**BUILDING A PREDICTION MODEL TO PREDICT DELAYS IN CONSTRUCTION LOGISTICS**

### A PROJECT REPORT

Submitted in partial fulfillment for the award of the degree of

**M.S**

***in***

**Software Engineering**

***By***

**KARTHIGA.S**

**(12MSE0227)**

*Under the guidance of*

**Prof. USHAPREETHI.P**

**ASSISTANT PROFESSOR**

****

**School of Information Technology and Engineering**

November, 2016

**DECLARATION BY THE CANDIDATE**

I hereby declare that the project report entitled **“BUILDING A PREDICTION MODEL TO PREDICT DELAYS IN CONSTRUCTION LOGISTICS”** submitted by me to VIT University, Vellore in partial fulfillment of the requirement for the award of the degree of **MS(Software Engineering)** is a record of bonafide project work carried out by me under the guidance of **Prof. USHAPREETHI.P**. I further declare that the work reported in this project has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place: Vellore Signature of the Candidate

Date: KARTHIGA.S

## 

## School of Information Technology & Engineering [SITE]

###### CERTIFICATE

This is to certify that the project report entitled “**BUILDING A PREDICTION MODEL TO PREDICT DELAYS IN CONSTRUCTION LOGISTICS”** submitted by **KARTHIGA.S (12MSE0227)** to VIT University, Vellore, in partial fulfillment of the requirement for the award of the degree of M.S in Software Engineering is a record of bonafide work carried out by him/her under my guidance. The project fulfills the requirements as per the regulations of this Institute and in my opinion meets the necessary standards for submission. The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma and the same is certified.

**Prof. USHAPREETHI. P , Assistant professor**

**Dr. Valarmathi. B**

**INTERNAL GUIDE**

**Head of Department**

**Department of Software and Systems Engineering**

**The project work is satisfactory / unsatisfactory**

Internal Examiner External Examiner

**Acknowledgement**

I wish to express our heartfelt gratitude to **Dr.G.Viswanathan**, Chancellor, VIT University,Vellore for providing facilities for the Final year project.

I am highly grateful to our Vice Presidents, **Shri. Sankar Viswanathan, Dr. Sekar Viswanathan and Shri. G.V.Selvam**, Vice Chancellor **Dr. Anand A. Samuel**, Pro-Vice Chancellors **Dr. S. Narayanan** and **Dr. V. Raju** for providing necessary resources.

My sincere gratitude to **Dr. Aswani Kumar Cherukuri**, Dean, School of Information Technology and Engineering for giving us the opportunity to undertake the project.

I wish to express my sincere gratitude to **Dr. Valarmathi.B**, Associate Professor, HOD of Software and Systems Engineering and the Project Coordinator **Prof. Manivannan.S, Assistant Professor (SG)** ,School of Information Technology and Engineering for providing me an opportunity to do my project work in **industry/VIT University.**

I would like to express my special gratitude and thanks to my internal guide **Prof. Ushapreethi.P,** Assistant Professor Junior, School of Information Technology and Engineering whose esteemed guidance and immense support encouraged to complete the project successfully.

I thank the Management of VIT University for permitting me to use the library resources. I also thank all the faculty members of VIT University for giving me the courage and strength I needed to complete my goals. This acknowledgement would be incomplete without expressing my whole hearted thanks to my family and friends who motivated me during the course of the work.

Place : Vellore Signature of the student

Date : **KARTHIGA.S**

# 

# ABSTRACT

Construction project management is vital for accomplishing pre-determined objectives.

Construction time is one of the basic elements of each contract for building construction, particularly contracts between investors with contractors, and contractors with subcontractors. Despite using construction management, most of the projects do not meet original time schedule or has been delayed.

Delay is one of the most reoccurring problems in the construction industry and has negative impacts on project success in terms of time, cost, quality and safety. To minimise these impacts, identifying the most significant causes of delay is vital.

The most common problems causing a multitude of negative effects on the project and its participating parties. Along with delay, the frequently faced consequences are project failure, reduction of profit margin, and loss of belief of citizen in government funded projects, etc

The main goals of any successful construction project management system(s) are to complete the project on time, within the planned budget, and with the required quality limits. The three goals are inter-related where each of them is affecting, and being affected by, the others.

