5.00	3.5082	1.36165
37	Criminal activities by workers	61	1.00	5.00	2.2787	1.14209
38	Issues and conflicts among workers	61	1.00	5.00	2.2131	1.06638
39	Cultural and traditional conflicts	61	1.00	5.00	2.1311	1.02430
40	Inflation and sudden changes in prices	61	1.00	5.00	2.8033	1.19471
41	Availability of Materials, manpower and equipment's	61	1.00	5.00	3.4426	1.13320
42	Delaying in resolving contractual issues	61	1.00	5.00	3.3279	.96127
43	Delays in resolving arbitration/disputes and litigation	61	1.00	5.00	3.2131	1.08189
44	Unfairness in awarding tenders	61	1.00	5.00	3.2131	1.25319
45	Local protectionism	61	1.00	5.00	2.5902	1.03886
46	Insurance compensation claims and delay issues	61	1.00	5.00	2.7705	.97286
	Valid N (list wise)	61				

5.3.3 Step Two: Significance Two Tailed Test

To know if the concerned respondents displayed significant agreement in their ranking the null hypothesis was tested using a t- test at a 95% confidence level. Previously worked out mean values of each variable were used and t-test was done for all and examines using a simple t-test and deriving the significant t-tailed values.

5.3.4 T-Test Results Discussions

As mentioned earlier, the questionnaire was divided into eight groups so test results are discussed in the same sequence with reference to their test results and ranking.

5.3.4.1 Project Team

Four (4) key causes of delay were highlighted from the literature review of other research studies and further related to the development and construction context of Abu Dhabi. It was reported that most significant factor in this group was “lowest bidder selection” ranking at number one (1) with the mean value of 4.065 and significance 2- tailed as .998 whereas the lowest ranking of number four (4) was “construction contract (lump sum, turnkey etc.)” with the mean value of 2.88 and significance 2-tailed is 0.998.

5.3.4.2 Client/ Owner Factors

Seven (7) key causes were addressed in this area through enough research area references and context it was concluded that the most important factor in this group was “Delay in approvals and decision making by Client” ranked to be number one in the group with mean value of four (4) and 2 tailed as 0.816 and the lowest ranking with number seven (7) in this specific group came as “No incentive to contractors for better performance” with a mean value of 3.08 and significance 2-tailed came to be 1.00.

5.3.4.3 Engineers/ Consultants Factors

Again seven (7) key causes were highlighted in this area from literature review and related context. It was observed that most important factor in this group was “Materials and drawings late approvals” ranked to be number one (1) with mean value of 3.77 and 2 tailed as 0.999 and

most lowest ranking with number seven (7) in this specific group came to be “Complexity of engineering design” with a mean value of 3.13 and significance 2-tailed came to be .999. One thing common in both the groups discussed above as client and here as consultants is that it is very important to get the materials and drawings approvals and decisions from the concerned parties so as to not have delays in the projects.

5.3.4.4 Contractors and Sub-Contractors

Ten (10) key causes are analyzed in this area from literature review and related context. It was noted that the key factor in this group was “Lack of coordination with Electro Mechanical works” ranked to be number one (1) in the group with a mean value of 4.18 and 2 tailed as 0.998 and most lowest ranking with number ten (10) in this specific group came as “Man contractor and Sub-contractor dispute” with a mean value of 3.39 and significance 2-tailed came to be .997. It is noted that second highest value in contractors delay factor was “Inefficient planning and scheduling of works” followed by “Coordination issues” and “labor and equipment productivity”. As the contractor plays the most important role when it comes to the construction stage of the projects, it is imperative for the contractor to keep a specific note of MEP coordination planning and resources productivity to have successful projects.

5.3.4.5 Materials

Three (3) key causes are mentioned in this area from literature review and related context. It was evaluated that most important factor in this group is “Materials delivery delays” ranked to be number one (1) in the group with mean value of 3.93 and 2 tailed as 0.998 and most lowest ranking with number three (3) in this specific group came as “Change of mater during construction” with a mean value of 3.39 and significance 2-tailed came to be .997. It is noted that even the third variable have the 2- tailed value very close but the mean value had a difference.

