KHALIL IBRAHIM RAHMEH

DELAY FACTORS IN GREEN BUILDING PROJECTS

NEU 2019

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A THESIS SUBMITTED TO THE GRADUATE SCHOOL OF APPLIED SCIENCES OF NEAR EAST UNIVERSITY

By

KHALIL IBRAHIM RAHMEH

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Civil and Environmental Engineering

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Approval of Director of Graduate School of Applied Sciences

Prof. Dr. Nadire ÇAVUŞ

We certify this thesis is satisfactory for the award of the degree of Master of Science in Civil Engineering

Examining Committee in Charge:

Prof. Dr. Hüseyin Gökçekuş	Committee Chair, Faculty of Civil and Environmental Engineering, NEU
Assist. Prof. Dr. Beste Çubukçuoğlu	Supervisor, Faculty of Civil and Environmental Engineering, NEU
Assist. Prof. Dr. Parvaneh Esmaili	Faculty of Engineering -Department of Electrical and Electronic, NEU
Assist. Prof. Dr. Anoosheh Iravanian	Faculty of Civil and Environmental Engineering, NEU
Dr. Shaban Ismael Albrka	Faculty of Civil and Environmental Engineering, NEU

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

Name, Last Name: KHALIL RAHMEH

Signature:

Date:

ACNOWLEDGEMENTS

I would like to thank my supervisor, Assist. Prof. Dr. Beste Çubukçuoğlu, whose expertise was invaluable in the formulating of the research topic and methodology in particular, this work would not have been possible without her.

I am especially indebted to Prof. Dr. Hüseyin Gökçekuş, Chairman of the Department of civil and environmental engineering, who have been supportive of my study goals and who worked actively to provide me with the protected academic time to pursue those goals.

I am grateful to all of those with whom I have had the pleasure to study during this and other related projects. Each of the members of my faculty has provided me extensive personal and professional guidance and taught me a great deal about both scientific research and life in general.

To my loving parents who supported me all the way hoping that I made them proud…

ABSTRACT

The widespread of conservation energy, global warming and use of non-renewable resources have given birth to the green building movement. In this study, a total of 164 respondents including engineers, architects, project managers, agents in Northern Cyprus and Dubai were interviewed using questionnaire survey to determine the most important factors responsible for delay in green building construction in the two case studies, and to also compare result of the countries. The result shows that the in Dubai coordination factors were more responsible for delays in green building construction while the top ranked factors in Northern Cyprus are technical factors. Increase in overall project cost, fewer number of specialized contractors, difficulty in the selection of subcontractors who provide green construction services, and availability of required equipment of material are the most responsible factors for delay in Northern Cyprus in order of their importance, while in Dubai poor scheduling, rise in contract sum, increased number of meetings and coordination required with green consultants and engineers and frequent alterations and variations with the design during the construction processes are the most relevant factors. The difference in ranking the factors was found to be as a result of higher acceptance of the green building technology, economy, and development in Dubai over the Northern Cyprus.

The delays can be minimized by development of good and effective work schedule, provision of complete and extensive drawings containing all the specifications which will minimize unnecessary alterations and changes in the design, careful selection of the specialized contractors and suppliers for green building services and employing skilled labor for the project who will do it right at once.

Keywords: Cyprus; Green Buildings; Dubai; Management; Timetable

ÖZET

Enerji tasarrufunun yaygınlaşması, küresel ısınma ve yenilenemeyen kaynakların kullanımı yeşil bina hareketini doğurmuştur. Bu çalışmada, iki vaka çalışmasında yeşil bina yapımında gecikmeden sorumlu en önemli faktörlerin belirlenmesi amacıyla anket çalışması kullanılarak mühendisler, mimarlar, proje yöneticileri, Kuzey Kıbrıs'taki ve Dubai'deki acenteler de dahil olmak üzere toplam 164 katılımcı ile görüşülmüştür. Sonuçlar, Dubai'deki koordinasyon faktörlerinin yeşil bina yapımındaki gecikmelerden daha fazla sorumlu olduğunu ve Kuzey Kıbrıs'ta en üst sıradaki faktörlerin teknik faktörler olduğunu göstermektedir. Genel proje maliyetinde artış, daha az sayıda uzman müteahhit, yeşil inşaat hizmetleri sağlayan taşeronların seçiminde zorluk ve gerekli malzeme ekipmanının bulunabilirliği, Kuzey Kıbrıs ve Dubai'deki önem sırasındaki gecikmeler için en sorumlu faktörlerdir.

Kötü planlama, sözleşme toplamında artış ve mühendisler için gerekli olan toplantı ve koordinasyon sayısındaki artış ve inşaat süreçlerinde tasarımda sık sık yapılan değişiklik en önemli gecikme faktörlerdendir. Gecikmeler, iyi ve etkili çalışma programlarının geliştirilmesi, tasarımdaki gereksiz değişiklikleri ve değişiklikleri asgariye indirecek tüm özellikleri içeren eksiksiz ve kapsamlı çizimlerin sağlanması, yeşil bina hizmetleri için uzman müteahhitlerin ve tedarikçilerin özenle seçilmesi ve vasıflı çalışanların kullanılmasıyla en aza indirilebilir.

Anahtar Kelimele: Kıbrıs; Yeşil Binalar; Dubai; Yönetim; Tarife

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INTRODUCTION

1.1 Background

After the industrial revolution in the 19th century, the wide use of fossil fuels had been started. From the beginning of the 19th century until the early 20th century, the common thought was that these resources were unlimited but then it was realized that these resources were not unlimited and needed to be protected somehow and hence the environment.

It was then that, from the 1960s onwards, interest in being concerned about the environment arose and has been realized that development had to be sustainable. In other words, the consumption of fossil resources should not exhaust the resources but instead allow those resources to generate and renew themselves naturally by time. This is indeed the reason how people discovered the matter of renewable energy resources and hence their importance in order to protect the health of human beings and the environment.

The discussion about the renewable energy resources was firstly raised up in Stockholm Conference back in 1972, where the issues had to be addressed on a world scale and culminated with the First Great Conference to take place in the world, which was the Rio Conference. After the Stockholm Conference, concerns began to emerge about the need to consider sustainable development and questioning what needed to be done to avoid further damaging the earth is what triggered the Great Conference. After all, Kyoto Agreement was raised up at the end of the Kyoto Conference. Following this, there have been many more gatherings regarding the development of the concept of sustainable development. Some have been, as discussed by the press, a bit of a failure because the objectives set were not reached due to this lack of agreement.

The Great Conference which represented a radical change because the Kyoto Protocol was made, was the one held in 1997. In the Kyoto Protocol, the developed countries said that they were going to carry out actions within their industries (it was for the CO_2 produced by

industry) to reduce by 5% the polluting gases that they were producing, basically CO_2, in 1990. They were in the year 1997 but agreed that they would decrease it by 5% based on levels produced in the year 1990. This is what they strove to do and had to be achieved by the year 2012. A lot has been succeeded to achieve the target, but it was not possible for all countries to meet this objective.

The agreement extended in 2012, during the Kyoto Protocol's first stage finished, by doing an extension period to 2020 in Doha agreement. It was equivalent to reduce the greenhouse gas emissions and one of the most efficient ways to reduce emission is by integrating green approaches into the construction industry. Since then huge attention was paid on the use sustainable construction materials and integration of new approaches in order to achieve sustainable.

Those conferences help countries to look into details and look for reasons that could cause this damages that's when the light has spotted to the construction sector and the hazard that could make.

1.2 Research Goals

Construction materials have detrimental impacts on the environment. The world's yearly production of cement exceeds 1.6 billion tons that contribute to the atmosphere global loading of carbon dioxide for about 7%. (V. M. Malhotra, 1999, Mehta, 2001)

Moreover, typical concrete made out about (13%) cement and up to (80%) aggregate by mass which is the main reason of exhausting naturally available resources. The concrete production process, consume sand, gravel, and crushed rock which is about 10 to 11 billion tons, yearly (Adinkrah-Appiah, Kpamma, Nimo-Boakye, & Asumadu, 2016). Moreover, the concrete production process releases huge amount of CO_2 gases into the atmosphere.

Recycling of waste construction materials is considered to be difficult. A study shows that in the United States the amount of produced Municipal Solid Waste (MSW) exceeded 254 million tons in 2007, even though the quantity of treated and reused MSW is greater than

ever had been but it is only 9 million ton which present about 3% out of the solid waste that had been recycled.

Construction and Demolish waste (C&D) is the waste that associated with construction industry and pulling down which present approximately 26% of nonindustrial waste assembling C&D with MSW(Yuan & Shen, 2011). Furthermore, only 20-30% of C&D debris is treated for processing and recycling, because the renovation or deconstruction idea is not in architects and builders stereotypically design. Where it should be spicily in residential homes, because of people tend to move from one place to another, as a study shows that the average U.S. families tend to changes their homes every ten years which makes more MSW (Khasreen, Banfill, & Menzies, 2009).

Not only have the materials used in the construction industry had detrimental impact on the health of public and the environment. The required water for construction is approximately 1 trillion Liter yearly. Without a dependable estimate, but a considerable amount of fresh water has been used for washing by mixing concrete production phase (Mehta, 2001).

As energy sector statistic shows, (38.9%) out of the United States consumed energy, accounted for buildings and it's divided as: residential buildings consume about (53.7%), and (46.3%) accounted for commercial buildings. Moreover, electricity consumption in buildings is estimated for (72%) of the total United States usage in 2006 and it’s expected to be (75%) in 2025. While residential buildings accounted for (51%), and the commercial building consumes the other (49%). In the United States, an average householder spends at least 2,000 US dollar per year on energy bills, over half of that bills go to the process of removing heat and moisture from the interior of occupied space, to improve the comfort of occupants. Air conditioning can be used in both domestic and commercial environments. This process is most commonly used to achieve a more comfortable interior environment (Energy star, 2016).

The building is hazardous to the air and atmosphere. Buildings attribution is up to 38.9% of the national carbon dioxide emissions in the United States. 20.8% of the total emission are in residential development, while 18% out of the commercial buildings in 2008

(Energy Information Administration, 2008). Due to the buildings contribution on emissions; the annual air temperature is in a city with a population exceeding 1 million warmer than its suburbs by average 2 °C, The difference could reach up to 12°C in the evenings (US EPA heat Island program, 2008).

Furthermore, the indoor environment and its importance on habitat health because its where the most place people spend their time. The American citizen spent more than 90% of their time indoors. When, the indoor level of pollution could be higher than outdoor from two to five times and on some occasions more than 100 times (Washington, DC, 1997) by going into details in the 1990s, 10% of the schools in the U.S. stated unsatisfactory because of the indoor air quality, and 20% of schools stated to have poor ventilation (Executive Summary, 1999).

Indoor air pollution could affect the occupant's health by having combustion causes such as the construction materials, or could it be the central heating and cooling systems and humidification devices (US EPA, 2005). Also, asthma dust mites, molds, cockroaches, pet dander, secondhand smoke, and some chemicals it's not the main reason of asthma but it is the reason to trigger it attacks which make it an indoor contaminant (Health E Stats, 2003).

The numbers about asthma are not that easy as a statistic (US gov, 2008) in the year 2000 shows the estimated cost is $3.2 billion per year for treating asthma in those under 18 (US gov, 2008). One of the most causes of this kind of diseases is the building design; it could be avoided by advanced building design. Those factors need to be considered, and the best alternatives to get over all these problems are the green buildings.