In this project ,we use “Naive Bayes” algorithm to predict the delays by identifying some delay causing factors such as labour\_absent,financial\_delay,weather\_delay,logistics\_code and redesign\_architecture,etc. The predictive model for this project was generated by “NAIVE BAYES ALGORITHM”.

This project is a study the critical delay factors for project management in construction focusing contractors and to build a prediction model to avoid the same in future projects.

The objectives of this project are to investigate delay factors to help contractors to reach their goals on time during construction.

Traditional management style, poor scheduling, using old technology, purchasing problems, low level of commitment among supply chain members, storage issues, and poor weather conditions are the top causes of delays in the construction industry.

CHAPTER 1

INTRODUCTION

BACKGROUND:

According to [Shen et al (2001)](https://link.springer.com/article/10.1057/rlp.2009.11" \l "CR25" \o "View reference), the majority of the building projects usually cannot be accomplished within the stipulated contract period. Delays occur in most construction project and the magnitude of these delays varies considerably from project to project, and the problem of delays in project is a worldwide phenomenon.

PROBLEM STATEMENT:

Delay in construction projects has been a major issue in the construction industry over the past decades.

The delay in dispute settlement has manifold effects such as it will give detrimental to the relationship between owner and contractor. The contractor and the owner pay for the extra charge for the completion of the project due to delay in large construction projects. When the completion time of the construction project exceeds the agreed completion time, it is known as construction project delay. It is needed to conduct detailed investigation and identification of delay factors and then selecting the right actions to counter theses delay factors within cost and maintaining quality. The faults and errors due to the contractor cause delays and waste of capital and time

Moreover contractors are constantly loosing contracts due to delay or incompletion of previous projects.Delay has also led to a lot of disputes amongst stake holders in the construction industry. If these disputes cannot be resolved amicably to the satisfaction of every party, some parties will prefer litigation and arbitration. All this will go a long way to increase the cost of the overall project.

Finally, delay will result to negative perception of the country’s construction industry. Investors will not be willing to carry out construction projects in the country. This will results to the country’s construction industry be less competitive.

Therefore with all these problems faced by the government, business organizations, contractors, consultants, community and the construction industry as whole, it is therefore imperative that a study be conducted to ascertain the factors contributing or resulting to the delay of construction projects.

With these factors clearly outlined, they can be considered as the critical success factors of the projects.Moreover a study on delay will help stakeholders to be able to pin point exactly where the delay is from or what causes the delay and which of the stake holder should be held responsible. With this the issue of disputes, litigation and arbitration can be avoided.

MOTIVATION

RELATED WORK:

**Causes of delay in large construction projects by Sadi A. Assaf, Sadiq Al hejji [1]:**

A survey based project conducted in Saudi Arabia to determine causes of delays and their importance according to each party of the project namely owner, consultant and contractor. The survey included twenty three contractors, nineteen consultants and fifteen owners. Seventy three causes of delays were identified and the most common cause as indicated by all three parties was change the order.

The study covered both private and public projects and owners included government departments. Spearman’s Rank Correlation, importance index and severity index were used to analyze the survey. From owners point of view the most severe cause was type of project bidding and award whereas contractor outlined delay in progress payment by owner as the most critical. The consultants shared the view of owners. On the importance index, the shortage of labor was ranked number one by owner whereas delay in progress payment was ranked highest by contractor. The consultants ranked type of project bidding and award as the most important.

**A Quantitative analysis by Ayman H.Al.Momani (Jordan’s Construction Industry) [2]**

Research has been carried out on 130 public sector projects in Jordan. The purpose of research was to find delays & facilitate the construction managers so that the construction managers can have better control on site. The main delays identified were user changes, designers, weather, site conditions, late deliveries, economic conditions & increase in quantity of work.

Quantitative data was used.130 samples had taken during the period of 1990-1997. Different types of structures were viewed in this study. They are:

1.Residential houses of public figures.

2.Office and administrative buildings.