5.3.4.6 Government Authorities Factors

Five (5) key causes are mentioned in this group from literature review and related context. It was evaluated that most important factor in this group is “Late issuance of required permits to work by ADM, ADDC, ADSSC, ETISALAT, CIVL DEFENSE and DOT ETC. ” ranked to be

number one (1) in the group with mean value of 3.77 and 2 tailed as 0.998 and most lowest ranking with number five (5) in this specific group came as “short working hours in authorities and many holidays” with a mean value of 2.42 and significance 2-tailed came to be 0.997. It is noted that specific importance is given in this group towards the issue prevailing and most of the respondents agree in this group that authority approvals and release of permits plays an important role and projects can be delayed due to this issue.

5.3.4.7 Social and Economic Factors

Five (5) key causes are highlighted in this group from literature review and related context. It was evaluated that most important factor in this group is “Availability of required materials, manpower and equipment’s ” ranked to be number one (1) in the group with mean value of 3.44 and 2 tailed as 0.997 and most lowest ranking with number five (5) in this specific group came as “Cultural and traditional conflicts” with a mean value of 2.13 and significance 2-tailed came to be 0.999. It is noted that United Arab Emirates has strict rules and regulations and expects people are to follow these rules so any conflicts and rallies are not prevailing in the country making it more peaceful and law abiding for all. Labor rights are always a priority and being a global village everyone has the right to practice their culture and traditions.

5.3.4.8 Others

Five (5) key causes are pointed out in this group from literature review and related context. It was noted that the most important factor in this group is “Delay in resolving contractual issues” ranked to be number one (1) in the group with a mean value of 3.44 and 2 tailed as 0.994. The lowest ranking with number five (5) in this specific group was “Local protectionism issues” with a mean value of 2.59 and significance 2-tailed came to be 0.999.