1.3 Research Outline

The green building is defined as the process of establishing whole units and the use of a more friendly environment process's that are guided and efficient during the predicted age of the building's circuition, from sitting to design, construction, operation, maintenance, renovation, and deconstruction. This process goes further to be a supplement to conventional buildings in design, economical, usefulness, strength and leisurely buildings. Sometimes the green building could be called sustainable buildings or buildings with high

efficiency. It’s designed to minimize the building environment effects on habitant's health and the surrounding nature.

Expands IAQ (Indoor Air Quality): the green building encourage the air quality indoors to be more healthy by improving the air feature healthy and sustained: the used material components, systems that require only non-toxic or low in VOC. Locally produced: materials, components, and systems found in local area or region for lowering the energy consumption and lower the resources in transportation to the project site. Reasonably priced: through the building product lifetime the financial benefit compared to traditionally designed ones (Lynn M.Foreschle, 1999).

As said in US EPA, 2016 The benefits of green building are varied and it has a good influence in various ways as:

The green buildings have an effect on the national economy. Based on Kats, 2003, a recent assessment on this issue, “The Costs and Benefits of Green Buildings about Massachusetts” Massachusetts is one of the leading states in fast-growing green building movement. Traditional buildings consume a large part of the material, water, waste generated in the national economy, and around 70% of the electricity. The traditional building has been viewed as a relatively static sector of the national economy, Massachusetts suffer from relatively little changes in the technology or resources consumption pattern. Until this date, there has been a spread perception that green building is more relevant to an environment and a healthy point of view.

The high green building cost perception has been the largest obstruction to more spread reliance on green design. The green building provides financial benefits that conventional building cannot. As a report Kats, 2003 the financial benefits of green design is in range of 50$ to 70 $ for one square feet in buildings that classified by LEED. The financial benefits include savings on energy and water, waste, and lower cost in environmental and emissions.

Mainly, the green building effect on habitat health as indoor lighting in Green building found to be much better on occupants eye health and visual comfort.

A study was made by Han & Kim, 2010 about Samsung Co. head office. Building design aimed for a green office building in terms of IEQ, energy and green building, to ensure optimal energy efficiency and pleasant working environment, while trying to maintain aesthetic value of the building design. The building received 1st Grade Green Building certification, which was conducted by KGBC (Korea Green Building Certification) in January 2008. The investigations cover the lighting on occupants' visual comfort and eye health. The result of the analyzed data showed daylighting can advance psychological health and productivity. The annoyance glare could be reduced by the screen type shading device by intercepting the sunlight, the results show the occupant's annoyance was reduced significantly (T. Hwang & Jeong Tai Kim, 2011).

The daylight and natural illumination source also have a positive effect on students productivity. As a study conducted about facility in California *U.S. Green Building Council* , 2003 targeted 21,000 students with different classrooms light sources the results were in classrooms with more natural illumination 20% of the students had a higher score in math classes and up to 26% higher in reading classes, in comparison to rooms with less natural sours of light. Moreover, regularly staying away from school without good reason declined by 15% (*U.S. Green Building Council, 2003*).

Furthermore, the influence could lead to more productivity of employees when it is a commercial building. The effect of Indoor Environmental Quality (IEQ): the employee health, and productivity are one of the important factors in occupational and public health especially in office buildings (Henneberger, 2006). IEQ could affect negatively on occupants comfort and physical health (e.g., respiratory allergies, and asthma exacerbation) through the excess humidity, poor air quality exaggerated temperatures (e.g., stress and depression) and also by inefficient lighting, acoustics and comfortable design (ergonomic). Employees who have adverse health conditions are less productive and lose more hours supposed to be working hours and noted a severe drop in hours of absent to those employees who suffer these conditions as the studies shown (May 2006).

By providing healthier building environments the IEQ will be addressed and the employee health will be a concern that's what the green building seeks to. Though, claiming improving health and productivity by improving the IEQ is based on many qualitative studies (Lee & Kim, 2008) which lead to substantial motivation toward green building (G. H. Kats, 2003, Diego, 2014).

For employee, moving from traditional to green building recognized by LEED found the stately benefits through decreasing in reported absenteeism and more efficient work hours and perceived effect of the work atmosphere on their output. The improvements were fairly genuine and could result additionally 38.98 work hours per year for each employee of the building (Singh, Syal, Grady, & Korkmaz, 2010).

The green building is designed out of environmentally friendly material, which can help to create more health-giving and naturally sensitive buildings. This can be achieved by integration and using ecologically friendly materials. As consider to be the most important part of the green building is to compel observance of compliance the specifications during the construction phase to guarantee environment-friendly building, when the building is completed, the maintenance ensures the sustainability and good performance for the green material, and after all whole green performance.
Green buildings material and systems has to have multiple main points: first the sustainability: saving resources by reusing material is economically beneficial and good for the environment. Green building materials can be used again which capable of being helpful to the national sources or have been gathered from renewable sources. Second the durability: material has to be used long-term or are equal to traditional with long term expectations. The third consideration is humidity: the material need to resist humidity or prevent biological growth of contaminants in the indoor environment. In addition, the energy effectual for each step in materials life cycle and after structures to minimize consumption of power usage in houses and buildings while water saving systems that lessen water usage in buildings and save water in landscaped areas.

Choosing construction project materials can be divided into three phases; The investigation phase, assessment, and material choice. Meanwhile, the problem that face green building

project is that there is the lack of standard format for providing environmental product information which could affect later on the timetable of the project.

This can be alleviated by requesting letters of clarification from the manufacturer. Reviewing product warranty and durability test information is also important. Evaluation and assessment can be accomplished by comparing similar types of building materials based on the environmental criteria.

Delay is a major problem facing all kind of projects in all countries which makes construction more difficult task and not easy to predicts and in some situations could cause this delay. The Delay in construction is a global phenomenon. And it had been coved will in many studies as Assaf & Al-Hejji, 2006 mentioned that in Saudi Arabia 70% of the construction projects construction project experience delay. With overrun average time (10 to 30 %) of the scheduled time. Odeyinka & yusif, 1997 found that seven out of ten construction projects in Nigeria suffered delays in their executing time. In Hong Kong, a study conducted by D. W. Chan & Kumaraswamy, 1997 about project delaying in the construction industry failure to complete project on schedules time interval, within the specified budget and the poor specified quality which result in a various unexpected negative impact on the projects.

Delay could cause extension or acceleration in the project and therefore incur an additional cost. The rule usually makes a percentage of the project cost as a contingency allowance in the contract price and this allowance is usually based on previous agreement (Othuman Mydin, Sani, Taib, & Mohd Alias, 2014).

Although, the contract parties agreed upon the extra time and cost, the problem between the contractor and the owner in many cases as to whether the contractor was entitled to claim the extra cost. Such situations usually involved questioning the facts, causal factors, and contract interpretation. Thus, construction projects give rise to discontent to the involved parties and that the main role of the project manager is to make keep that the projects are completed within the budgeted time and cost.

Delay could occur for many reasons mentioned in many studies. Mansfield, 1994 distinguishes between 16 major factors that cause delay and overrun cost in Nigeria. The survey questionnaire carried out with contractors, consultants, and client. They showed that the delayed and overrun causes in Nigerian construction projects were assigned to the poor contract management, finance and payment arrangement, materials shortage, inaccurate estimation, and price fluctuations.

(Assaf, Al-Khalil, & Al-Hazmi, 1995) came to the conclusion that there are 56 main causes of delay in Saudi Arabia, large building construction projects and their relative importance. One of the main delay factors based on the contractors survey were:(1) changes in design by owner or payment,(2) preparation and approval of shop drawings (3) contractor's progress delay (4) the cash problems during construction, (5) the slow decision-making process by the owner (6) the relationship between subcontractors. Although there are other main reasons like owners agreed that the design error, labor shortages, and ineligible labor skills.

A survey study conducted to determine and evaluate the relative importance of significant factors causing a delay in construction projects in Hong Kong conducted by Chan DWM, Kumaraswamy MM. 1997 found that the main reason for analyzed and ranked the buildings can be done by classifying the factors into two groups: (I) the parties role in the local construction industry (II) the type of the project. The results indicated five major factors could cause delays: supervision and poor site management, unforeseen ground conditions, all project teams decision making speed, client-initiated variations and necessary variation of works.

In Nigeria another study was conducted by Odeyinka HA, Yusif A. 1997 and it was found and discussed main causes of delays in building projects. Delaying factors were classified as extraneous and participants factors. Extraneous causes of delay were: inclement weather acts of nature, labor disputes, and strikes. Contractor-related delays were: planning and scheduling problem, inadequate site inspection, financial difficulties, material management problems, equipment management problems, shortage in labor, and some client related delays included variation in order slow decision making and cash flow problem.

Another survey study was conducted by Odeh & Battaineh, 2002 to identify the most important causes of delays in construction projects with the traditional type of contracts. As the results of the survey, some of the top ten important factors are the owner interference, contractor inadequate experience, financial and payments, decision making shallowness and faulty in planning, this factors from construction contractors and consultants. Second study had similar quantitative analysis had been conducted by Al-Momani A. 2000 in Jordan, The study results indicated that the owner changes, unexpected weather, some site conditions, and economic conditions.

A questionnaire had been sent to three groups of construction practitioners in Nigeria (surveyors, architects engineers, and contractors) by Aibinu & Jagboro, 2002 to study and evaluate the effect of delays in construction on project delivery. As the study showed there are six effects on construction delays and they were : the overrunning of time, cost, parties dispute, arbitration or litigation, and total abandonment.

Some studies have referred to the probability of a link between the delay factor and the effects of delay straightway without analyzing. Like in Nepal the cost overrun linked to the material related factors. In Saudi Arabia Assaf & Al-Hejji, 2006 linked the time overrun to the contractor and labor-related cases. A study by Odeh & Battaineh, 2002 looked at the disputes occurring to the contractor cases in Jordan construction projects. (D. W. Chan & Kumaraswamy, 1997) the time overrun in Hong Kong construction projects linked to consultant and client-related factors. Frimpong et al., and Mansfield NR.1994 linked the probable overrun of time and cost to the client, consultant, and material related factors.

The scheduling performance in green building has its own uniqueness which has been noted by a study of G. H. Kats, 2003. Designing and implementing green building usually takes a long time than any ordinary buildings. The required time goes back to the extra knowledge and experience is required to the team member, although the project documents have to be more thorough before construction, and the equipment required to implement the green systems in buildings (G. H. Kats, 2003).

The situation in Northern Cyprus is unique to some extend due to: the limited natural resources (Altinay, 2000), the lack of familiarity with green designs, and the limitation in other types of resources such as energy and water (Doratli, Hoskara, & Fasli, 2004), the economic problems (exchange rate recently, unemployment, political isolation) and the low densely populated in Northern Cyprus and lack of infrastructure (Farmaki, Altinay, Botterill, & Hilke, 2015). Conceivably, the solution to many of these concerns lies in embracing sustainability within the hotel sector, primarily as it relates to small-scale hotels as alternatives to the standard large resorts that exist throughout the world (Teare, 1990).

On the other hand, green buildings in Dubai have different status. The municipality has strategic plan in Dubai Green Building Regulations and Specifications, which was issued in 2010 and initially was applicable as mandatory requirement for construction of new government buildings. In 2016, the regulation was re-issued as AL SA'FAT - Dubai Green Building Evaluation System.