For analysis of data Microsoft Excel was used where all the diagrams were developed. Different tables were also used for clear depiction of results. The Standard deviation of different projects was also developed. In tests and results an equation was developed that relates the two variables. This was developed by regression analysis. Some of the limitations of this research are:

1. Construction experience of the contractors has not been used.
2. The actual cost of construction is also not used.
3. **Chalabi and Camp in 1984[3]** discussed causes of building project delays in developing countries during the pre-planning and the construction stages. Their study dealt with developed countries where workers are relatively skilled. They found that adequate planning at the very early stages of the project is important for minimizing delay and cost overruns in most projects in developing countries.
4. **Fereig and Qaddumi (1984)[4]** discussed construction problem in the Arabian Gulf area. They recognized that some of these problems relate to the special characteristics of this part of the world, such as productivity, where as other are inherent in the nature of construction projects, such as planning and control problems.

CHALLENGES:

As one of the major economic sectors, the construction industry is one of the industries that cannot run from problems or challenges.There are many challenges faced by the construction industry.

One of them is project delay. The construction industry has a very poor reputation in coping with delays. As a result, many major projects fail to meet schedule deadlines. The time allowed for construction project performance is usually an important consideration for both the project owner and the project contractor. The time delay is a very frequent phenomenon and almost associated with nearly all constructing projects. The more complex the project, the less likely it is to be completed on time.

The construction industry poses a another great challenge as it is essential in generating wealth, financial delay is one of the riskiest delay in construction project.However, delays still occur in construction projects as the industry is famed for poor risk management, with many projects failing to meet deadlines and cost targets.

ESSENCE OF APPROACH

ASSUMPTIONS  
ORGANIZATION OF REPORT  
DRAWBACK OF EXISTING SYSTEM

**AIMS AND OBJECTIVES:**

The main aim of this project is to find out the causes of delay in building construction projects in construction industy and to implement a prediction model to avoid the same problems would occur in the future.

Objectives:

This project attempts to generalize:

1. To identify various factors that cause the delays 2. How unpredicted delays can cause delays resulting in delays of the total project 3. The effects of the delays on the project 4. Study the causes and effects of the delays at various projects and to find out the most important causes.5. To identify the relevant ways of eliminating or mitigating the delays of construction.

**2.LITERATURE REVIEW:**

**2.1 INTRODUCTION** :

The process of construction can be divided into three distinct and significant phases; the project conception phase, project design phase and the project construction phase.

As stated by **(Chan and Kumaraswamy, 1997)** a vast majority of project delay occur during the construction phase where many unforeseen circumstances and factors occur. Completing a construction projects within the estimated time and cost is an indicator of efficiency, but the process of construction is subjected to many unpredictable and changing factors which comes from different sources. These sources include performance of parties, resource availability, environmental conditions, and involvement of other parties and contractual relations, thus the completion of the project within the estimated time is rare **(Asaf, 2006).**

However, construction project success can be defined as the completion of a project within the estimated time and cost. But it is rather unfortunate that projects successes are not common in the construction industry especially in the developing countries and third world countries. This could be due to inadequate expertise, finance, and environmental uncertainties and also inadequate supply of materials.

From several studies and empirical evidence, it is clear that projects overruns comprises both delays and cost overruns occur during the construction phase. Therefore scholars, researchers and professionals have been motivated to take steps to meet these challenges.Construction project delay is worldwide phenomenon **(Sambasivan and Soon, 2007)** that affects not only the construction industry but the overall economy of countries as well **(Faradi and El-Sayegh, 2006)**. It often involves multiple complicated issues all of which are invariable critical to recover the cost of delay or the necessity to prolong the project with the consequential entitlement to recover the costs of adjusting to the contract schedules. When delay arises, there is always a question as to the causes of the delay and the opportunity of blames which most of the times will results to disputes and litigation **(Bolton, 1990).**

Currently stake holders in the construction industry are increasing their concerns about the duration of the construction projects because of increasing interests, inflation, commercial pressures **(Nkado, 1995)** and of course it’s potential to lead to disputes and claims leading to arbitration and litigation.

**2.2 Classification of construction projects delays:**

Construction projects can be caused by many factors. **(Ahmed, 2003)** classified delay into two groups;

1. The internal causes which arises from within the project stakeholders (clients, contractors and consultants).

2. External factors which occur as a result of unforeseen factors. These factors arise not from the project participants. They can be termed act of God and may include the followings; weather conditions, natural disasters, government actions and material supplies.