Table-8: Descriptive Mean Highest and lowest as per the Groups

Descriptive Mean Highest and lowest as per the Groups							
Highlighted Causes of Delay	N	Minimum	Maximum	Mean	Std. Deviation	Sig(2-tailed)	Ranking (Group wise)
Original contract duration is not realistic	61	1.00	5.00	3.8361	1.05167	1.000	2
<i>Type of construction contract (Lump sum, turnkey etc.)</i>	61	1.00	5.00	2.8852	.89626	0.998	4
<i>Selection of the lowest bidder commercially</i>	61	1.00	5.00	4.0656	.91047	0.996	1
Change order after tender award	61	1.00	5.00	3.7869	.83894	0.993	3
Delay in periodic payment to contractors effecting cash flow	61	1.00	5.00	3.7541	1.09019	0.999	4
Site handing over delays by client	61	1.00	5.00	3.1311	1.17580	0.999	6
Client introduction of additional work during construction period	61	1.00	5.00	3.9180	.89991	0.899	2
Delay in design approval by client	61	2.00	5.00	3.8525	.79238	0.996	3
<i>Delay in approvals and late decision making</i>	61	2.00	5.00	4.0000	.81650	1.000	1
Lack of technical knowledge by client	61	1.00	5.00	3.2295	1.03913	0.997	5
<i>Unavailability of incentives for contractors for better performance</i>	61	1.00	5.00	3.0820	1.06919	1.000	7
Inadequate technical experience of consultant	61	1.00	5.00	3.3607	.98375	0.996	4
Deficiencies in drawings, details and specifications	61	1.00	5.00	3.6557	.94667	0.995	2
Drawings and design documents late issuance	61	1.00	5.00	3.6557	.94667	0.995	2
<i>Complexity of engineering design</i>	61	1.00	5.00	3.1311	.82614	0.999	7
Supervision site staff not available	61	1.00	5.00	3.1803	1.05685	0.998	6
<i>Materials and drawings late approvals</i>	61	1.00	5.00	3.7705	1.11644	0.997	1
Stubbornness of consultants	61	1.00	5.00	3.2787	1.06663	0.996	5
Arranging financing facilities for the project	61	1.00	5.00	3.6721	1.26123	0.999	7
Coordination issues and quality of work	61	1.00	5.00	3.8852	.96779	0.998	3
Labor and equipment non productivity	61	2.00	5.00	3.8852	.85826	0.998	3
<i>Lack of coordination with Electro- mechanical works</i>	61	2.00	5.00	4.1803	.84672	0.998	1
Inefficient planning and scheduling of the project	61	2.00	5.00	3.9180	.93622	1.000	2
Contractor management incompetency	61	1.00	5.00	3.6885	.86681	0.996	6
Rework due to mistakes in construction	61	1.00	5.00	3.5410	.95871	1.000	8
Subcontractors/suppliers incompetency	61	2.00	5.00	3.7541	.82977	0.999	5
Frequent changes of subcontractors	61	1.00	5.00	3.4918	1.02669	0.995	9
<i>Main contractor and Subcontractors disputes</i>	61	2.00	5.00	3.3934	.86176	0.997	10
Materials shortage in market	61	1.00	5.00	3.4262	1.17557	0.999	2
<i>During construction change of materials</i>	61	1.00	5.00	3.3934	1.06894	0.997	3
<i>Materials delivery delay</i>	61	1.00	5.00	3.9344	1.10859	0.998	1
Government Authorities and bureaucracy	61	1.00	5.00	3.3934	.98790	0.997	3
<i>Late issuance of required permits to work by authorities i.e. ADM, ADDC, ADSSC, ETISALAT, CIVIL DEFENSE, DOT etc.</i>	61	1.00	5.00	3.7705	1.29606	0.998	1
<i>Short working hours and many holidays</i>	61	1.00	5.00	2.4262	1.04018	0.999	5
Changes in requirements and regulations	61	1.00	5.00	3.0000	1.23828	1.000	4
Delay in connecting utilities (electricity, water, etc.)	61	1.00	5.00	3.5082	1.36165	0.999	2
Criminal activities by workers	61	1.00	5.00	2.2787	1.14209	0.999	3
Issues and conflicts among workers	61	1.00	5.00	2.2131	1.06638	0.999	4
<i>Cultural and traditional conflicts</i>	61	1.00	5.00	2.1311	1.02430	0.999	5
Inflation and sudden changes in prices	61	1.00	5.00	2.8033	1.19471	0.999	2
<i>Availability of Materials, manpower and equipment's</i>	61	1.00	5.00	3.4426	1.13320	0.997	1
<i>Delaying in resolving contractual issues</i>	61	1.00	5.00	3.3279	.96127	0.994	1
Delays in resolving arbitration/disputes and litigation	61	1.00	5.00	3.2131	1.08189	0.999	2
Unfairness in awarding tenders	61	1.00	5.00	3.2131	1.25319	0.999	2
<i>Local protectionism</i>	61	1.00	5.00	2.5902	1.03886	0.999	5
Insurance compensation claims and delay issues	61	1.00	5.00	2.7705	.97286	0.997	4
Valid N (list wise)	61						

5.3.5 Step Three: Over All Ranking of Causes of Delay through MEAN values

It is very important to know the overall standing of all the 46 highlighted variables?. Overall ranking of variable was needed should done in a descending order without any reference to the groups.

Descending order analysis was done with the details in the below mentioned table describing the highest to the lowest mean values of the of the variables, the highest being 4.18 “Lack of coordination with MEP works” followed by 4.06 “Selection of the lowest bidder”, 4.00 “Delay in approvals and late decision making” and so on, followed by all the rest of the variables, the least being the 2.13 “Cultural and traditional conflicts”.