On 13-Feb-2014, Dubai Municipality Building Department issued Circular (198) 2014, providing for the mandatory implementation of the Dubai Green Building Regulations and Specification (GBRS) on all new constructions and buildings within the Emirate of Dubai, effective 01 Mar 2014.

The purpose of the Dubai GBRS is to improve the performance of buildings in Dubai by reducing the consumption of energy, water and materials, improving public health, safety and general welfare, and, by enhancing the planning, design, construction and operation of buildings, to create an excellent city that provides the essence of success and comfort of sustainable living.

1.4 Problem Statement

The consecutive of implementing and design the green buildings has a full of challenges and obstacles to companies due to the acceleration of modern technologies for its construction. These challenges related to time management of the project and cause of delay, which has not and need to be known and analyzed, one to be more concern about.

Moreover, the factors of delay are different from country to another regarding to these analyses factors.

1.5 Aim and Scope

The aim of the study is to provide a clear understanding of the green building scheduling performance and find the most influential factors that should be taken consideration in green building projects. While finding strategies to avoid or overcome the negative impact of these factors to help partitions for a better deal, by already knowing the potential causes of delay and introduces delays that are not present in traditional building construction to reach the preferable schedule performance and better time management.

The study based on many steps first was determined by the key factors that could cause a delay in green building projects. Second is to evaluate the factors to determine to consider first and the difference between Dubai and Northern Cyprus to find the impact of each factor and find ways to overcome those factors.

1.6 Importance of The Research

As the literature review shows that there are other factors in green buildings which should be known and studied all those factors could not be traced in a conventional building; and needs to be clearer to engineers and managers. The green building is a common practice around the world as traditional buildings because of the unique challenges to these projects. There is not much research has been conducted to analyze such project's management. The bridge between project management and sustainability is still being built. . This research focuses on the factors which may cause delays in the completion of the projects mainly focuses on the construction projects located in Northern Cyprus and Dubai. In order to collect data regarding to the factors which may cause delays in those specific areas interviews were undertaken with workers, contractors and engineers.

CHAPTER 2
LITERATURE REVIEW

Green building requires specific purchasing experience (Wiley, 2008) , and also requires more knowledge of local materials that may be used to meet green standards, and the purchasing manager must provide them on time and if they are to be imported the time that conceded a major problem in Northern Cyprus, as will be mentioned in details in the next section.

Although the main goal in terms of sustainable construction is to reduce its environmental impact. Studies show that the design of a green building project is still new to the industry. A study Construction, 2006 of 400.00 architects and contractors indicates that spending is a priority for 54% of them, while only 24% of participants give priority to the environment. When asked about the challenges posed to green buildings, the answer was provided. Cost as mentioned in Dwaikat & Ali, 2016, which means that the other benefits of the building take a back seat. It is therefore important for sustainable building managers to put in place a strategy to save time during the first phase of the project.

2.1 Delay Factor Related to Green Building Management

Green building scheduling and time management is directly influenced by the higher performance of construction management (Meryman & Silman, 2004). Management's top concern about the environment is reflected into the employee so that he can do his job properly because of their limited power (Ball, 2002). The higher management must have the necessary knowledge to ensure that the manager, as well as the supplier, and the subcontractors, have knowledge of the materials, the manufacturing and the environmental issues of the supply chain; it is the additional cost of these materials and the costs of the technology that have been seek did not cross the interest of the stakeholders, which makes it an obstacle to the calendar (Love, Holt, Shen, Li, & Irani, 2002; Shi, Zuo, Huang, Huang, & Pullen, 2013a).

For the management of contracts, the building must be insured after construction during its life cycle (Pollington, 1999). The cost of maintenance should not exceed 12% of the total

cost of energy consumed (Thormark, 2002), generally in most countries where construction companies provide technicians or support to operate the building to ensure the expected efficiency of the building, this action may be delayed because its contracts are different from ordinary contracts (Cole, Brown, & McKay, 2010; Leaman, Stevenson, & Bordass, 2010). This makes the responsibility of the contractor even more and takes longer than expected.

2.2 Delay Factor Related to Green Building Cost

Green buildings are generally known for their environmental impact, but financial benefits are a more effective reason for building green buildings (Meryman & Silman, 2004b). In addition, green construction is known for its high initial cost compared to conventional projects; thus, price variation may be justified by the building's ability to conserve long-term savings throughout the building's life cycle (Bhattarai, Neupane, Chaudhary, Shah, & Kumar, 2013). Neither the least could be an obstacle. Green buildings can reimburse the initial cost by saving 9% throughout their life cycle, which could offset the initial cost of 7.5% (Ahn & Pearce, 2007).

Regarding the fiscal benefits of green building of which the finance could also be a barrier to implementation (Ofori & Kien, 2004), due to the additional costs of installing new technology and the special type of material that has greater insulation than ordinary materials, and that poses a problem of size; in green building in China (Liu et al., 2012).

Time is always important for stakeholders and that's the first thing they think about (Ofori & Kien, 2004). This is because, any delay in implementation could damage the company's reputation (Hoffman, Rosenfield, Gilbert, & Oandasan, 2008).

Although this may lose the trust of another component in the construction of green buildings. In some situations, the project had to have a quick revenue strategy that covered the expenses and obtained the benefits without waiting for the exploitation phase that could occur when the developer was interested only in short-term investments that may require a certain amount of money, time and can cause a significant damage (H. Y. E. Chan, Tung, & O'Kane, 2002).

A well-known cost control challenge for conventional construction projects is the lack of effective communication between different technical experts who use their own tools, protocols and industry standards to make decisions and track information (Sappe 2007). Architects, engineers and builders are generally highly specialized and provide services in technical isolation. This "silo effect" makes it difficult to manage change, mitigate risks and control costs, with a global vision of the project. It also prevents the project from using system optimization, which saves time and money. These communication problems can be compounded by unique considerations in green technology and project accreditation (Reed & Gordon, 2000).

Communication is improved when all trades work together, unlike the "silo" effect, where subcontractors only care about their own scope and little or no cooperation or coordination necessary with other trades. This lack of cooperation is a typical problem of traditional construction, as jobs are usually "difficult" tender numbers. That's why most subcontractors try to get in and out as quickly as possible.

To address technology and communication gaps in a green building project, the USGBC has launched an accreditation program to train and certify LEED professionals in energy and environmental design. LEED is a third-party certification program run by the USGBC to set standards and measure the sustainability of building construction and operation. LEED focuses on performance in five key areas, including sustainable site development, water conservation, energy efficiency, choice of materials, and indoor climate quality. LEED accredited professionals, called "LEED APs", must demonstrate a working knowledge of sustainable construction practices and LEED certification requirements. LEED-AP with experience with LEED, can manage sustainable construction projects more efficiently and cheaply. L. Griffin, "Articulating Commercial and Ethical Arguments for Sustainable Construction", M.S. unpublished. Diploma Thesis (kibert, 2005).

A LEED project involves more intensive pre-planning so that all parties succeed. It would be useful in all projects, but it is not the reality. Moreover, it is profitable in this particular context. This in-depth review may have been the original intent of the LEED program, but

it has had that impact. LEED is not just about improving communication, because detailed planning is essential.

2.3 Delay Factor Related to Green Building Awareness

The awareness about green buildings is attached to green building performance and other environmental issue need to be more common by public, owners, and politicians, to know the designer and encourage this sector (Wong, 2010). The knowledge about the environmental impacts and hazards of building is not enough, the government and public indifference could be an obstacle to the engineers and do not make it run as smooth as it is supposed to be. A study by Bilec, Ries, & Matthews, 2007 ,and educate the public and decision-makers about the initial expenses and the benefits will be collected out of those buildings which make another technical problem to executing and manufacturing of material (Meryman & Silman, 2004).

2.4 Delay Factor Related to Green Building Technology

As a result, the green building project needs more time than the traditional project (GreenBiz, 2005). Due to the additional need that could not be included in other projects, for example, the team member must be familiar with the special requirements for green building implementing this practice. In addition, during the planning phase, the preparation of design documents takes longer than that of the conventional document to cover the green section. And everything should be planned before construction. The time required by architects and engineering designers to apply ecological practice to the project increase the cost of design and time (G. Kats, 2003).

Technology is one of the factors that must be a concern. In green buildings, the appearance of the building is essential to adapt to the green and sound architecture that requires a certain set of materials and technologies. For example, the implementation of the solar system takes longer to integrate without damaging the facade or the necessary with this new technology, which takes more time during the design and implementation phase of the project. The degradation of this equipment is more difficult in green buildings and requires more time because of the attention required for the aesthetic appearance that might be more difficult to install than conventional buildings (Sartori & Hestnes, 2007a).

Green building requires more experience in different types of materials and equipment. Uncertainty related to green technology reduces construction performance (Shi et al., 2013a). The misunderstanding in green technologies and still in its infancy, which means that more consideration needs to be given to the specification of materials and application instructions, could be the main obstacle to the timing of green buildings as a study carried out in Europe and China (Shareef M. S. Hasan & Zhang, 2016).

2.5 Delay Factor Related to Green Building Profitability:

It is important to explain the difference between cost and profitability. The costs associated with construction projects are related to the effectiveness with which the project team produces the result. On the other hand, the profitability of the investment indicates to what extent the business case for the project has been prepared and the extent to which the cost/benefit of the asset to be provided has been assessed prior to the construction of the asset in question provide.

While green buildings focus on positive environmental impact, research shows that a developer's decision to become greener continues to rely on its financial viability. A 2006 survey by McGraw-Hill Construction of more than 400,000 architects, engineers and contractors found that 54% of respondents identified the potential for reducing energy costs as the primary reason for green building.

According to the same study by McGraw-Hill Construction, only 24% of respondents said that the value of green building for the environment was the driving force behind their commitment to the sector. When asked about barriers to green building, respondents chose higher upfront costs as their main barrier. Davis Langdon's 2004 study found that sustainable projects and conventional projects cost very different costs.

In this study, only 24% of respondents said that the value of sustainable building was the driving force behind their commitment to the sector. When asked about barriers to green building, respondents chose higher upfront costs as their main barrier. Davis Langdon's 2004 study showed that sustainable projects and conventional projects have very different costs.

2.6 The Application of Social Network Analysis in Green Building

The analysis of social networks, which has its origins in the 1840s as an important branch of sociology, was used in 1954 to study the social structure of a small fishing village in Norway and in 1957 to study the social network British. The purpose of social network analysis is to show the influence of the network structure on the group and the individual function, starting with the interaction of structure and function. The specific practice is to examine the relationship between actors in the social network and to determine their properties in order to discover the influence of relationships with the organization.

The two most important components of social network analysis are actors and relationships. Therefore, social network analysis can help us understand the cooperative relationships between organizations in different areas. There are few studies on the development and application of GRBs to analyze social networks. Some studies focus on stakeholder analysis of the risk network in the green building process. From a technology perspective and in combination with BIM and social media analysis, life cycle energy analysis of buildings will help create an effective energy saving plan for residential buildings. In addition to analyzing the risks associated with the development of construction projects, the SNA can also analyze the factors that influence the development of projects, taking into account the interdependence of stakeholders.