Moreover construction delay was also classified into three categories by **(Bolton, 1990).** These include;

1. Excusable but non compensable. This is caused by circumstances not attributed to the project stakeholders or participants.

2. Compensable delay. This occurs as a result of acts or omissions of client or someone for whose acts the owner is liable to.

3. Inexcusable delays. This results from contractors’ own fault or his subcontractors or materials. This may be sometimes due to lack of experience.

**2.3 Construction delay:**

The construction industry is regarded as a complex, fragmented, scheduled and resource driven industry. A successful project is one that is completed on time, within budget and meets the specified quality standard that is satisfactory to the clients and all stakeholders involved **(Chan and Kumaraswamy, 1993).** A timely completion of the project is a criterion to ascertain project success.

**2.4 Factors causing construction projects delays:**

Several academic researchers have carried out studies over the years to investigate the causes of construction projects delays.

Amongst these studies were; A study carried out by **(Sweis et al, 2008)** on the causes of delay of residential projects in Jordan found out that financial difficulties faced by contractors and too many changes made by the client were the leading causes of most delays.

In another related research performed by **(Abd El-Razak, 2008)** in Egypt discovered that the most important causes of delay were financing by contractors during construction, delay in contractors’ payment by owners, frequent design changes by owners or his agent during construction, partial payments and non-utilization of professional construction and contractual management.

Furthermore a study was conducted by **(Assaf and Alhajji, 2006)** on time performance of different types of construction projects in Saudi Arabia, in an attempt to investigate the causes of construction delay and their importance according to each project participant (owner, consultant and contractor). A total of 73 delay related factors 20 were observed and the most common cause of delay identified by all three project participants was change on order.

Moreover a study was conducted **by (Ayman, 2000)** in Jordan. He investigated the causes of delay of 130 public projects in Jordan. These projects were inclusive of residential buildings, offices, administrative buildings, medical centers and communication facilities.

The results indicated that the main causes of delay of the public construction projects were related to designers, user changes, weather, site conditions, and late deliveries of materials, economic conditions and increase in quantity.

In Malaysia, a study of delay factors and their impacts on construction projects completion in the Malaysian construction industry was carried out by **(Sambasvian and Soon, 2007).** Their results showed a list of 28 different causes.

Amongst these causes were; contractors improper planning, contractors poor site management, shortage of material, inadequate labor supply, equipment availability and failure, lack of communication amongst project participants and mistakes during the construction phase. Previous review also indicated that the factors that leads to delay in construction projects are many and differ from country to country and from circumstances to circumstances.

**(Oluguna et al, 1996)** reported that there were distinct problems that caused delays in the construction industry of Nigeria. These factors were classified into 3 groups namely; firstly problems of shortages or inadequacies in industry infrastructure which are mostly supply of resources, secondly problems caused by clients and consultants and thirdly problems caused by contractors’ incompetence or knowledge and experience deficiencies.

Also, a research was also conducted in Ghana by **(Frank and Adwoa, 2007)** to determine the factors causing delay of building construction projects in the Ghana construction industry. They carry out a survey using a semi structured interview of 15 key players in the construction industry of Ghana. A total of 32 delay related factors were determined. The most important factors were found out to be; delay in honoring certificates, underestimation of the project cost, underestimation of project complexity, difficulty in accessing bank credit, poor supervision, underestimation of completion time of projects by contractors, shortage of materials, poor professional management, fluctuation of prices, rising cost of materials and poor site management.

In addition **(Kaming et al, 1997)** cited that design changes, material changes, material shortages, and inadequate planning were the most important cost of delay in construction projects.

**2.5 Effects of Construction Project Delay**:

When construction projects are delayed, the effects are often injurious to the stakeholders. A research conducted in Nigeria by **(Aibinu and Jaboro).** They studied the effects of the delay in the construction industry of Nigeria. They discovered six possible common effects which arising in most countries as a result of delay. These effects were; cost overrun, time overrun, disputes, arbitration and litigation and total abandonment of project.