Table-9: Descriptive mean and Overall Ranking

Descriptive Statistics & Means with Over All Ranking							
Sr No	Highlighted Causes of Delay	N	Minimum	Maximum	Mean	Std. Deviation	Over All Ranking
1	Lack of coordination with Electro- mechanical works	61	2.00	5.00	4.1803	.84672	1
2	Selection of the lowest bidder commercially	61	1.00	5.00	4.0656	.91047	2
3	Delay in approvals and late decision making	61	2.00	5.00	4.0000	.81650	3
4	Materials delivery delay	61	1.00	5.00	3.9344	1.10859	4
5	Client introduction of additional work during construction period	61	1.00	5.00	3.9180	.89991	5
6	Ineffecient planning and scheduling of the project	61	2.00	5.00	3.9180	.93622	5
7	Labor and equipment non productivity	61	2.00	5.00	3.8852	.85826	7
8	Coordination issues and quality of work	61	1.00	5.00	3.8852	.96779	7
9	Delay in design approval by client	61	2.00	5.00	3.8525	.79238	9
10	Original contract duration is not realistic	61	1.00	5.00	3.8361	1.05167	10
11	Change order after tender award	61	1.00	5.00	3.7869	.83894	11
12	Late issuance of required permits to work by authorities i.e. ADM, ADDC, ADSSC, ETISALAT, CIVIL DEFENSE, DOT etc	61	1.00	5.00	3.7705	1.29606	12
13	Materials and drawings late approvals	61	1.00	5.00	3.7705	1.11644	12
14	Subcontractors/suppliers incompetency	61	2.00	5.00	3.7541	.82977	14
15	Delay in periodic payment to contractors effecting cash flow	61	1.00	5.00	3.7541	1.09019	14
16	Contractor management incompetency	61	1.00	5.00	3.6885	.86681	16
17	Arranging financing facilities for the project	61	1.00	5.00	3.6721	1.26123	17
18	Drawings and design documents late issuance	61	1.00	5.00	3.6557	.94667	18
19	Deficiencies in drawings, details and specifications	61	1.00	5.00	3.6557	.94667	18
20	Rework due to mistakes in construction	61	1.00	5.00	3.5410	.95871	20
21	Delay in connecting utilities (electricity, water, etc)	61	1.00	5.00	3.5082	1.36165	21
22	Frequent changes of subcontractors	61	1.00	5.00	3.4918	1.02669	22
23	Availability of Materials, manpower and equipments	61	1.00	5.00	3.4426	1.13320	23
24	Materials shortage in market	61	1.00	5.00	3.4262	1.17557	24
25	During construction change of materials	61	1.00	5.00	3.3934	1.06894	25
26	Main contractor and Subcontractors disputes	61	2.00	5.00	3.3934	.86176	25
27	Government Authorities and bureaucracy	61	1.00	5.00	3.3934	.98790	25
28	Inadequate technical experience of consultant	61	1.00	5.00	3.3607	.98375	28
29	Delaying in resolving contractual issues	61	1.00	5.00	3.3279	.96127	29
30	Stubbornness of consultants	61	1.00	5.00	3.2787	1.06663	30
31	Lack of technical knowledge by client	61	1.00	5.00	3.2295	1.03913	31
32	Unfairness in awarding tenders	61	1.00	5.00	3.2131	1.25319	32
33	Delays in resolving arbitration/disputes and litigation	61	1.00	5.00	3.2131	1.08189	32
34	Supervision site staff not available	61	1.00	5.00	3.1803	1.05685	34
35	Complexity of engineering design	61	1.00	5.00	3.1311	.82614	35
36	Site handing over delays by client	61	1.00	5.00	3.1311	1.17580	36
37	Unavailability of incentives for contractors for better performance	61	1.00	5.00	3.0820	1.06919	37
38	Changes in requirments and regulations	61	1.00	5.00	3.0000	1.23828	38
39	Type of construction contract (Lump sum, turnkey etc)	61	1.00	5.00	2.8852	.89626	39
40	Inflation and sudden changes in prices	61	1.00	5.00	2.8033	1.19471	40
41	Insurrance compensation claims and delay issues	61	1.00	5.00	2.7705	.97286	41
42	Local protectionism	61	1.00	5.00	2.5902	1.03886	42
43	Short working hours and many holidays	61	1.00	5.00	2.4262	1.04018	43
44	Criminal activities by workers	61	1.00	5.00	2.2787	1.14209	44
45	Issues and conflicts among workers	61	1.00	5.00	2.2131	1.06638	45
46	Cultural and traditional conflicts	61	1.00	5.00	2.1311	1.02430	46
	Valid N (listwise)	61					