In addition, studies on the factors that influence GRBD have been shown to be rather fragmented and not systematic or unifying. Although some studies involve stakeholders in GRBD, the full development cycle is not taken into account. In addition, it has been proven that the social network analysis method can analyze the factors influencing the entire life cycle of construction projects. However, the existing application of GRB's social networks focuses primarily on risk analysis. In this article, which is based on the entire life cycle of the GRBD process, the SNA is used to examine the relationships between the factors underlying bodily risk factors and to identify the critical factors that affect sustainable building. We are developing the application of social network analysis in the Green Building study.(B.-G. Hwang & Tan, 2012)

CHAPTER 3
METHODOLOGY

In order to determine the delay factors in the green building construction which is the aim of the study, a questionnaire survey was conducted amongst stakeholders (engineers, architects, quantity surveyors, managers, workers etc.) in two places Northern Cyprus and Dubai in the United Arab Emirates. The detail procedure for conducting the study is explained in the following subsections.

3.1 Study Area

North Cyprus and Dubai were selected for conducting the study, this is because the two cities differ widely in terms of green building construction with Dubai been more developed and practiced ecological construction more than the North Cyprus. The North Nicosia is located at approximately 35° N and 33° E, in the east end of the Mediterranean Sea, and is ~224 km WSW to ENE, and ~97 km NNW–SSE with a land area of approximately 9250 km2 (Figure 3.1). The island has two mountain ranges—the Troodos Massif (maximum elevation 1951 m) in the southwest and the Kyrenia range (maximum height 1000m) along the northern coast, which give Cyprus high topographical variability. The climate of North Cyprus is typical Mediterranean with hot dry summers where the average temperature can reach up to 40◦ C. In cool winter months the lowest temperature tends to be around 10◦ C.

Figure 3.1: Map of Northern Cyprus

Dubai is located at approximately 25° N, 55° E, on the Persian Gulf, in the northeast of the United Arab Emirates. Dubai is the second largest emirate with an urban area of 3885 sq km (Figure 3.2). The weather in Dubai is warm and sunny. In the winter it has an average daytime temperature of 25°C, nearer the coast 12-15°C, in the desert or mountains 5°C. With the nights being relatively cool. Near coastal areas humidity can average between 50% and 60%. In the summer, the weather in Dubai is very hot and humid, with temperatures reaching mid 40's. Even the sea temperature can reach 37°C, with humidity averaging over 90%. Dubai population stands at an estimation of 1.5 million, with three quarters of the population being male. The city of Dubai is made up of a multicultural society; with only 5% of local Emiratis, the rest are expatriates from all over the world.

Figure 3.2: Map of Dubai

3.2 Questionnaire

For assessing the delay factors in the two case studies, a questionnaire was prepared to collect the relevant information about the delay factors in green building construction. The questionnaire has 20 questions grouped into three sections the questionnaire are in appendix (A1). The first part of the questionnaire contains the demographic characteristics of the correspondents (gender, profession, professional experience). The second part of the

questionnaire contains information about the construction problems.. The last part which is the most important one contains the delay factors which the participants have to rank to extent he\she agree that this factor could cause a delay. 15 factors believed to cause delay in green building construction from the planning phase to the project maintenance have been assessed in this study. These factors have previously been studied by other studies in other parts of the world and are summarized in Table 3.1.

Table 3.1: Delay factors and references:

S/N	Delay Factor	Reference
1	Stakeholder's attitude	(Lam, Chan, Chau, Poon, & Chun, 2009)
2	Authorities interference	(Shi, Zuo, Huang, Huang, & Pullen, 2013b)
3	Low number of specialized contractors	(Gluch & Baumann, 2004)
4	Finding expert engineer in green building to design	(Robichaud & Anantatmula, 2011)
5	Poor scheduling	(Qin, Mo, & Jing, 2016)
6	Difficulty in the selection of subcontractors who provide green construction services	(B. G. Hwang & Leong, 2013a)
7	contractors providing the material	(B.-G. Hwang & Tan, 2012b)
8	Finding the required level of experienced labour	(B. G. Hwang & Leong, 2013a)
9	The increased number of meetings and coordination required with green consultants and engineers.	(B. G. Hwang & Leong, 2013a)
10	Worker allergy to some construction material	(Rajendran, Gambatese, & Behm, 2009)
11	The rating tools is an obstacle to timetable	(Zhao, Hwang, & Gao, 2016)
12	The more frequent alterations and variations with the design during the construction process	(B. G. Hwang & Leong, 2013a)
13	Unexpected budget	(B. G. Hwang & Leong, 2013a)
14	Availability of required equipment of material	(Ho, Dickinson, & Chan, 2010)

(For more information check the questionnaire in the appendix B).

Although, the questionnaire had been applied for ethical approval, with enclose all relevant materials including interview questions , participant information sheets and participant consent forms where applicable. the approval granted by relevant ethics committee of the Board of Near East University (check appendix C)

3.3 Data Analysis

The data collected was analyzed by SPSS (the statistical software package for the social sciences), a software developed by IBM. It is widely used to analyze data and build forecasts based on specific collections in the dataset. The first test performed by the software is reliable. The reliability of the questionnaire was determined by the manipulation of Cronbach Alpha. It is used to measure internal consistency and is considered a reliability factor. Then, looking for the frequency of each factor, prioritize them for the companies and compare the data. Data cooperation between Dubai and the northern part of Cyprus will be in two categories: technical factors, coordination factors.

CHAPTER 4
RESULTS AND DISCUSSION

The result of the questionnaire survey for the two case study areas is presented in the sub sections below according to the study area:

4.1 Reliability of the Results

The reliability of the questionnaire was determined through the manipulation of Cronbach Alpha. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. A "high" value for alpha does not imply that the measure is unidimensional. If, in addition to measuring internal consistency, you wish to provide evidence that the scale in question is unidimensional, additional analyses can be performed. Exploratory factor analysis is one method of checking dimensionality. Technically speaking, Cronbach's alpha is not a statistical test – it is a coefficient of reliability (or consistency). The alpha coefficient for the 54 items is 0.639, which depicts that the reliability of the questionnaire is highly valid and reliable (Finkelhor, Hamby, Ormrod, & Turner, 2005).

4.2 Northern Cyprus

4.2.1 Demographic Characteristics:

Kyrenia, Nicosia, and Famagusta were selected for conducting the research in Northern Cyprus, due to their importance in the country, according to the latest census which was performed in 2011, one third of the population of the North Cyprus lives in Nicosia (Statistics and Research Department Nicosia, 2017) and construction developments are on the increase in these cities to carter for the house demand as more foreigners come to the country for educational and tourism purposes. Since the number of males in the construction industry outperformed that of the females, majority of the respondents are male (85.2%). The participants experience in green building construction is really low both for managerial and technical cadre of the construction industry. This is because Cyprus is a developing country and economic factor has been described by Meryman et al., (2004) as the most important barrier to green construction.

Lack of recognition of the Northern Cyprus by the international world apart from Turkey is crippling the economy of the country and has made it difficult for foreign investors in the field of green building technology to invest in the country in order provide materials and services required for the green building construction. This coupled with other factors is among the reason why the stakeholders in the construction industry have limited experience when it comes to green building in Northern Cyprus. This problem (lack of recognition) has enacted it from performing of Energy Performance of Buildings Directive (EPBD) practice in the area which leads to lack of financial aid or any national support related, moreover the government have lacked in regulation, certification, and codes.

A total of 54 relevant people in the construction industry from three major cities in the Northern Cyprus participated in the survey study conducted. 12 participants from Kyrenia , 20 from Nicosia and 22 from Famagusta. The participants were mostly men covering 85.2% (46) while females covered the remaining 14.8% (8) . Since the study was aimed at determining factors from planning phase to the completion and maintenance stage, participants with different role in construction industry participated in the study, majority of participants work as a project director or at a high management (31.5%) where as, project manager and academics accounts for 14.8% contractors, project personnel, project engineer, and 13% are architects (16.7%). The participants experience in green building construction was found to be very low as 92.6% of the participants have 0-years of experience in green building construction, and only 5.7% have participated in at least 1 green building construction. The summary of the demographic characteristics participated in survey result is presented in Table 4.1.

Table 4.1: Demographic Properties of the respondents

Profile of Respondents'	Variables	Frequency	Percentage
Gender	Male	46	85.2
	Female	8	14.8
Experience in green building construction (years)	0	50	92.6
	1	1	1.9
	2	1	1.9
	5	2	3.7
Cities	Kyrenia	12	22.2
	Nicosia	20	37.0
	Famagusta	22	40.8
Occupation	Agent	18	33.3
	Architect	1	1.9
	Civil Engineer	9	16.7
	Designer	11	20.4
	Director	2	3.8
	Manager	2	3.8
	Owner	1	1.9
	Project coordinator	2	3.8
Participation in green building construction (Number)	0	48	88.9
	2	1	1.9
	3	1	1.9
	5	1	1.9
	Invalid	3	5.6

The sample had been distributed in Northern Cyprus. The covered area is the major cities starting by Kyrenia where 12 participants contributed which present 22.2% of the sample than in Nicosia the contribution where 20 questionnaires which are about 37%. Due to the big number of companies in Famagusta because it's developing and it's expanding the major contribution where from there which was 22 participants and them percent 40.7% of the sample.

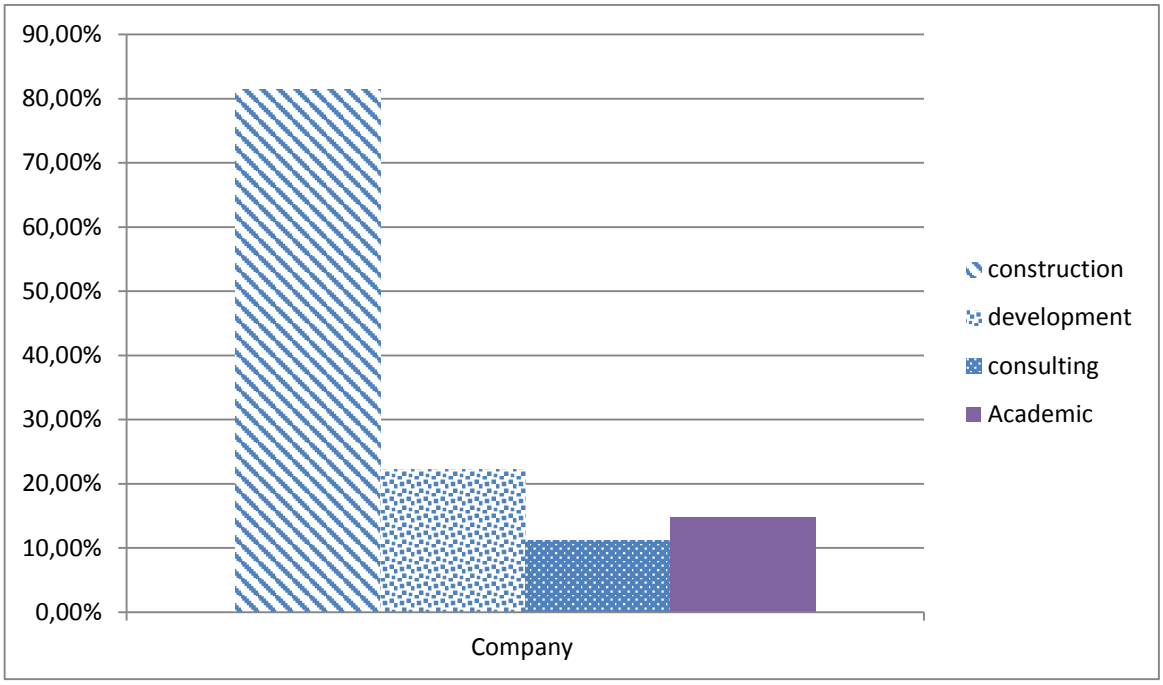

Figure 4.1: The Participants Companies Characteristic

Participants' experiences or their field of work is an important factor to be considered in data analysis. The majority of participants work as a project director or at a higher management level by 31.5% (17 participants) in the second place were Project manager construction manager and academics 14.8% (8 participants), the number of contractors and Project personnel project engineer construction engineer were the same 7 participants and 13% each. The percent of participants who work as Architectures is 16.7% (9 participants) when the worker in the field had been considered because of their experience on the ground and they present 7.4% (4 participants). The numbers add up to more than 100% because some participants had experience in more than one field. Due to the more speared of the newly constructed project compared to the Additional project. The owners prefer to demolish and reconstruct the building than adding to the exacting one because sometimes the addition could cost as much as new building and the design will have to be based on the existing building. So the experiences found to be almost all the participant worked in newly constructed project and only 5 participants had experience in the addition which presents less than 10 %.