5.4 Top 10 Causes of Delay

The table below is list of the top ten (10) causes of delay based on the ranking of their average mean values and it is observed that the most frequent cause of delay, as per survey was, 1) Lack of coordination with electro mechanical works (average mean value of 4.18) ranked as no 1 which falls in the range of high to very high, as per the assessment scale. Followed by 2) selection of lowest bidder commercially (average mean value of 4.06), 3) Delay in approvals and late decision making (Average mean value 4.00) which is more than moderate and very close to high, as per assessment scale. Further, it is reported that 4) Materials delivery delay (Average mean value of 3.93), 5 and 6 respectively) Client introduction of additional works during construction period (average men value of 3.91), Inefficient planning and scheduling of the projects are on the (same mean values of 3.91) which is again more than moderate and very close to high. 7 and 8 respectively) Labor and equipment non productivity carries a (mean value of 3.88), Coordination issues and quality of works, 9) delays in approvals by client (mean average value of 3.852) and 10) Original contact duration s not realistic carries the (same mean value of 3.83) which is more than moderate and close to high. It is also noticed that there is not much difference in the average mean values.

The top ten list clearly shows that there are four (4) cause of delay which belongs to the group of contractor and sub-contractor, two (2) factors that belong to the project team group and two (2) factors belong to the client/ owner and only one (1) factor that referred to was from the group of materials.

It is also worth noting here that the top three (3) causes belongs to contractors/ sub-contractors with the average mean value of 4.18, the second one belongs to the project team, having value of 4.06 and the third one belongs to the Client/ Owner with 4.00.

Table-10: To Ten (10) Causes of Delays

Descriptive Statistics & Means as per the Variable list									
Sr No	Highlighted Causes of Delay	Responsible Team	N	Minimum	Maximum	Mean	Std. Deviation	Sig(2-tailed)	Top Ten Ranking
1	Lack of coordination with Electro- mechanical works	Contractors & Sub-contractors	61	2.00	5.00	4.1803	.84672	0.998	1
2	Selection of the lowest bidder commercially	Project Team	61	1.00	5.00	4.0656	.91047	0.996	2
3	Delay in approvals and late decision making	Client/Owner	61	2.00	5.00	4.0000	.81650	1.000	3
4	Materials delivery delay	Materials	61	1.00	5.00	3.9344	1.10859	0.998	4
5	Client introduction of additional work during construction period	Client/Owner	61	1.00	5.00	3.9180	.89991	0.899	5
6	Inefficient planning and scheduling of the project	Contractors & Sub-contractors	61	2.00	5.00	3.9180	.93622	1.000	5
7	Labor and equipment non productivity	Contractors & Sub-contractors	61	2.00	5.00	3.8852	.85826	0.998	7
8	Coordination issues and quality of work	Contractors & Sub-contractors	61	1.00	5.00	3.8852	.96779	0.998	7
9	Delay in design approval by client	Client/Owner	61	2.00	5.00	3.8525	.79238	0.996	9
10	Original contract duration is not realistic	Project Team	61	1.00	5.00	3.8361	1.05167	1.000	10

5.5 Lowest Ranking of Causes of Delay

Lowest ten (10) factors are listed below out of the forty six (46) causes mentioned in the list as per the mean values analyzed. Mean values for the least causes ranges from (average mean 3.08) to (average mean 2.13) which is the least of the forty six (46) reasons of delay. Unavailability of incentives for contractor for better performance, Change in requirements and regulations, Inflation and sudden changes in prices, insurance compensation claims and delay issues, local protectionism, Short working hours, Criminal activities by workers, issues and conflicts among workers.