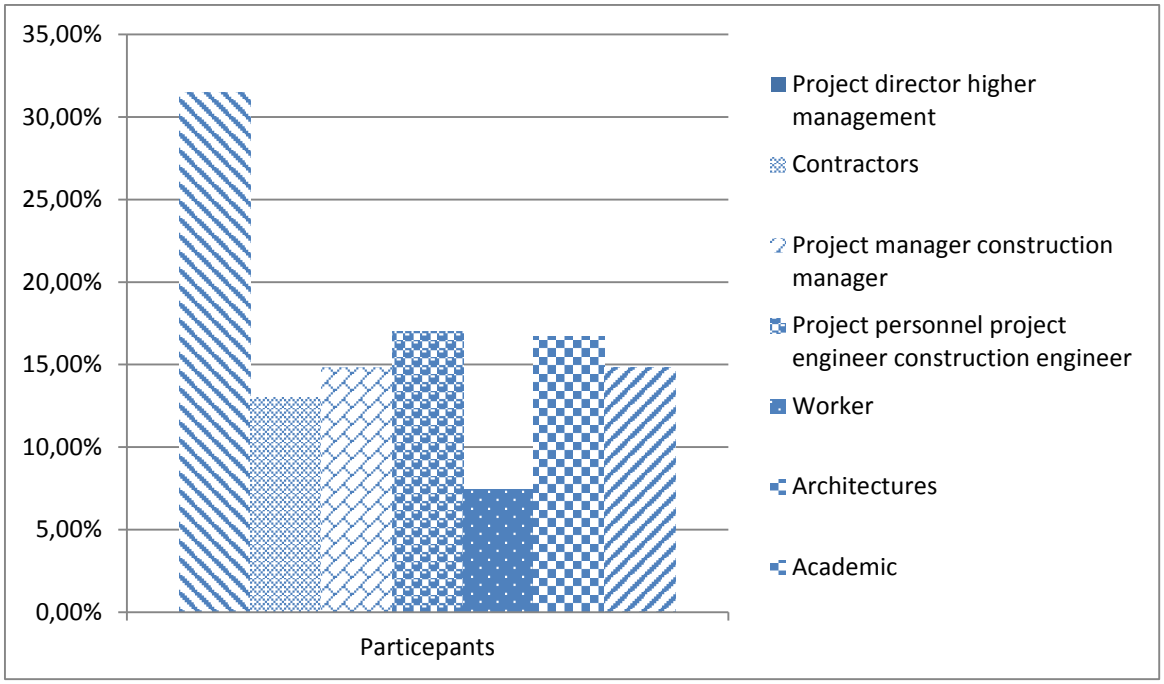

Figure 4.2: The Participants Current Job

4.2.2 Delay Factors in Northern Cyprus

The result of the 15 delay factors evaluated in the study in Northern Cyprus was presented in Table 4.2. The factors were ranked based on the factor's mean value which was obtained by averaging the level to which the correspondents agree to the factors relevance in delaying green building construction. Unexpected budget was found to be the most important factor responsible for delay in green building construction with a mean value of 4.11, followed by low number of specialized contractors to handle green building construction (mean value = 4.07), then difficulty in finding subcontractors to provide the needed services for green building construction (mean value= 4.00). Delay factors in conventional building apply in green construction, worker allergy to some material, rating tools were considered less relevant factors.

Table 4.2: The Participants Responses in Northern Cyprus:

	Reason for delay	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Rank
1	*Stakeholder's attitude*	14	21	13	6	0	3.80	10
		25.9%	38.9%	24.1%	11.1%	0%		
2	*Authorities interference*	11	26	12	6	0	3.79	11
		20.4%	48.1%	22.2%	9.3%	0%		
3	*Low number of specialized contractors*	19	25	6	3	1	4.07	2
		35.2%	46.3%	11.1%	5.6%	1.9%		
4	*finding an expert engineer in green building construction*	20	16	6	12	0	3.82	9
		37%	29.6%	11.1%	22.2%	0%		
5	*Poor scheduling*	18	24	6	6	0	4.00	5
		33.3%	44.4%	11.1%	11.1%	0%		
6	*Difficulty in the selection of subcontractors who provide green construction services*	17	23	11	3	0	4.00	3
		31.5%	42.6%	20.4%	5.6%	0%		
7	*The contractor providing the material is a reason for delay.*	13	27	11	3	0	3.91	7
		24.1%	50%	20.4%	5.6%	0%		
8	*Finding the required level of experienced labor is a reason for delay.*	18	18	10	8	0	3.85	8
		33.3%	33.3%	18.5%	14.8%	0%		
9	*The increased number of meetings and coordination required with green consultants and engineers.*	10	20	15	8	1	3.56	12
		18.5%	37%	27.8%	14.8%	1.9%		
10	*Worker allergy to some material*	1	10	17	17	9	2.57	14
		1.9%	18.5%	31.5%	31.5%	16.7%		
11	*The rating tools is an obstacle to timetable*	3	14	20	15	2	3.02	13
		5.6%	25.9%	3%	27.8%	3.7%		
12	*The more frequent alterations and variations with the design during the construction process*	13	29	7	4	1	3.91	7
		24.1%	53.7%	13%	7.4%	1.9%		
13	*Unexpected budget*	20	26	2	6	0	4.11	1
		37%	48.1%	3.7%	11.1%	0%		
14	*Availability of required equipment of material*	15	26	11	2	0	4.00	4
		27.8%	48.1%	20.4%	3.7%	0%		
15	*The delay factors in conventional building apply in green construction*	16	18	9	8	3	3.67	15
		29.6%	33.3%	16.7%	14.8%	5.6%		

The response from the survey in Northern Cyprus was further studied according to cities and the result in presented in Table 4.3. The results showed that the most concerned factor

in Kyrenia and Nicosia was fewer numbers of specialized contractors while poor scheduling due to lack of experience is the most concern factor in Famagusta.

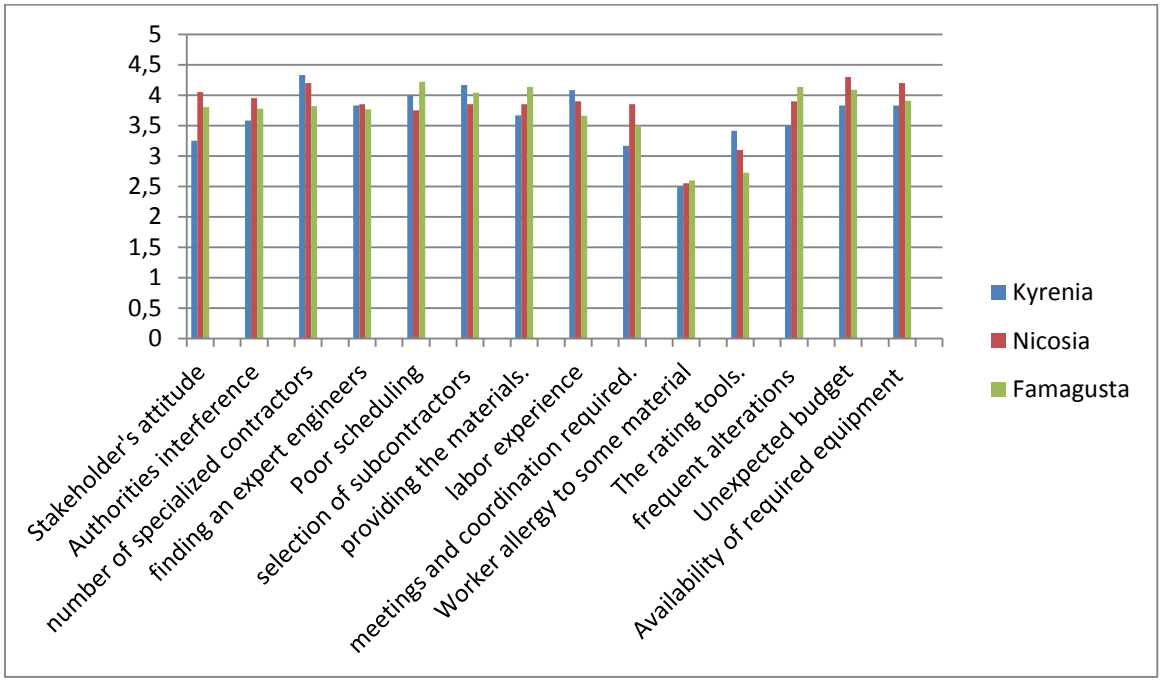

Figure 4.3: Results of the most effective factor based on the area in northern Cyprus.

Results in Dubai

The Reliability of the Questionnaires was determined through the manipulation of Cronbach Alpha. It is used to measure the internal consistency and is considered to be a coefficient of reliability. The alpha coefficient for the 110 items is 0. 802; which depicts that the reliability of the questionnaire is highly valid and reliable.

4.3 Survey Results

A total of 110 engineers in Dubai have been interviewed through questionnaire survey. All the respondents have at least experience of five years in construction industry and 0-5 years of experience in green building construction. It was observed that the percentage of respondents with experience in green building construction in Dubai is much higher than those in the first case study (Northern Cyprus). The summary of the survey result was presented in Table 4.3. Unlike in Northern Cyprus, the most relevant factors in Dubai are

contractors providing the materials for the green building construction, poor scheduling, unexpected budget ranked as 1st, 2nd and 3rd, respectively. The factors that were found to have less effect on delay are delay factors in conventional building apply in green construction, worker allergy to some material, authorities' interference ranked 15th, 14th, and 13th.