The lowest 10 factors, out of the forty six (46) causes mentioned before, are listed below and their mean value have to be calculated and analyzed.

Table-11: Lowest Ranking Causes of Delay

Descriptive Statistics & Means as per the variable list								
Sr No	Highlighted Causes of Delay	N	Minimum	Maximum	Mean	Std. Deviation	Sig(2-tailed)	Lowest Ranking
1	Unavailability of incentives for contractors for better performance	61	1.00	5.00	3.0820	1.06919	1.000	37
2	Changes in requirements and regulations	61	1.00	5.00	3.0000	1.23828	1.000	38
3	Type of construction contract (Lump sum, turnkey etc.)	61	1.00	5.00	2.8852	.89626	0.998	39
4	Inflation and sudden changes in prices	61	1.00	5.00	2.8033	1.19471	0.999	40
5	Insurance compensation claims and delay issues	61	1.00	5.00	2.7705	.97286	0.997	41
6	Local protectionism	61	1.00	5.00	2.5902	1.03886	0.999	42
7	Short working hours and many holidays	61	1.00	5.00	2.4262	1.04018	0.999	43
8	Criminal activities by workers	61	1.00	5.00	2.2787	1.14209	0.999	44
9	Issues and conflicts among workers	61	1.00	5.00	2.2131	1.06638	0.999	45
10	Cultural and traditional conflicts	61	1.00	5.00	2.1311	1.02430	0.999	46

6 Chapter 6 Conclusion and Recommendation

6.1 Conclusion and Recommendations

The probable reasons of delay in construction developments in Abu Dhabi has been reviewed by means of a literature assessment and a formal survey of 46 hypothesized survey answers from industry specialist in the construction. The questions were carefully chosen from previous research studies while keeping in view the UAE environment and distributed to the key stakeholders i.e. clients, consultants, and contractors.

Based on the outcome of results the top ten (10) reasons of delay are 1) Lack of coordination with electro mechanical works, 2) selection of lowest bidder commercially, 3) Delay in approvals and late decision, 4) Materials delivery delay, 5) Client introduction of additional works during construction period, 6) Inefficient planning and scheduling of the projects, 7) Labor and equipment non productivity, 8) Coordination issues and quality of works, 9) delay in approvals by client and 10) Original contract duration is not realistic.

It is observed that number one (1st) cause of delay falls in the contractors and subcontractors group making MEP coordination with construction activities very critical and the second (2nd) falls in with the project team group, proving that selection of lowest bidder is not beneficial for the projects, succeeded by the third (3rd) factor in the client/ owner category where approvals and decision making becomes very important. The fourth (4th) is the materials factor that delay in materials delivery can delay projects, the fifth (5th) belongs to client/ owner confirming additional works during the construction stage will disrupt , 6th, 7th. 8th factors fall in the contractor's category. The ninth (9th) again relate to client/ owners and the tenth (10th) factors fall in project team.

This dissertation research concludes that the causes of delay falls in to the client, project team (clients' representative), contractors and materials group category who are seemingly crucial parties in any development.

Therefore, it is suggested that the main stakeholders should uptake full accountability of their scope of work and should coordinate and execute actions wisely on the acknowledged top ten (10) reasons to evade delays in projects. The practitioners and executors can utilize their project management skills to mitigate and reduce the identified delays to have successful projects. The

academicians can concentrate on more specific and detailed studies on the causes and effects of delays.

As a result of the constricted timetables, study was narrowed towards specific respondents. Nevertheless for the purpose of future research it may be suggested to incorporate a greater study populace from the clients, consultants, and contractors to have a bigger perspective. It would be an essential approach for forthcoming review to assess reasons and consequences of delays on the project delivery.