Delay factors in green buildings in Northern Cyprus and Dubai were asked the participant to be evaluated. Referees are listed in appendix (Table 6. 1)

Table 4.3: The Participants Responses in Dubai:

	Reason for delay	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Rank
1	*Stakeholder's attitude*	15	41	25	17	2	3.36	10
		13.6	37.3	22.7%	24.5%	1.8%		
2	*Authorities interference*	8	31	32	35	4	3.04	13
		7.3%	28.2%	29.1%	31.8%	3.6%		
3	*Low number of specialized contractors*	8	44	33	25	0	3.32	12
		7.3%	40%	30%	22.7%	0%		
4	*finding an expert engineer in green building construction*	12	48	38	10	2	3.53	7
		10.9%	43.6%	34.5%	9.1%	1.8%		
5	*Poor scheduling*	19	56	24	10	1	3.75	2
		17.3%	50.9%	21.8%	9.1%	0.9%		
6	*Difficulty in the selection of subcontractors who provide green construction services*	10	52	33	14	1	3.51	8
		9.1%	47.3%	30%	12.7%	0.9%		
7	*The contractor providing the material.*	15	70	15	9	1	3.81	1
		13.6%	63.9%	13.6%	8.2%	0.9%		
8	*Finding the required level of experienced labor*	8	63	31	8	0	3.65	6
		7.3%	57.3%	28.2%	7.3%	0%		
9	*The increased number of meetings and coordination required with green consultants and engineers.*	13	62	26	8	1	3.71	4
		11.8%	56.4%	23.6%	7.3%	0.9%		
10	*Worker allergy to some material*	4	26	29	43	8	2.77	14
		3.6%	23.6%	26.4%	39.1%	7.3		
11	*The rating tools is an obstacle to timetable*	6	52	30	16	6	3.33	11
		5.5%	47.3%	27.3%	14.5%	5.5%		
12	*The more frequent alterations and variations with the design during the construction process*	14	60	25	11	0	3.7	5
		12.7%	54.5%	22.7%	10%	0%		
13	*Unexpected budget*	12	68	18	11	1	3.72	3
		10.9%	61.8%	16.4%	10%	0.9%		
14	*Availability of required equipment of material*	7	55	28	20	0	3.45	9
		6.4%	50%	25.5%	18.2%	0%		
15	*The delay factors in conventional building apply in green construction*	22	57	17	10	3	3.78	15
		20%	52.3%	15.6%	9.2%	2.8%		

4.4 Green building construction delay factors in Northern Cyprus

Among the fifteen factors surveyed which are believed to cause delay in green building construction, Unexpected budget was found to be the most important factor causing delay in Northern Cyprus. This is because stability of country's financial and economic situation is a major factor in the success of any investment or project, and during the last 12 months the Turkish Lira has been falling. This fluctuation makes the overall project cost to increase since most of the construction material are imported with a different currency mostly dollar and euro. The change in the overall budget will surely delay the project since client's approval especially with regards to budgets usually takes time even in the traditional construction. The second most relevant factor identified to be affecting the green buildings is the low number of specialized contractors (green buildings), the effect of this factor in delaying the project is very clear since when only limited professionals provide a certain service, all their clients should que up and serve according to "first to come, first to serve", and if the contractors (specialist) have many project at hand, the project should wait until they have time to provide that service especially with limited resources. Thirdly difficulty in selecting subcontractors to provide the green building services is also a factor delaying the project, this is because there are no certified contractors to provide the services for the green building construction in the Northern Cyprus and the criteria to be used by the client will difficult and since all clients will try to obtain the best services in order to avoid losses and to also get a quality service. These factors were found to be somehow different with study conducted by (B. G. Hwang & Leong, 2013b) in Singapore where speed of decision making by client, speed of decision making involving all project teams, communication/coordination between key parties, level of experience of consultants and difficulties in financing project by contractors were found to be the most importance factors responsible for delay in green building construction in order of their importance. This variation was due to the participants experience and involvement in green building construction as well as the economic status of the country. In this study only 11.2% of the respondents participated in green building construction while in Singapore all respondents have at least participated in one green building construction that delay was experienced. It can be observed that, the factors identified as the most responsible factors for delay in green building construction in North Cyprus may also a direct relation with increasing the project cost.

In this study, the least relevant factors causing delay in green building construction were influence of delay factors in conventional building are applied in green construction, worker allergy to some material, problem with rating tools and ranked 15, 14, 13, respectively. Some factors like coordination between key parties, speed of decision making involving all project team, speed of decision making by clients which were the most important factors responsible for delay in conventional buildings were equally the most responsible factors for delay in green construction (B. G. Hwang & Leong, 2013b) which goes contrary to the findings of this research where the respondents voted factors delaying conventional construction have no effect delaying green buildings.

The survey requested the respondents to mention other possible factors that they believe may cause delay in green building construction which were not stated in the questionnaire. The factors that most of the respondents provide include quality of green building materials; availability of the materials for the construction; economic stability of the country. Since the idea of green building is new in Northern Cyprus and only few specialists are available, there are tendencies that sometimes the required standard could only be achieved after couples of errors which rectifying those errors will temper with the time overall time frame of the project hence causes delay. Another challenge is importing the materials and manpower (specialist) needed for the green buildings construction, since these raw materials which are necessary for green building construction are not locally made and needs to be imported from neighboring countries, delays may happens in the process and when poor materials are used, the project must stop in order to import quality materials that satisfy the required specification. Another reason why import poses a threat in delaying the project is whenever there is alterations in the design due to some unforeseen problem in a way that more materials are required, non-availability of the materials locally may cause unnecessary delay especially if it involve a critical activity hence increasing the overall duration of the project.

Often these materials and systems are not available locally and must be imported from the surrounding countries like Europe with different climatic condition that is usually cold, unlike Northern Cyprus which is usually sunny. The materials or systems that fit for those countries may not necessarily fit for Northern Cyprus and may require some basic adjustment needs to be added to these materials and systems to correspond with the host

country. Making those changes takes time and coordination which may lead to a delay in the time specified for this task.one way to figure out a solution for this problem is to import from a country that has climate correspond with Northern Cyprus climate and if that country was found it also takes time to coordinate the procedures for imports.

Lack of experience is essential factor identified by the respondents as a factor that may delay green building construction in North Cyprus. Whenever a problem is encountered with regards to design, it will take more than required time to review the design. The municipality should promote the green building construction among professional working in the construction industries through awareness, advertisement, as well as encouraging and motivating companies that are into green buildings. This will surely increase number of green building construction, hence more people will be involved in green buildings and increasing their experience and expertise in green building construction.

According to some academics interviewed in the study, only few studies were conducted in the field of green buildings so that different kind of materials used in green building had not been analyzed which makes it difficult for the engineers and architects to choose which material best suits particular country or a particular project and lack of this knowledge may results in using poor material which must be replaced hence causing a delay that will affect the project duration.

There are some other factors that affected the project time table that has been mentioned by participants

One of the mentioned factors is the quality of the green material. Even the contractor providing the materials in time they may not be as the international codes, which force them to refund the material and get a new one which may consume times.

Green buildings need more advertisement Although the importance of green buildings, the knowledge and awareness seemed to be scarce and there is a lack of advertising among the people. There has to be an increase in such awareness and knowledge on this matter. This can be done by giving more space in the advertisement section on social media and public platforms among professional working in these contexts.

Another arousing challenge is importing the materials and systems needed for the construction of green buildings because these raw materials are not locally made which makes the import of these materials and systems a necessary thing for constructing green buildings. The import of these materials and systems is not an easy process because of the customs difficult procedures due to their lack of knowledge about the use of these materials and systems. so it leads to longer time and most probably delay to the project expected time.

The municipality does not have experience. One more obstacle is the lack of experience in green buildings because whenever they face a green building design it takes them a lot of time to review the designs and study it then approving it. Sometimes they ask for adjustments that go hand in hand with the surrounding environment and the city even do not have a plan for such kind of projects unlike Dubai which offers a great environment for the success of these kinds of projects.

According to some academics who had been interviewed in the study little number of studies discussed of green buildings materials so the different kind of materials used in green building had not been analyzed and studied which makes it difficult for the engineers and architecture engineers to choose which one best suited for which. This continues hesitation leads to a delay in the project time table.

Northern Cyprus as unrecognized country by most the world has not been involved in the field of global construction because of its occupied place as an island standard one unrecognized by the world and due to the political issue of the area, its enacted from performing of Energy Performance of Buildings Directive (EPBD) practice in the area which leads to lack of financial aid or any national support related, moreover the government have lacked in regulation, certification, and codes.

4.5 Green building construction delay factors in Dubai

The survey result of the fifteen delay factors evaluated in Dubai is in range between 1 the lowest and 5 as the most effective factor the result where there are more green buildings in comparison with the North Cyprus indicates that, delays related to constructors supplying materials for green in building construction has the highest mean (3.81) among all the

delay factors evaluated. This is due to the high acceptance of green buildings in the country and these contractors are limited compared to the demand for their services and therefore sometimes the due to increasing need in the materials for the green building construction, they run out of materials and have to wait for couple of days before receiving order especially when the materials required are imported from foreign land. This factor is very critical and can also be managed if the stakeholders made necessary arrangements in good time, so that the site will never run out of all necessary material especially material required from specialized contractors.

The second most important factors resulting to delay in the country poor scheduling with a mean value of 3.75. Poor scheduling has been a major factor for delay even in traditional buildings. This is because when the project is not properly schedule, some critical activities will be delayed hence increasing the overall critical time and overall project duration. A proper schedule can help in conducting multiple activities that are not dependent on each other, hence maximizing time efficiently. Poor scheduling will affect green buildings more since some activities require a specialist and since these specialists are limited in number and many projects to serve, poor scheduling of an activity requiring specialist or special material may cause a serious delay in the project since the project managements have little control over this factor. Green buildings to some extent unlike other kinds of buildings require alterations and variations that are integrated with the design during the construction process which is considered as a vital issue that delay the time table. This issue is considered to be the main one that is highly affecting the time table. One of the many reasons for these alterations and changes as the project progresses is the inconsistency of the drawings provided by the architect and the final design that formulated the green buildings features. The design should always be in accordance with codes and specifications of green buildings and should be accurate. Adequate time is required for proper supervision from both the authorities and the rating tools which provides the building approval in order to avoid redoing some parts of the project which takes time. This will always help minimize delays.

Third most important delay factor in Dubai is the unexpected budget, this as a result of the many alterations in the drawings in such a way some details of design and specifications were not properly captured in the documents. Since its believed that delays increases the

project budgets, delays caused by first and the second factor will inflate the project cost, and needing approval from clients with regards to budget usually takes time as mentioned by (B. G. Hwang & Leong, 2013b).

In Dubai increased number of meetings with green building consultants was ranked fourth among the delay factors in Dubai, this is because only the consultant should authorize any change/alteration in the project since they have professional technical know-how of the green construction. It is a tradition that, the moment project is awarded an inception meeting is held among the stakeholders involved in the project including the green building consultants in order to plan for a successful and duly completion of the project to discuss on number and frequency of meetings (bimonthly, monthly, quarterly etc.), channels of communication and to also make the goal and what they want achieve in the project so that everyone is carried along. The project manager and the project owner himself to provide a clear idea about the project goals for all the participants in the project. These start-up meetings will set the foundation stone for integrating a solid and relaxing environment. Therefore, the project manager must take action and start leading his team and building up a roadmap that organizes and connects all the parts of the project together. There are some simple touches that may ease teamwork and document sharing and give it professionalism as if the project manager purchased a management software that is designed for this purpose. Despite the multiple benefits that these coordination meetings take time and it may delay the time table of the project. As a response to this arousing issue, there has to be more coordination in an intensive way by the project manager with the stakeholders in order to guarantee a successful outcome for the project.