6.2 Areas that may need more concentration in relationship to UAE Environment

6.2.1 Implementation of Risk Assessment and Risk Management

Risk assessment can be considered as one area which is not given enough importance during the project evaluation processes and needs to be practiced in projects. Projects executed and delivered in different parts of world and facing delays of many types as highlighted in above discussions have been investigated by many well-known researchers resulting in losses ultimately. Risk assessment and risk management can play an important role for projects at the initiation stage as the risks can be identified and mitigated accordingly. Unlike other regions UAE construction face special challenges such as mix culture, major diversity factor, time limitations, specialist architecture and very high standards of construction, it is deemed necessary to identify, mitigate and manage risks in advance to avoid any uncertainties.

6.2.2 Implementation of Knowledge Sharing and Knowledge Management

Knowledge sharing and knowledge management is basically the utilization of right knowledge to the right people and at the right time, it is also utilization of learned skills based on experiences and knowledge in various situation to resolve issues. It is not very frequently practiced by several organizations in UAE and they are still hesitant to implement without knowing that lessons learned will always be beneficial for not repeating the same mistakes. TACIT or EXPLICIT knowledge are the two forms of knowledge management and sharing, in documented or in not documented form can be useful for resolving many problems. Every project is different in nature but literature review shows that there are many causes of delays which are common in delayed projects. So if lessons learned process is implemented in projects

it is expected that the projects can be more successful. In very short time, many developmental projects have providing vast experience to all associated professional in projects.

6.2.3 Ownership and Responsibilities

Causes of delays are always reflected on to some groups or individuals, although it is not easy to accept the fact but responsibility and the severity of the same becomes very critical for the projects. It is recommended that each concerned group should be able to control, minimize and mitigate their causes of delay by taking responsibility of their actions. More awareness and self-realization is required which comes with acceptance and knowledge. Ownership and responsibilities matrix needs to be carefully defined in the initiation stage of project then the concerned parties will know their scope and appropriate action can be taken accordingly.

6.2.4 Optimization of Resources

Optimization of resources is very critical for the projects as it plays an important role in the successful completion of the projects. All associated resources from tools and equipment's, materials and manpower to be used in the most optimized and if required to be sub optimized as well. Procurement and development of competent resources is very important as the well-equipped resources will have better understanding of the problems and can propose solution from their experience and competencies. Resource planning and utilization with specified responsibilities would be beneficial for projects. It is expected that proper resource management will be helpful and will have long-term effect on projects.

6.2.5 Innovation and Creative Approach

Innovative and creative approach is required to achieve better results, project management has been very flexible and adaptable since its inception and still have room for improvement. Stereo type system and approach needs to be changed and more practical and adaptive solution are required. Management needs to be more approachable and acceptable in accepting news innovative ideas and implementation of the same. Project teams involved in the construction can always come up with proposals and ways of progressing to avoid unwanted delays and in the projects.

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8 Appendices

-Questionnaire

-Other related information

Ghias ur Rehman
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Date:

Dear Participate,

Causes of Delays in Projects in Abu Dhabi – A Questionnaire survey

Introduction:

Delays in construction projects often occur and the critical impact of delays are cost and time over run. Delays in projects brings a bad name for all associated parties and in general bad reputation for the project.

Objective:

The objective of this dissertation is to find out the major causes of delay in construction projects through this quantitative approach, using the questionnaire and identifying the responsible parties.

Invitation:

My name is Ghias ur Rehman, and I am a Masters in Project Management Student at the British University Dubai. As a part of my programme I am carrying out a study about causes of delays in projects in Abu Dhabi United Arab Emirates. I would like to invite you to participate in this research study, by completing this questionnaire, as you have been a credible consultants, contractors or owner representatives with experience of Project Management.

Simple Instructions:

Completion of the attached questionnaire will take approximately 15 minutes, and all questions can be answered by following the simple instructions. Completion of the questionnaire is completely voluntary. All responses are anonymous; there are no correct or incorrect answers and respondents who take part will not be identifiable. If results of this study are published these will be a summary of all responses to ensure that your privacy is protected.