Another threatening matter is that many workers had solid mentality regarding their traditional practices and they have a shortage of knowledge regarding green technologies. These workers need to be trained on these technologies and techniques which also takes the time that may delay the time table even more. Although the availability of the equipment and resources for green projects in Dubai, there is a need for the training of the engineers and subcontractors to be able to deliver this kind of buildings which takes a lot of effort because they are working on a fixed schedule and the intervention of many factors like minimizing disturbance and enhancing the function of local, regional and global

ecosystem both during and after its construction and identified service life which may delay the project delivery date from the perspectives of the engineers and subcontractors.

Stakeholders most concern is the degradation of aesthetic appearance which the adoption of green construction technologies is the reason for it. Aesthetic issues affect the construction-related embodied energy, although the energy efficiency that the solar house has, stakeholders sometimes prefer the conventional buildings that have less energy efficiency and more attractive appearance (Sartori & Hestnes, 2007b).

4.6 Comparison of the delay factors in Dubai and North Cyprus

The factors causing delay in green construction have been categorized into technical factors, coordination/administration factors and discussed in the following sub-sections for the two different case studies.

4.6.1 Technical Factors

The technical factors believe to be responsible for causing delays in the study are a) few numbers of specialized contractors, b) few numbers of experts engineer in green building to design c) poor scheduling (lack of experience), d) fewer number of contractors providing the material e) finding the required level of experienced labor. Comparing the relevance of the delay factors between the two case studies shows that there is a wide difference in the response between North Cyprus and Dubai as shown in Table 5.1 which was due to so many reasons such as economic status, technological advancement, widespread of these kind of buildings, developed software for communication purposes among the teamwork, easy procedures and the familiarity of these technologies which makes it easy to import and implement, example fewer number of specialized contractors for providing the services required in green building was ranked 2nd in North Cyprus but 12th in Dubai due to the wide difference in awareness and acceptance of the technology between the two countries. Likewise, availability of equipment required for green building construction was ranked 9th in Dubai and 4th in North Cyprus. Unexpected increase in budget was found to be relevant in both countries which is expected since its also a major factor causing delay in conventional buildings. Increase in overall projects requires approval by clients, other parties involved and this process was believed to be delaying projects as shown in other studies example (B. G. Hwang & Leong, 2013b). The technical

factors are the most relevant factors causing delay in both countries with 1st -3rd in Dubai and 1st, 2nd, 4th and 5th factors in North Cyprus falls within the technical factors.

Table 4.4: Comparison of Technical and Coordination Factors between Dubai and North Cyprus

Categories	Factors	Rank	
		Dubai	North Cyprus
Technical	Few numbers of specialized contractors	12	2
	Few numbers of experts engineer in green building to design	7	9
	Poor scheduling (lack of experience)	2	5
	Fewer contractors supplying the materials	1	6
	Required level of experienced labor	6	8
	The unexpected budget	3	1
	Unavailability of required equipment for material	9	4
Coordination/Administrative	Stakeholder's attitude toward green buildings	10	10
	Authority’s interference	13	11
	Difficulty in the selection of subcontractors who provide green construction services	8	3
	Increased number of meetings and coordination required with green consultants and engineers.	4	12
	Assessment procedures	11	13
	Frequent alterations and variations with the design during the construction process	5	7

For more information check the questionnaire in the appendix A.

4.6.2 Coordination/Administrative Factors

The coordination-related delay factors in the study were found to be a) the stakeholders attitudes towards green buildings, b) the several meetings arranged between the team members, c) the widespread of green buildings projects which deviate their attention to the specific details of coordination, d) the increase of the needy stakeholders who ask for uncommon designs that provides more aesthetic appearances for the green buildings and e) more frequent alterations and variations with the design during construction process. The ranks for each factor have been shown in Table 5.1. The coordination-related delay factors were found to be more problematic in Dubai compared to Northern Cyprus. This is because so many construction projects are undergoing in Dubai and since the contractors provide special services, factors such as arranging meeting with all stakeholders can be problematic due to heavy engagements. Clients interference may be more prevalent there, because of the competitions taking place in terms of aesthetic factors, a client may require the design to be renewed when what they aimed for has been attained by other clients.

4.7 Ways of Minimizing Delays in Green Building Construction

From the responses obtained in the survey, it can be seen that the delay problems can be addressed and minimized at the initial stage of the projects that is pre-project planning which consist of proper management schedule and planning; risk assessments and provision of communication between the stakeholders.

The pre-project processes in the green building construction should be given the appropriate time in order to capture all details in the project such as the selection of subcontractors, source of materials and experienced labor, disputes settlements strategies, alterations in the budges etc. this will surely help in guaranteeing the project completion on time. The project managers should be precise at schedule and planning management by implementing the analytical skills by all the project managers and analyze the whole situation at the inception of the project in order to come up with an integrated plan that will includes all the participating parties in solving the delay problem before it occurs. Another main aspect handling the delay in the green building construction is the risk management because it plays a vital role in choosing the subcontractors who play an important role in providing a quality and promising services (technologies and techniques) that are needed for green buildings constructions. Therefore, project managers must be fully aware of this

aspect and the importance of selecting the right subcontractors to deliver with professionalism. The project managers should possess the knowledge and the required skills for choosing the right participants in the project to guarantee a fixed time table and delivery on time.

In any project some unexpected events may arouse that go off the planned schedule and need to be dealt with professionalism in order not to affect the progress of the project, Therefore the project managers need to be equipped with the knowledge of problem-solving techniques in order to avoid any additional delay. Therefore, the project team should be equipped themselves with skills in dealing with the different challenges such as the challenges from the clients, skilled labor related challenges, project team work challenges, material and equipment related challenges.

Knowledge areas and skills for the project team related. Challenges In any project, the teamwork is a must for the success of the project. In green building a specific cohesiveness must be established between all the team members so they have to be well informed of the project aim and objectives in order to avoid any kind of conflict between them, however sometimes the arouse of conflicts can be unavoidable so the project managers must possess the skills and knowledge to address and deal with any kind of conflict without affecting the progress of the project.

Knowledge areas and skills for the material and equipment- related challenges. The understanding of cost management is a crucial factor in the success of the project to manage effectively the cost of green materials and to avoid exceeding the estimated budget so during the project planning phase the estimated cost must be as close as possible to the actual sum. despite the market uncertainty, the project managers must quantify the cost and benefits of using green materials and also they have to make the risk assessment involved in their acquisition.

Knowledge areas and skills for labor-related challenges. The project managers need to have a full understanding of the management of human resources in order to guarantee the effective assessment of the labor-related challenges. in addition, project managers must offer an appropriate and fixed training for their workers also because most workers are

trained to deal with the conventional type of building; a specific green building construction skills training needs to be provided for the workers.

Knowledge areas and skills for external challenges. In any project some unexpected events may arouse that go off the planned schedule and need to be dealt with professionalism in order not to affect the progress of the project, Therefore the project managers need to be equipped with the knowledge of problem-solving techniques in order to avoid any additional delay.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

The delay factors in green building construction in Northern Cyprus and Dubai were studied in this study using survey questionnaire distributed among the stakeholders in the construction industry. Green building was more accepted and practiced in Dubai than Northern Cyprus which is due to the difference in economic strength and the development of the two countries. Technical factors causing delay in green building construction were found to have higher effect in Cyprus while administrative/managerial factors were found to be the major factors in Dubai which is due to the higher acceptance of the green buildings in Dubai as well as higher experience in green building construction by the respondents in Dubai than those in Northern Cyprus.

The most relevant factors responsible for delay in green building construction for Northern Cyprus are unexpected budget, fewer number of specialized contractors and difficulty in the selection of subcontractors who provide green construction services, availability of required equipment of material, and poor scheduling in order of their importance. While for Dubai, the important factors in their order of relevance in causing delay for green buildings construction are fewer numbers of contractors supplying the materials, poor scheduling, unexpected budget, increased number of meetings and coordination required with green consultants and engineers and frequent alterations and variations with the design during the construction processes.

Delays in green building construction can be minimized by development of good and effective work schedule; provision of complete and extensive drawings containing all the specifications which will minimize unnecessary alterations and changes in the design; a careful selection of the specialized contractors and suppliers for green building services; assigning an experienced project manager who has an effective good understanding of the market and skilled in risk management; employing skilled labor for the project who will do it right at once.

The limitations of this research are that, the respondents in North Cyprus have limited experience in green building construction and therefore they may skip other important parameters that will impact the work schedule. Other important delay factors suggested by the respondents should be considered in further research.

5.2 Recommendations for further studies

As a future study it would be better if there is cooperation between researcher and specialist to got an access to the implemented project's time tables (as plan and as built). This access will provide more accurate data by studying each project step by step and collecting the factors that were had been neglected by engineers because they did not affect the time of the project but on the other hand, it had an invasion effect on noncritical activities which caused an obstacle during the project implementation. As well, evaluating the effect of each factor on the final time for the project held.

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APPENDICES

Appendix A :

Table 6. 1: Descriptive Statistics in Northern Cyprus.

	N	Mean	Std. Deviation
The unexpected budget	54	4.111	.9248
The few numbers of specialized contractors	54	4.074	.9286
difficulty in the selection of subcontractors who provide green construction services	54	4.000	.8687
The unavailability of required equipment for material	54	4.000	.8009
Poor scheduling (lack of experience)	54	4.000	.9517
The contractor providing the material	54	3.926	.8208
The more frequent alterations and variations with the design during the construction process	54	3.907	.9167
Finding the required level of experienced labor	54	3.852	1.0534

The few numbers of experts engineer in green building to design	54	3.815	1.1667
The stakeholder's attitude toward green buildings	54	3.796	.9592
The authorities interfering	54	3.796	.8770
The delay factors in conventional building apply in a green construction project. If 5.5d, please provide details in the next section.	54	3.667	1.2131
The increased number of meetings and coordination required with green consultants and engineers.	54	3.556	1.0218
The assessment procedures	54	3.019	.9613
Worker allergy to some material	54	2.574	1.0389
Valid N (listwise)	54		

Table 6. 2 : Descriptive Statistics in Dubai

	N	*Mean*	*Std. Deviation*	*Variance*
Worker allergy to some material	110	2.7727	1.01058	1.021
The authorities interfering	110	3.0364	1.02203	1.045
The few number of specialized contractors	110	3.3182	.90799	.824
The assessment procedures	110	3.3273	.97782	.956
The stakeholder's attitude toward green buildings	110	3.3636	1.05559	1.114
The unavailability of required equipment for material	110	3.4455	.86296	.745
difficulty in the selection of subcontractors who provide green construction services	110	3.5091	.86465	.748
The few number of experts engineer in green building to design	110	3.5273	.87482	.765
Finding the required level of experienced labor	110	3.6455	.72424	.525
The more frequent alterations and variations with the design during the construction process	110	3.7000	.81893	.671
The increased number of	110	3.7091	.80532	.649

meetings and coordination required with green consultants and engineers.				
The unexpected budget	110	3.7182	.82542	.681
Poor scheduling (lack of experience)	110	3.7455	.88241	.779
The delay factors in conventional building apply ia n green construction project. If 5.5d, please provide details in the next section.	109	3.7798	.96569	.933
The contractor providing the material	110	3.8091	.80703	.651
Valid N (listwise)	109			

Table 6. 3 Descriptive Statistics for Technical Factors in Dubai .

	N	Mean		Std. Deviation	Variance
	Statistic	Statistic	Std. Error	Statistic	Statistic
The contractor providing the material	110	3.8091	.07695	.80703	.651
Poor scheduling (lack of experience)	110	3.7455	.08413	.88241	.779
The unexpected budget	110	3.7182	.07870	.82542	.681
Finding the required level of experienced labor	110	3.6455	.06905	.72424	.525
The few number of experts engineer in green building to design	110	3.5273	.08341	.87482	.765
The few number of specialized contractors	110	3.3182	.08657	.90799	.824
Worker allergy to some material	110	2.7727	.09635	1.01058	1.021
Valid N (listwise)	110				

Table 6. 4 : Descriptive Statistics for Technical Factors in Northern Cyprus.

	N	Minimum	Maximum	Mean	Std. Deviation
The few number of specialized contractors	54	1.0	5.0	4.074	.9286
The few numbers of experts engineer in green building to design	54	2.0	5.0	3.815	1.1667
Poor scheduling (lack of experience)	54	2.0	5.0	4.000	.9517
The contractor providing the material	54	2.0	5.0	3.926	.8208
Finding the required level of experienced labor	54	2.0	5.0	3.852	1.0534
Worker allergy to some material	54	1.0	5.0	2.574	1.0389
The unexpected budget	54	2.0	5.0	4.111	.9248
The unavailability of required equipment for material	54	2.0	5.0	4.000	.8009
Valid N (listwise)	54				

Table 6. 5 : Descriptive Statistics for Coordination Factors in Dubai .

	N	Mean		Std. Deviation	Variance
	Statistic	Statistic	Std. Error	Statistic	Statistic
The increased number of meetings and coordination required with green consultants and engineers.	110	3.7091	.07678	.80532	.649
The more frequent alterations and variations with the design during the construction process	110	3.7000	.07808	.81893	.671
difficulty in the selection of subcontractors who provide green construction services	110	3.5091	.08244	.86465	.748
The unavailability of required equipment for material	110	3.4455	.08228	.86296	.745
The stakeholder's attitude toward green buildings	110	3.3636	.10065	1.05559	1.114
The assessment procedures	110	3.3273	.09323	.97782	.956
The authorities interfering	110	3.0364	.09745	1.02203	1.045
Valid N (listwise)	110				

Table 6. 6 : Descriptive Statistics for Coordination Factors in Northern Cyprus.

	N	Minimum	Maximum	Mean	Std. Deviation
The stakeholder's attitude toward green buildings	54	2.0	5.0	3.796	.9592
The authorities interfering	54	2.0	5.0	3.796	.8770
difficulty in the selection of subcontractors who provide green construction services	54	2.0	5.0	4.000	.8687
The increased number of meetings and coordination required with green consultants and engineers.	54	1.0	5.0	3.556	1.0218
The assessment procedures	54	1.0	5.0	3.019	.9613
The more frequent alterations and variations with the design during the construction process	54	1.0	5.0	3.907	.9167
Valid N (listwise)	54				

Appendix B :

Dear Participant,

I am currently pursuing an M.Sc. degree at Near East University, major in Civil Engineering. This questionnaire is designed to gather opinions about the delay factors in green building construction and hence, identify the most effective factor that could delay the construction project. The research is being conducted under the supervision of Assist. Prof. Dr. Beste Çubukçuoğlu.

We hope to use this information to make green building construction more efficient and effective. Participation in this survey is voluntary and once you fill in the questionnaire, you will be considered as having accepted our invitation to participate. The data that you provide will be kept confidential and will be anonymously used in the analysis. They will not be traced back to you in any way. This research effort and this questionnaire have been reviewed and approved by the Dissertation Proposal Review Board, which functions as the Institutional Review Board for ethical research at Near East University.

The results of the analysis will be presented in an anonymous way and will only be used for academic purposes. You can withdraw from the study at any time by contacting us using the following contact details. If you decide to withdraw, data collected from you will not be included in the final analysis. For further information, including a copy of the results of this study, please contact:

Mr. Khalil Rahmeh

M.Sc. Student

Civil engineering Department

Near East University

E-mail: khalilrahmeh@hotmail.com

Mobile phone: +905428848692

Assist. Prof. Dr. Beste Çubukçuoğlu

Vice Dean, Faculty of Civil and Environmental Engineering, Near East University

E-mail: beste.cubukcuoglu@neu.edu.tr

Thank you in advance for your attention and participation.

NOTE: By completing and submitting this questionnaire, you are indicating that you understand the statements above, and consent to participate in this study.

COMPANY INFORMATION

Please provide information by completing the blanks.

Company name: ……

Number of employee in your company: ……

Company Address: ……

E-mail: ……

The company characteristics:

( ) construction ( ) development ( ) consulting ( ) quantity surveying

Personal Information

Please provide information by completing the blanks.

What is your gender? ☐ Male ☐ Female

Age: _____

Occupation: ……

Experience in green buildings, if any (years, months): ……

The number of green projects you performed in the last five years: ……

The number of green projects you have worked which had scheduled delays:……

Experience respondent:

( ) project manager\construction manager ( ) contractors

( ) project director\higher management ( ) worker

( ) project personnel\project engineer\construction engineer

❖ **Part A:** mark the options that match your experience.

Note: If you worked in more than one type of building, or different projects please reprint the following pages.

1. Building type	( ) Residential ( ) commercial building	( ) school\hospital\hotel ( ) multifunction building,.
2. Project type	( ) new constructed	( ) addition & alteration
3. Project size	( ) less than 5M$ ( ) $5M to less than $10M ( ) $10M to less than$20M ( ) $20M to less than $30M	( ) $30M to less than $40M ( ) $40M to less than $50M ( ) $50M and above

❖ **Part B: Please read the following sentences carefully and mark the option that matches your opinion with (X) as in the example.**

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Example: There is high possibility of delay in green construction .	(X)	( )	( )	( )	( )
1. The stakeholder's attitude is a reason for a delay	( )	( )	( )	( )	( )
2. The authorities interfering is a reason of delay.	( )	( )	( )	( )	( )
3. To find an expert engineer in green building to design is a reason for delay.	( )	( )	( )	( )	( )
4. Poor scheduling is a reason of delay.	( )	( )	( )	( )	( )
5. The difficulty in the selection of subcontractors who provide green construction services is a reason of delay.	( )	( )	( )	( )	( )
6. The contractor providing the material is a reason of dealy.	( )	( )	( )	( )	( )
7. Finding the required level of experienced labor is a reason of delay.	( )	( )	( )	( )	( )
8. The increased number of meetings and coordination required with green consultants and engineers.	( )	( )	( )	( )	( )
9. Worker allergy to some material is a reason of dealy.	( )	( )	( )	( )	( )
10. The rating tools is an obstacle to timetable.	( )	( )	( )	( )	( )
11. The more frequent alterations and variations with the design during the construction process is areason of delay.	( )	( )	( )	( )	( )
12. The unexpected budget is a reason of delay.	( )	( )	( )	( )	( )
13. The low number of specialized contractor is a reason for delay"	( )	( )	( )	( )	( )

14. The availability of required equipment of material is a reason of delay.	( )	( )	( )	( )	( )
15. The delay factors in conventional building apply in green construction. If agree, please provide details below.	( )	( )	( )	( )	( )

The reasons for delays in Conventional buildings are:

- **Part C. List any other factor which may delay the green building construction.**

THANK YOU FOR YOUR CONTRIBUTION.

Appendix C :

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

06.02.2019

Dear Khalil Rahmeh

Your application titled **"Delay Factors in Green Building Construction"** with the application number YDÜ/FB/2019/50 has been evaluated by the Scientific Research Ethics Committee and granted approval. You can start your research on the condition that you will abide by the information provided in your application form.

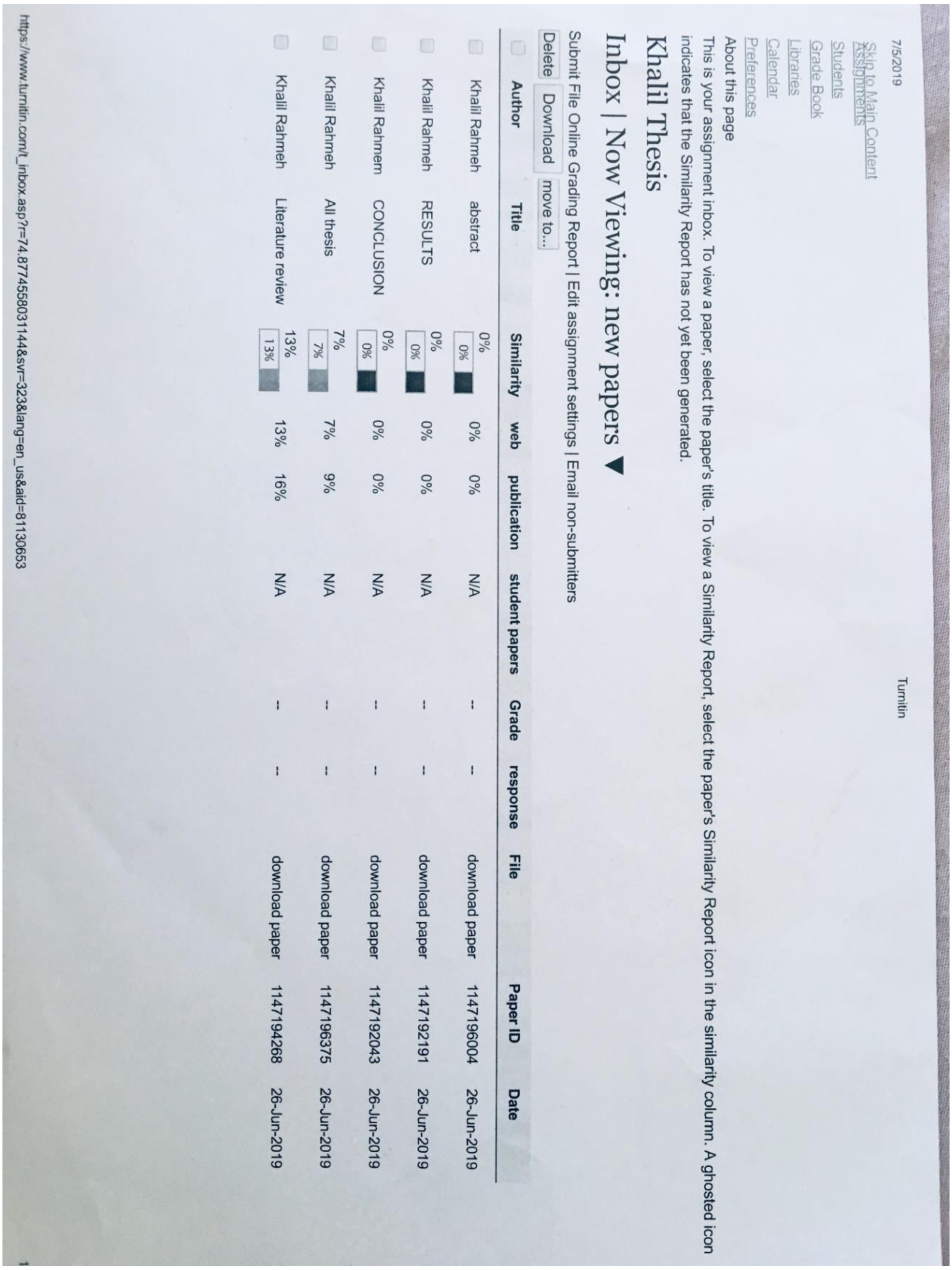
Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.

Appendix D :



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