Your kind assistance in this is highly appreciated. If you choose to participate in the study, your contribution is greatly appreciated. Thank you for your time and attention. I look forward to hearing from you.

Yours Truly,

Ghias ur Rehman

(Questionnaire survey)**Instructions:**

- **Please answer all questions.**
- **Tick (X) the relevant answer where applicable.**

Section (1) Demography

- 1- You are representing :
- Client/ Client Representative Engineering Consultant Contractor
 Other
- 2- Your Company is :
- Local International Government Private
- 3- Your current Role regarding construction is:
- Designer Contractor Construction Manager Project Manager Other (please specify)
- 4- Please indicate your years of industry experience:
- 0-2 years 3-5 years 6-10 years 11-20 years Over 20 years
- 5- The (Average) Price of your current project(s) is
- 0 - 50 51 - 100 101 - 500 Over 500 (Million AED)
- 6- How many projects your organization undertaken in the past 10 years?
- 1-10 11-20 21-30 31-40 41- 50 Over 50
- 7- How common your projects are delayed in the Abu Dhabi?
- 10%, 25%, 50%, More than 50%
- 8- Do you think delays in projects are directly affecting the performance of all associated parties?
- Yes No Not sure

Section 2 Causes and Effects of Delay

Please assess the causes of delay listed in the table below. Note that two things are being assessed per cause and severity: 1) Causes of Delay 2) Severity of delay. The probability refers to the possibility of occurrence of a delay while the effect refers to the consequence on project objectives once the event occurs.

Please base your assessment on the scale of: 1=very low 2=low 3 =moderate 4= high
5= very high

No.	Responsibility	Identified type of delays	Causes of Delay					Severity of Delays				
			01	02	03	04	05	01	02	03	04	05
1	Project Team	Original contract duration is not realistic										
2		Construction contract (Lump sum, turnkey etc.)										
3		lowest bidder selection criteria										
4		Changes order after tender award										
5	Client/ Owners	Delay in periodic payment to contractors effecting cash flow										
6		Site handing over delays by client										
7		Client introduction of additional works during construction period										
8		Delay in design approvals by client										
9		Delay in approvals and late decision making										
10		Lack of technical knowledge by client										
11		No incentives for contractors for better performance										
12	Engineers/ Consultants	Inadequate technical experience of consultant										
13		Deficiencies in drawings, details and specifications										
14		Drawings and design documents late issuance										
15		Complexity of engineering design										

16		Supervision site staff not available													
17		Materials and drawings late approvals													
18		Stubbornness of consultants													
19	Contractors and Subcontractors	Arranging financing facilities for the project													
20		Coordination issues and quality of work													
21		labor and equipment non productivity													
22		Lack of coordination with Electro- mechanical works													
23		Inefficient planning and scheduling of the project													
24		Contractor management Incompetency													
25		Rework due to mistakes in construction													
26		Subcontractors/ suppliers Incompetency													
27		Frequent changes of subcontractors													
28		Main contractor and Subcontractors Disputes													
29	Materials	Materials Shortage in market													
30		During construction change of material													
31		Material delivery delay													
32	Government Authority	Government Authorities and bureaucracy													
33		Late issuance of required permits to work by authorities i.e. ADM, ADDC, ADSSC, ETISALAT, CIVIL DEFENSE, DOT etc.													

General comment on causes of delays in construction projects in Abu Dhabi

34		Short working hours and many holidays										
35		Changes in requirements and regulations										
36		Delay in connecting utilities (electricity, water, etc.)										
37	Socio- Economic	Criminal activities by workers										
38		Issues and conflicts among workers										
39		Cultural and traditional Conflicts										
40		Inflation and sudden changes in prices										
41		Availability of required materials, manpower, equipment's										
42	Others	Delaying in resolving contractual issues										
43		Delays in resolving arbitration/ disputes and litigation										
44		Unfairness in awarding tendering										
45		Local protectionism										
46		Insurance compensation claims and delay issues										

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End of questionnaire

Please return completed questionnaire to:

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